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This project is funded by
the European Union

FINAL REPORT ON ECONOMIC AND FINANCIAL VIABILITY OF PROCESSING CASHEW IN THE GAMBIA

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This report has been prepared by Olivier van Lieshout and Abdoulie Khan at the International Trade Centre as part of “The Gambia: Youth Empowerment Project” (YEP), financed by the European Union.

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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 (GN); (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 Cashew.

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 changed. 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 Cashew

2.1 Conclusions

- Growing cashew nuts is profitable for farmers. The nuts are large and fetch a good price in the world market. An average hectare with 100 trees brings D45,000 per season, despite 40% post-harvest losses. Reducing these losses is the easiest way to increase output.
- Most of the crop is exported without being processed. This implies that the potential in job creation and its impact on poverty reduction remains untapped.
- Processing sorted nuts can add 80% additional value to the harvested nuts.
- To export processed cashew, consistent quality and supply throughout the year is imperative and this means a processing with a minimum output capacity of 1,000 MT per year. This is beyond the scope of small enterprise.
- For a small processing facility, the quantity of raw nuts required to breakeven is 35 tons. Under today's farming conditions this is equivalent to the production of 6,200 trees, or 4,100 trees with better crop and harvest management and max. 10% losses.
- For the purpose of this report, we assumed that a village can supply at least 200 MT of raw cashew to a local processing unit (breakeven is 35 tons). If this can be ensured, and the sales can be sold domestically or in the immediate region, then it is worth investing in a cashew processing unit.
- All figures change if the processor combines production with other crops like groundnuts.

2.2 Margin and profit comparison Cashew

To make a fair comparison, we assume that 200 tons of raw cashew nuts (from about 36,000 trees) is available. Table 1 shows that this will generate D14.5 million profit in farming.

Table 1 gives an overview of the margins, contribution and profits that can be generated from the cashew nut value chain. The underlying assumptions for each link in the chain (in [blue color](#)) can be on the respective sheets in the Excel file attached.

Cashew farming. The margin is D73 per kg, or 88%. This is very high because farmers use no inputs. The only variable costs are tree replacement (age = 25 years) and hired labor to prune and clean dead leaves below the trees to reduce the risk of fruit and plant damage from bush fires. The harvest fruit starts to ferment rapidly producing alcohol, forbidden in most rural areas. Therefore, the farmers do not harvest themselves instead they recruit workers from Guinea Bissau and Casamance who obtain the apple in lieu of payment.

The average yield is 4500 fruits with a kernel weight of 2.1 grams (equivalent to 220 kernels per pound). But it is estimated that at least 40% of the fruits are lost, stolen, eaten by young kids or grazing animals. Hence a tree will yield about 5.60 kg raw cashew nuts per season. We estimate that 85% of the nuts are A-quality priced at D85 per kg and 15% are B-quality priced at D68 per kg. One hectare carries about 100 trees and gives D40,000 profit per year.

To make a fair comparison, we assume that 200 tons of raw cashew nuts (from about 36,000 trees) is available. Table 1 shows that this will generate D14.5 million profit in farming.

Table 1 – Margins and Profit in the Cashew Value Chain from 200 tons of raw nuts

Value chain	Margin in dalasi per kg	Margin %	Fixed costs	Breakeven quantity in kg	Breakeven in kg raw cashew	Breakeven in Trees	Contribution	Profit per kg raw cashew nut	Profit per kg raw nut	Value added
0 Cashew nut farming	80	98%	0	0	200,000	36,000	14,500,000	14,500,000	73	100%
1 Cashew nut tolling	76	66%	800,000	10,800	44,300	8,000	3,700,000	2,900,000	65	20%
2 Cashew processing unsorted	215	30%	3,600,000	16,700	66,700	12,000	10,800,000	7,200,000	108	50%
3 Cashew processing sorted	261	35%	2,800,000	10,500	34,800	6,200	14,400,000	11,600,000	333	80%
3a. Wholes & Halves (80%)	294	37%	2,500,000	8,500	33,800		11,800,000	9,300,000	275	
3b. Candies cashew (20%)	128	26%	300,000	2,000	1,000		2,600,000	2,300,000	2,300	

Cashew processing adds value, that is obvious. We used the outfit of Jawneh & Sons to calculate cost and profitability. Their processing system is given in the box below. Jawneh follows the full process and combines primary processing with secondary processing.

Cashew processing in Gambia: Jawneh & Sons	
1. <u>Steaming</u> :	10 min at 7 bar, 21 firewood sticks per day at D35 per stick;
2. <u>Decortication</u> :	100 kg/hour 0.5 kW at D10.9 per kWh;
3. <u>Oven drying</u> :	8 hours at 80 Celsius to 5%; 80 kg max; 11 sticks per day;
4. <u>Re-humidification</u> :	prior to peeling, with remaining steam from steamer;
5. <u>Reheating</u> :	in oven, 10 min with remaining heat;
6. <u>Peeling</u> :	by hand, 2 tables * 6 people, 2 kg per person per hour;
7. <u>Grading</u> :	by hand, 1 table * 4 people, 6 kg per person per hour;
8. <u>Roasting</u> :	to color in oven, 80 kg max for 4 hours;
9. <u>Filling</u> :	packs by hand (100g-200g-500g), 80 packs per person per hour;
10. <u>Sealing</u> :	with machine;
11. <u>Labeling</u> :	sticking label by hand.

To compare value addition of three systems: (1) tolling; (2) processing unsorted nuts, (3) processing sorted nuts.

The investment in the Jawneh unit was D2.56 million and it is capable of processing 236 tons of raw cashew yielding 57.6 tons of saleable produce per year. To reach this capacity utilization, the raw nuts must be kept for a period of 9-10 months. This is possible when the nuts are well dried (8% moisture) and stored in a conditioned warehouse. The lower the temperature, the longer the shelf life. Between 0-10°C, the raw cashew nuts can be kept up to 12 months (see <http://ucanr.edu/datastoreFiles/234-2753.pdf>).

Output capacity per batch (kg)	80
Production batches per day	2.00
Length of harvesting season in days	360
Maximum capacity per year	57,600

(1) **Tolling** is processing unsorted nuts for the owner against a service fee. The fee depends on the number of steps in the process. Tolling does not require working capital to procure the nuts. It gives a margin of D76 per kg, 66%, hence the risks are very low. Tolling 200 tons of

raw nuts gives D2.9 million profit and adds 20% on top of the value of the raw nut. The raw material breakeven point for tolling is 44 tons, or 8,000 trees (Table 7).

- (2) **Processing unsorted nuts** requires working capital. We assumed that 70% of the raw nuts needs to be financed, requiring D11.5 million at 24% interest. Compared with tolling, risks and rewards (if properly managed) are higher. With a margin of D215 per kg (30%), 200 tons of raw cashew nut give D7.1 million profit, adding 50% in value. The raw material breakeven point for processing unsorted nuts is 67 tons, or 12,000 trees (Table 8).
- (3) **Processing sorted nuts**, is more profitable and therefore the common practice in the cashew chain. After decortication, nuts are sorted into:
- **Wholes & Halves**, if properly harvested and processed, constitute 80% of the crop. So, 200 tons of raw nuts yields 40 tons that can be sold with a margin of D294 per kg (37%). This will give D9.3 million profit (Table 9).
 - **Broken halves and split** (remaining 20%) gives 20 ton of cashew candies, because 50% sugar is added. Candies can be sold D500 per kg, where the splits and halves are selling at D375 only. The margin on candies is D128 per kg leading to D2.3 million profit (Table 10).

Because of the higher margins, the breakeven point of sorted processing is lower: 35 tons of raw nuts, or 6,200 trees. It adds 80% of value to the raw nuts.

2.3 Investment & Finance of a Cashew Processing Unit

Table 2 shows the investment required in fixed assets and for working capital. About D2.5 million (€47,000) is needed for cashew processing building and equipment with a capacity to process 230 tons of raw nuts in 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% (46 tons of raw cashew) and a cycle of 6 weeks. The total investment in assets and working capital is D3.4 million.

Table 2 - Investment & Finance Required for Cashew Processing

CB4 Table 1. Investment & Finance		v1 CASHEW PROCESSOR GAMBIA 1000 Dalasi						
		Investment		Finance				
A	Existing land plot (rented, leased)	0	0%	E	Equity			
	Cashew processing equipment	1,800	53%		Owner's Family	100%	560	16%
	Civil works and storage	760	22%		Other Partners	0%	0	0%
	Quality control systems	0	0%		Company owners	100%	560	16%
	Packaging system	0	0%		Grants	78%	2,000	58%
	Equipment, crates, other	0	0%		Total equity		2,560	75%
B	Working capital	867	25%	D	Debt			
	Technical assistance (grant) 2 yr	0	0%		Development loan		0	0%
					Working capital loan		867	25%
C	Services, initial labor, unforeseen	0	0%				867	25%
Total Cost		3,427	100%	Total Finance			3,427	42%

We assumed that about 80% of the production assets are paid for by a grant, leaving D560,000 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 10%, this means less than 2 months of operations.

2.4 Return on Investment of Cashew Processing

The ROI depends primarily on the capacity utilization, margins and FC3 Overhead costs. To attract youth to work for the processing unit (11 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 cashew) increasing gradually to 80% in year 7. See the P&L in Table 3.

Because the harvest season is only 4 months, raw cashew 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 3 - Profit & Loss Projection Cashew Processing

CB4 Table 2. P&L		v1	CASHEW PROCESSOR GAM				f 1000 Dalasi
		2018	2019	2020	2021	2027	
PRODUCTION							
	<i>Margin Wholes & Halves</i>	37%	37%	35%	34%	23%	
	VC Wholes & Halves	4,549	6,823	9,387	11,916	22,353	
	<i>Margin Candied cashew</i>	26%	26%	24%	23%	22%	
	VC Candies cashew	1,713	2,570	3,519	4,456	7,188	
	Variable costs	6,262	9,393	12,906	16,372	29,542	
	Overhead (FC3)	3.1%	686	686	686	686	686
	Total Cost	6,948	10,079	13,592	17,058	30,228	
SALES EXW							
	<i>price/kg (ex VAT)</i>						
	Max. sales Wholes & Halves (ton)	788	46	46	46	46	46
	Max. sales Candied cashew (ton)	500	23	23	23	23	23
	Capacity utilization % of maximum	20%	30%	40%	50%	80%	
	Total Revenues	9,562	14,342	19,123	23,904	38,246	
EBITDA		2,613	4,263	5,531	6,846	8,018	
	EBITDA %	27%	30%	29%	29%	21%	
	Depreciation	136	136	136	136	136	
EBIT		2,478	4,128	5,395	6,710	7,882	
	Interest payments	208	0	0	0	0	
Profit before Tax		2,270	4,128	5,395	6,710	7,882	
	Income tax paid	20%	-454	-826	-1,079	-1,342	-1,576
Profit after Tax		1,816	3,302	4,316	5,368	6,306	

Table 4 - Profitability ratios in Cashew Processing

CB4 Table 6. Profitability Ratios		v1 CASHEW PROCESSOR GA1000 Dalasi				
	period	2018	2019	2020	2021	2027
Cumulative Profit after tax /	2,376	1,816	5,118	9,434	14,802	50,027
Cumulative Equity paid in	560	560	560	560	560	560
<i>Return on equity (ROE)</i>	424.3%	324%	457%	562%	661%	893%
Cumulative Profit after tax /	2,376	1,816	5,118	9,434	14,802	50,027
Total Investment	2,560	2,560	2,560	2,560	2,560	2,560
<i>Return on investment (ROI)</i>	92.8%	71%	100%	123%	145%	195%
Annual Profit after tax /	62,533	2,270	4,128	5,395	6,710	7,882
Net Sales	282,067	9,562	14,342	19,123	23,904	38,246
<i>Return on Sales = Profitability</i>	22%	24%	29%	28%	28%	21%
Contribution /	70,962	3,300	4,950	6,217	7,532	8,705
Net Sales	282,067	9,562	14,342	19,123	23,904	38,246
<i>Contribution margin</i>	25%	35%	35%	33%	32%	23%

Table 5 - IRR and Payback Period Cashew Processing

CB4 Table 7. IRR and NPV		v1 CASHEW PROCESSOR GA1000 Dalasi				
		2018	2019	2020	2021	2027
Investment in assets		-2,560	0	0	0	0
Net cash flow		-609	3,438	4,452	5,504	6,442
Discounted net cash flow	24.0%	(609)	2,772	2,895	2,887	929
Accumulated discounted net cash flow		(609)	2,164	5,059	7,946	17,117
		NPV	IRR	PBP		
Net Present Value / IRR (10 yrs)		17,117	592.2%			
Net Present Value / IRR (15 yrs)		19,669	592.2%	2 years		

The ROI = 93% and the investment of D2.56 million is repaid in Year 2. See Excel sheet CB4_Cashew_Processor for all other CB4 tables.

2.5 Employment from Cashew

The processing unit above directly employs 11 permanent works. And, at 85% capacity utilization, needs 200 tons of raw cashew from 36,000 trees. This requires about 8,100 man-days, or 23 FTE for tree maintenance and land clearing and another 5.5 FTE for harvesting by the *Manjago* people from Guinea Bissau and Casamance. So, a total of 40 FTE per processing unit.

Table 6 - CB1 Cashew Farming

CASHEW FARM 1 HA NOT IRRIGATED YIELD AT FULL MATURITY						GAMBIA		2017	
CB1 Cashew nut raw nuts in jute bags, 90 kg; Cashew fruit in crates of 25 kg									
Hectares planted	1 ha		Yield per hectare	0.556 ton/ha		Kernels per tree			
Quality grade finished product				GMD per ton		GMD per year			
Percentage grade	100%	fruit	A-nuts	B-nuts		Total Revenue	45,835		
Price (delivered)		0	85,000	68,000	82,450	Total Cost	967		
VC4 Transport					5	Profit Before Tax	44,868		
VC4 Other costs					1	Profit %	98%		
P (Ex Farm)					82,444	Cash flow	44,868		
Seedlings 4% replacement/ year	qty	price	total farm	cost/ha	cost/ton		Asset value	-	
Fertilizers (ton)	0	450	0	0	0	0%	Depreciation %	0.0%	
Pesticides, herbicides (per ha)	1	0	0	0	0	0%	FC1	-	
VC1			60	60	108	6%	Debt 50% of assets, 100% of VC	-	
Hired labor fire protection & pruning, man days	man days	price					Interest rate	25.0%	
Hired labor harvesting, man days	6	0	0	0	0	0%	FC2	-	
Tractor use (kms)	0	2.5	0	0	0	0%	FTE family labor	-	
Irrigation water, kWh	0	0.05	0	0	0	0%	Family labor cost (80% of hired labor)	-	
VC2			900	900	1,619	93%	Other overhead (33% of family labor cost)	-	
Packaging of cashew nuts (90kg)	5.3	0.025	0.1	7	13	1%	FC3	-	
Packaging of cashew fruit (25kg)	0.0	0.001	0.0	0	0	0%	FC	-	
VC3			0.1	7	13	1%	FC % attributed to product	100%	
VC			967	967	1,740	100%	FC (attributed to product)	-	
Margin			44,868	80,704			Contribution	44,868	
Margin %						98%	Quantity sold q (= ha * yield)	0.6	
VC				967	1,740	100%	Break even volume (ton)	-	
FC / q				0	0	0%	Break even yield (ton/ha)	-	
TC / q				967	1,740	100%			
Profit / q				44,868	80,704	98%			

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

Table 7 - CB1 Cashew Nut Tolling

CB1 CASHEW NUT TOLLING 200 TON		GAMBIA		Sep-17
Dried cashew nuts WW in 200g standup pouch, 100 in plastic box (20 kg)				
	GMD per kg			GMD per year
Price (PROCESSING FEE)	115	100%	Total Revenue (Delivered)	5,589,000
VC4 Sales commission, 4%	-	0%	Total Cost	2,698,356
VC4 Transport	-	0%	Profit Before Tax	2,890,644
Price (EXW)	115	100%	Profitability %	52%
			Cash flow	3,554,324
Price (cashew delivered)	-		Asset value	2,560,000
Processing ratio	4.1		Depreciation %	5.3%
Raw Material cost	-	0%	FC1	135,680 17%
Other ingredients	-	0%	Debt (20% of raw material processed)	-
VC1	-	0%	Interest rate	24.0%
Production cost per batch	3,087		FC2	- 0%
Production quantity per batch (kg)	80		Number of FTE employed	11
VC2	39	100%	Salaries staff incl. social taxes	528,000 64%
Cost of packing material (pouch, 2 labels, carton)	0		Other overhead, rent, internal revenue tax	158,400 19%
Number of selling units per kg	0.05		FC3	686,400 83%
VC3	-	0%	FC	822,080 100%
FG losses % in storage	0.1%		FC % attributed to product	100.0%
VC	39	100%	FC (attributed to product)	822,080
Margin	76		Quantity sold q (kg)	48,600
Margin % of Price	66%		Contribution	3,712,724
VC	39	70%	Break even volume (sales)	10,761 19%
Fixed Cost / q	17	30%	Break even volume (raw material)	44,284
Total Cost / q	56	100%	Output capacity per batch (kg)	80
Profit / q	59		Production batches per day	2.00
			Length of harvesting season in days	360
			Maximum capacity per year	57,600
			Capacity utilization	84%

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

Table 8 - CB1 Cashew Processing Unsorted Nuts

CB1 CASHEW NUT PROCESSING UNSORTED		GAMBIA		Sep-17
Dried cashew nuts WW in 200g standup pouch, 100 in plastic box (20 kg)				
	GMD per kg			GMD per year
Price (delivered client)	705	100%	Total Revenue (Delivered)	35,380,272
VC4 Sales commission, discount, 4%	28	4%	Total Cost	28,195,469
VC4 Transport	20	3%	Profit Before Tax	7,184,803
Price (EXW)	657	93%	Profitability %	20%
			Cash flow	7,848,483
Price (cashew delivered)	82.5		Asset value	2,560,000
Processing ratio	4.0		Depreciation %	5.3%
Raw Material cost	329	74%	FC1	135,680 4%
Other ingredients	-	0%	Debt (70% of raw material processed)	11,543,000
VC1	329	74%	Interest rate	24.0%
Production cost per batch	3,087		FC2	2,770,320 77%
Production quantity per batch (kg)	80		Number of FTE employed	11
VC2	39	9%	Salaries staff incl. social taxes	528,000 15%
Cost of packing material (pouch, 2 labels, carton)	1,410		Other overhead, rent, internal revenue tax	158,400 4%
Number of selling units per kg	0.05		FC3	686,400 19%
VC3	71	16%	FC	3,592,400 100%
FG losses % in storage	1.0%		FC % attributed to product	100%
VC	442	100%	FC (attributed to product)	3,592,400
Margin	215		Quantity sold q (kg)	50,185
Margin % of Price	30%		Contribution	10,777,203
VC	442	86%	Break even volume (sales)	16,728 29%
Fixed Cost / q	72	14%	Break even volume (raw material)	66,667
Total Cost / q	514	100%	Output capacity per batch (kg)	80
Profit / q	143		Production batches per day	2.00
			Length of harvesting season in days	360
			Maximum capacity per year	57,600
			Capacity utilization	87%

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

Table 9 - CB1 Cashew Processing Wholes & Halves

CB1 CASHEW PROCESSING Wholes & Halves		GAMBIA		Sep-17
Dried cashew nuts WW in 200g standup pouch, 100 in plastic box (20 kg)				
	GMD per kg			GMD per year
Price (delivered client)	788	100%	Total Revenue (Delivered)	31,616,413
VC4 Sales commission, discount, 4%	32	4%	Total Cost	22,304,415
VC4 Transport	20	3%	Profit Before Tax	9,311,998
Price (EXW)	736	93%	Profitability %	29%
			Cash flow	9,975,678
Price (cashew delivered)	82.5		Asset value	2,560,000
Processing ratio	4.0		Depreciation %	5.3%
Raw Material cost	329	74%	FC1	135,680 4%
Other ingredients	-	0%	Debt (70% of raw material processed)	9,233,000
VC1	329	74%	Interest rate	24.0%
Production cost per batch	3,087		FC2	2,215,920 73%
Production quantity per batch (kg)	80		Number of FTE employed	11
VC2	39	9%	Salaries staff incl. social taxes	528,000 17%
Cost of packing material (pouch, 2 labels, carton)	1,410		Other overhead, rent, internal revenue tax	158,400 5%
Number of selling units per kg	0.05		FC3	686,400 23%
VC3	71	16%	FC	3,038,000 100%
FG losses % in storage	1.0%		FC % attributed to product	82%
VC	442	100%	FC (attributed to product)	2,489,472
Margin	294		Quantity sold q (kg)	40,148
Margin % of Price	37%		Contribution	11,801,470
VC	442	88%	Break even volume (sales)	8,469 18%
Fixed Cost / q	62	12%	Break even volume (raw material)	33,751
Total Cost / q	504	100%	Output capacity per batch (kg)	64
Profit / q	232		Production batches per day	2.00
			Length of harvesting season in days	360
			Maximum capacity per year	46,080
			Capacity utilization	87%

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

Table 10 - CB1 Cashew Processing Splits into Candies

CB1 CASHEW PROCESSING CANDIES		GAMBIA		Sep-17
Candied cashew splits 5g individually wrapped, 4000 pieces per Selling unit (20 kg)				
	GMD per kg			GMD per year
Price (delivered client)	500	100%	Total Revenue (Delivered)	10,036,957
VC4 Sales commission, discount, 4%	20	4%	Total Cost	7,725,743
VC4 Transport	20	4%	Profit Before Tax	2,311,214
Price (EXW)	460	92%	Profitability %	23%
			Cash flow	2,974,894
Price (grade III and IV cashew)	375		Asset value	2,560,000
Processing ratio	0.5		Depreciation %	5.3%
Raw Material cost	188	57%	FC1	135,680 9%
Other ingredients	28	8%	Debt (70% of raw material processed)	2,632,000
VC1	215	65%	Interest rate	24.0%
Production cost per batch	795		FC2	631,680 43%
Production quantity per batch (kg)	60		Number of FTE employed	11
VC2	13	4%	Salaries staff incl. social taxes	528,000 36%
Cost of packing material (wrap, PP bag)	2,005		Other overhead, rent, internal revenue tax	158,400 11%
Number of selling units per kg	0.05		FC3	686,400 47%
VC3	100	30%	FC	1,453,760 100%
FG losses % in storage	1.0%		FC % attributed to product	18%
VC	332	100%	FC (attributed to product)	262,484
Margin	128		Quantity sold q (kg)	20,074
Margin % of Price	26%		Contribution	2,573,698
VC	332	96%	Break even volume (sales)	2,047 9%
Fixed Cost / q	13	4%	Break even volume (raw material)	1,024
Total Cost / q	345	100%	Output capacity per batch (kg)	5.0
Profit / q	115		Production batches per day	12.8
			Length of harvesting season in days	360
			Maximum capacity per year	23,040
			Capacity utilization	87%

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
- 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 % = 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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