

FOOD RESEARCH INSTITUTE
(COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH)

**COST OF PLANT EQUIPMENT AND MACHINERY
FOR THE PRODUCTION OF FUFU FLOUR**

AND

**TECHNO-ECONOMIC GUIDE FOR THE
ESTABLISHMENT AND OPERATION OF FUFU
FLOUR PROCESSING PLANT**

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FOR
MINISTRY FOR WOMEN & CHILDREN'S AFFAIRS
ACCRA

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TECHNO – ECONOMIC GUIDE FOR THE ESTABLISHMENT OF FUFU PROCESSING FACTORIES AT SELECTED DISTRICTS

EXECUTIVE SUMMARY

Processing of agricultural produce not only contributes to food preservation and security but also offers better opportunity for expanded product utilization and adds value. This is even more compelling in a situation where the nation records an annual post – harvest loss of agricultural produce of over 25%.

This techno – economic guide has therefore been prepared to facilitate investment decision making by District Assemblies in the establishment and operation a small-scale food processing plant to produce fufu flours and fermented maize and cassava flour in their districts.

The guide is modelled on the following:

- ⇒ That a factory structure will be built at a location in the district close to the raw material supply base and where facilities such as electricity and water exist.
- ⇒ That a 300 kg per day capacity plant equipment and machinery will be constructed and or acquired, delivered and installed by the Food Research Institute.
- ⇒ That a loan of ₵560,000,000 with interest of 40% with one year moratorium on the principal is given to the “ owners” and operators of the factory.

Please note that cost of factory building and loan value are not fixed depending on local situation such the use of existing structure and the Assembly investing without a loan.

Cost of Investment

Total cost of Investment is estimated at ₵594,000,000. This is made up of the following:

- Fixed Assets ₵358,000,000
- Working Capital ₵236,000,000

Production Plan

The production plant is designed to produce 27metric tonnes of plantain, 27 metric tonnes of yam and 18 metric tonnes of cocoyam flours as well as 9 metric tonnes each of fermented maize and cassava flours.

Revenue/Profit estimates

Revenue accruing from sales of products is projected to increase from ₦1,600,000,000 in the first year of operation to ₦2,500,000,000 in the seventh year with corresponding net profit levels of ₦265,000,000 and ₦750,000,000 respectively.

Cash flow projections

Projected Net Cash flow position would also increase from ₦290,000,000 in the first year to ₦1,000,000,000 in the seventh year.

Lastly, the project seeks to achieve an NPV and IRR of ₦460,000,000 and 60% respectively. The IRR of 60% is higher than opportunity cost of capital which presently stand at about 35%. Such a high IRR value does not only prove the financial viability of the project but also guarantees the project's survival from unexpected external shocks.

Socio – economic Benefits

Benefits to be derived from such ventures will include the following

- The provision of job opportunities for the youth in the area.
- Increased output of selected agricultural produce of the rural farmer.
- Annual injection of ₦430,000,000 as earnings of workers and farmers into the economy of the district, thus raising the purchasing power of the people and their standard of living.
- Reduction of post – harvest losses of agricultural produce in the district.

PRODUCTS

The factory produce three major authentic Ghanaian fufu flours from 100% locally produced raw materials. These are plantain, yam, and cocoyam fufu flours. These commodities would be processed separately during their respective seasonal periods. During the time of the year when these three commodities are all off season, the plant will process maize and cassava into products such as fermented maize meal and cassava flour as minor products.

By-product/Waste product

By-product/waste products to be realized from the processing plant are peels from plantain, yam, cocoyam and cassava. These are to be sold as feed for the livestock industry. Also peels

Table 1: List of plant equipment and accessory with cost

Equipment	Qty	Unit Cost	Amount, ₦
Disintegrator	1	5,000,000	5,000,000
Grater	1	3,500,000	3,500,000
Walk-in hot air cabinet dryer	1	40,000,000	40,000,000
Attrition mill	1	6,000,000	6,000,000
Hammer mill	1	10,000,000	10,000,000
Sifter	1	10,000,000	10,000,000
Blender	1	7,000,000	7,000,000
Trolley	1	600,000	600,000
Weighing scale, 0-25/50kg	1	6,500,000	6,500,000
Weighing balance	3	500,000	1,500,000
Heat scales	2	1,500,000	3,000,000
Packaging bench	3	1,800,000	5,400,000
Plastic receptacles	10	150,000	1,500,000
TOTAL			126,700,000

Notes:

- The above cost does not include cost of transportation to site and installation.
- Please add ₦12,000,000 for contingency, transportation and installation. (Refer Appendix II of financial analysis)
- Cost of land and factory is not fixed and can change depending on conditions in the district.

Table 1 : List of plant equipment and machinery with cost

Equipment	Qty	Unit Cost	Amount, ¢
Peeling bench	1	4,000,000	4,000,000
Mobile holding tanks	1	2,000,000	2,000,000
Pressure cooker/Cooking vessel	2	4,000,000	8,000,000
Industrial gas burner with accessories	2	2,000,000	4,000,000
Disintegrator	1	5,000,000	5,000,000
Grater	1	3,500,000	3,500,000
Walk-in hot air cabinet dryer	1	40,000,000	40,000,000
Attrition mill	1	6,000,000	6,000,000
Hammer mill	1	10,000,000	10,000,000
Sifter	1	10,000,000	10,000,000
Blender	1	7,000,000	7,000,000
Trolley	1	600,000	600,000
Weighing scale, 0-25/50kg	1	6,500,000	6,500,000
Weighing balance	3	600,000	1,800,000
Heat sealer	2	1,500,000	3,000,000
Packaging bench	3	1,600,000	4,800,000
Plastic receptacles	30	150,000	4,500,000
TOTAL			120,700,000

Note:

- The above cost does not include cost of transportation to site and installation.
- Please add ¢32,000,000 for contingency, transportation and installation.
(Refer Appendix II of financial analysis).
- Cost of land and factory is not fixed and can change depending on conditions in the district.

APPENDIX I

SUMMARY OF PROJECT INVESTMENT COST

	Amount, ₦
Fixed assets	
- Land, Factory Building and Compound	196,350,000
- Plant equipment and machinery	152,685,500
- Office Equipment and Furniture	8,800,000
Working Capital	235,825,746
<u>Total cost of Investment</u>	<u>593,661,246</u>

Peeling bench	4,000,000	4,000,000
Mobile holding tanks	2,000,000	2,000,000
Pressure cooker/Cooking vessel	4,000,000	4,000,000
Industrial gas burner with accessories	2,000,000	2,000,000
Disintegrator	5,000,000	5,000,000
Grinder	3,500,000	3,500,000
Walk-in hot air cabinet dryer	40,000,000	40,000,000
Air motion fan	8,000,000	8,000,000
Flour sifter	10,000,000	10,000,000
Sifter	10,000,000	10,000,000
Sieves	7,000,000	7,000,000
Trolley	200,000	200,000
Weighing scale, 0-25, 50kg	6,000,000	6,000,000
Weighing balance	1,000,000	1,000,000
Heat sealer	3,500,000	3,500,000
Packaging bench	1,600,000	1,600,000
Plastic receptacles	150,000	150,000
Contingency, 10%		12,267,000
Transportation and installation, 1.5%		1,915,500
Total		<u>152,685,500</u>

SCHEDULE C: Office Equipment & Furniture

Computer, complete with printer	6,000,000
Desks, chairs, tables, shelves, etc.	2,000,000
Contingency, 10%	800,000
Total	<u>8,800,000</u>

APPENDIX II

FIXED CAPITAL COST

<u>SCHEDULE A : Factory Building and civil works</u>			<u>COST (¢)</u>
Land, 6 plots			12,000,000
Factory Building			175,000,000
Contingency, 5%			9,350,000
Total			<u>196,350,000</u>
<u>SCHEDULE B: Plant equipment & machinery</u>			
	<u>Quantity</u>	<u>Unit cost</u>	<u>Cost (¢)</u>
Peeling bench	1	4,000,000	4,000,000
Mobile holding tanks	1	2,000,000	2,000,000
Pressure cooker/Cooking vessel	2	4,000,000	8,000,000
Industrial gas burner with accessories	2	2,000,000	4,000,000
Disintegrator	1	5,000,000	5,000,000
Grater	1	3,500,000	3,500,000
Walk-in hot air cabinet dryer	1	40,000,000	40,000,000
Attrition mill	1	6,000,000	6,000,000
Hammer mill	1	10,000,000	10,000,000
Sifter	1	10,000,000	10,000,000
Blender	1	7,000,000	7,000,000
Trolley	1	600,000	600,000
Weighing scale, 0-25/50kg	1	6,500,000	6,500,000
Weighing balance	3	600,000	1,800,000
Heat sealer	2	1,500,000	3,000,000
Packaging bench	3	1,600,000	4,800,000
Plastic receptacles	30	150,000	4,500,000
Contingency, 10%			12,070,000
Transportation and installation, 15%			19,915,500
Total			<u>152,685,500</u>
<u>SCHEDULE C: Office Equipment & Furniture</u>			<u>Cost (¢)</u>
Computer, complete with printer			6,000,000
Desks, chairs, tables, shelves, etc.			2,000,000
Contingency, 10%			800,000
Total			<u>8,800,000</u>

APPENDIX III

OPERATING COST (UNIT COST OF PRODUCTION)

SCHEDULE A: DIRECT COST

1. PRODUCTION PLAN AND RAW MATERIAL REQUIREMENT

Plant

Installed capacity per day, kg		300.0
Number of production days per year		300
Installed capacity per year, kg		90,000

Total production output, kg **90,000**

Annual Production, kg

Production days

Plantain fufu	90	27,000
Yam fufu	90	27,000
Cocoyam fufu	60	18,000
Fermented Maize meal	30	9,000
Cassava flour	30	9,000

Total **90,000**

Raw material requirement

	<u>QTY (kg)</u>	<u>PRICE/KG</u>	<u>COST, ₦</u>
Plantain	54,000	2,000	108,000,000
Yam	54,000	1,500	81,000,000
Cocoyam	36,000	1,300	46,800,000
Maize	11,250	850	9,562,500
Cassava	396,000	400	158,400,000
Total	551,250		<u>403,762,500</u>

2. HUMAN RESOURCE

	<u>Number</u>	<u>Monthly Salary</u>	<u>Annual Salary</u>
Technical Director/Managing Director	1	2,000,000	24,000,000
Production Manager	1	1,500,000	18,000,000
Supervisor	2	1,200,000	28,800,000
Skilled labour	3	800,000	28,800,000
Semi skilled labour	3	600,000	21,600,000
Unskilled labour	12	300,000	43,200,000
Social security fund, 12.5%			20,550,000
Perquisites, 25% total salary			41,100,000
Total			<u>226,050,000</u>

<u>3. ELECTRICAL ENERGY REQUIREMENT</u>		
Total Plant Rating, Kw		60
Operating Period/batch, hr		15
Percentage utilization		65%
Energy consumption/batch, Kwh		585
No. of productive days/year		300
Energy consumption/ year, Kwh		175,500
Energy Cost/Kwh, ¢		500
Energy Cost/year, ¢		87,750,000
Total Energy cost/year, ¢		<u>87,750,000</u>
<u>4. WATER REQUIREMENT</u>		
Water consumption/day, litre		10,000
No. of production days/yr		300
Water consumption/yr, litre		3,000,000
Cost/1000litres, ¢		6,000.00
Total		<u>18,000,000</u>
<u>5. GAS REQUIREMENT</u>		
Gas consumption/day, kg		25
No. of production days/yr		300
Gas consumption/yr, kg		7,500
Cost per kg		4,000.00
Total		<u>30,000,000</u>
<u>6. PACKAGING MATERIAL REQUIREMENT</u>		
Weight of product per day, kg		300
Number of packaging materials per day		600
Number of production days per year		300
Number of packaging materials per year		180,000
Cost per unit packaging material, ¢		850.00
Total		<u>153,000,000</u>
<u>7. TOTAL DIRECT OPERATING COST</u>		<u>Cost (¢)</u>
Direct Labour		226,050,000
Raw material		403,762,500
Electricity		87,750,000
Water		18,000,000
Gas		30,000,000
Packaging material		153,000,000
Total		<u>918,562,500</u>

SCHEDULE B: ADMINISTRATIVE COST			
<u>1. INDIRECT LABOUR</u>			
	<u>Number</u>	<u>Monthly Salary</u>	<u>Annual Salary</u>
Secretary	1	400,000	4,800,000
Accounting Officer	1	600,000	7,200,000
Security Officer	4	200,000	9,600,000
Total			<u>21,600,000</u>
<u>2. DEPRECIATION, REPAIR & MAINTENANCE AND INSURANCE</u>			
<u>A. DEPRECIATION</u>			
	<u>VALUE</u>	<u>RATE</u>	<u>VALUE</u>
Factory Building	196,350,000	5%	9,817,500
Plant Equipment & machinery	152,685,500	10%	15,268,550
Office equipment & furniture	8,800,000	5%	440,000
Total	349,035,500		25,526,050
<u>B. REPAIR AND MAINTENANCE</u>			
		<u>RATE</u>	<u>VALUE</u>
Factory Building	196,350,000	3%	4,908,750.0
Plant Equipment & machinery	152,685,500	5%	7,634,275.0
Office equipment & furniture	8,800,000	3%	220,000.0
Total	349,035,500		12,763,025
<u>C. INSURANCE</u>			
		<u>RATE</u>	<u>VALUE</u>
Factory Building	196,350,000	1%	981,750
Plant Equipment & machinery	152,685,500	2%	3,053,710
Office equipment & furniture	8,800,000	1%	88,000
Total	349,035,500		4,123,460
<u>3. OTHER INDIRECT COSTS</u>			
			<u>Cost (¢)</u>
Stationery			1,500,000
Fuel and lubricants			500,000
Audit & Legal fees			2,000,000
Post & Postage			1,000,000
Communication			2,000,000
Operating Overheads, 2%			140,000
Contingency, 10%			714,000
Total			<u>7,854,000</u>
<u>4. TOTAL ADMINSTRATIVE COST</u>			
Indirect Labour			21,600,000
Repair and maintenance			12,763,025
Insurance			4,123,460
Other indirect cost			7,854,000
Total			<u>24,740,485</u>
<u>UNIT COST OF PRODUCTION</u>			
			<u>10,481</u>

APPENDIX IV

WORKING CAPITAL (3 MONTHS)

Operating cost		229,640,625
Administrative cost		6,185,121
Total working capital		<u>235,825,746</u>

APPENDIX V

PROJECT FINANCING PLAN & LOAN REPAYMENT

SCHEDULE A: FINANCING PLAN

	EQUITY, ₦	LOAN, ₦	TOTAL, ₦
Fixed Assets			
Land, civil works and drainage	21,350,000	0	21,350,000
Factory Building	0	175,000,000	175,000,000
Equipment & Machinery	0	152,685,500	152,685,500
Office equipment & furniture	8,800,000	0	8,800,000
Working capital	0	235,825,746	235,825,746
Total	30,150,000	563,511,246	593,661,246
Equity to loan ratio	1	19	
Percentage equity	5%	95%	

SCHEDULE B: LOAN REPAYMENT							
ITEM / PAYMENT DATE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7
PRINCIPAL	563,511,246						
INTEREST RATE	40%						
REPAYMENT PERIOD :	7 YEARS						
COMMITMENT FEE, 1%	5,635,112						
MORATORIUM ON PRINCIPAL	1 YEAR						
AMOUNT OUTSTANDING	569,146,359	569,146,359	474,288,632	379,430,906	284,573,179	189,715,453	94,857,726
LOAN REPAYMENT	0	94,857,726	94,857,726	94,857,726	94,857,726	94,857,726	94,857,726
INTEREST PAYABLE	227,658,543	227,658,543	189,715,453	151,772,362	113,829,272	75,886,181	37,943,091
CLOSING BALANCE	569,146,359	474,288,632	379,430,906	284,573,179	189,715,453	94,857,726	0
TOTAL AMOUNT PAYABLE	227,658,543	322,516,270	284,573,179	246,630,089	208,686,998	170,743,908	132,800,817
TOTAL CUM. AMOUNT PAYABLE	227,658,543	550,174,813	834,747,993	1,081,378,082	1,290,065,080	1,460,808,987	1,593,609,804

APPENDIX VI

PRODUCTION PLAN & REVENUE ESTIMATION

I. PRODUCTION PLAN	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7
Plant							
Installed capacity per day, kg	300.0	300.0	300.0	300.0	300.0	300.0	300.0
Number of production days per year	300	300	300	300	300	300	300
Installed capacity per year, kg	90,000	90,000	90,000	90,000	90,000	90,000	90,000
Plant capacity utilization, %	85	90	90	95	95	95	95
Total production output, kg	76,500	81,000	81,000	85,500	85,500	85,500	85,500
Annual Production, kg							
Plantain fufu	22,950	24,098	25,302	26,567	26,567	26,567	26,567
Yam fufu	22,950	24,098	25,302	26,567	26,567	26,567	26,567
Cocoyam fufu	15,300	16,065	16,868	17,712	17,712	17,712	17,712
Maize meal	7,650	8,033	8,434	8,856	8,856	8,856	8,856
Cassava flour	7,650	8,033	8,434	8,856	8,856	8,856	8,856
Total	76,500	80,325	84,341	88,558	88,558	88,558	88,558

2. REVENUE							
Item / Year	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7
a) Ex-factory price, €/kg							
Plantain fufu	24,000	25,200	26,460	27,783	29,172	30,631	32,162
Yam fufu	24,000	25,200	26,460	27,783	29,172	30,631	32,162
Cocoyam fufu	24,000	25,200	26,460	27,783	29,172	30,631	32,162
Maize meal	12,000	12,600	13,230	13,892	14,586	15,315	16,081
Cassava flour	10,000	10,500	11,025	11,576	12,155	12,763	13,401
b) Revenue							
Plantain fufu	550,800,000	607,257,000	669,500,843	738,124,679	775,030,913	813,782,458	854,471,581
Yam fufu	550,800,000	607,257,000	669,500,843	738,124,679	775,030,913	813,782,458	854,471,581
Cocoyam fufu	367,200,000	404,838,000	446,333,895	492,083,119	516,687,275	542,521,639	569,647,721
Maize meal	91,800,000	101,209,500	111,583,474	123,020,780	129,171,819	135,630,410	142,411,930
Cassava flour	76,500,000	84,341,250	92,986,228	102,517,317	107,643,182	113,025,341	118,676,609
Total Revenue	1,637,100,000	1,804,902,750	1,989,905,282	2,193,870,573	2,303,564,102	2,418,742,307	2,539,679,422
NOTE: ASSUMPTION							
Ex-factory price increases by 5% every year							
Production cost increases by 5% annually							

APPENDIX VII

PROJECTED INCOME STATEMENT

ITEM / YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7
Revenue	1,637,100,000	1,804,902,750	1,989,905,282	2,193,870,573	2,303,564,102	2,418,742,307	2,539,679,422
Direct Operating Cost	918,562,500	964,490,625	1,012,715,156	1,063,350,914	1,116,518,460	1,172,344,383	1,230,961,602
Gross Profit Margin	718,537,500	840,412,125	977,190,126	1,130,519,659	1,187,045,642	1,246,397,924	1,308,717,820
Administrative Cost	24,740,485	25,977,509	27,276,385	28,640,204	30,072,214	31,575,825	33,154,616
Marketing and distribution cost	32,742,000	36,098,055	39,798,106	43,877,411	46,071,282	48,374,846	50,793,588
Depreciation	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050
Profit before Interest/Tax	635,528,965	752,810,511	884,589,585	1,032,475,994	1,085,376,096	1,140,921,203	1,199,243,566
Interest on Loan	227,658,543	227,658,543	189,715,453	151,772,362	113,829,272	75,886,181	37,943,091
Corporate Tax, 35%	142,754,648	183,803,189	243,205,946	308,246,271	340,041,388	372,762,258	406,455,166
Net Profit	265,115,774	341,348,779	451,668,186	572,457,360	631,505,436	692,272,764	754,845,309
NOTE : ASSUMPTIONS							
Direct Operating Cost increases by 5% every year							
Administrative Cost increases by 5% every year							

APPENDIX VIII

PROJECTED CASH FLOW STATEMENT

ITEM / YEAR	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7
<u>Cash inflow</u>								
Net Profit	0	265,115,774	341,348,779	451,668,186	572,457,360	631,505,436	692,272,764	754,845,309
Depreciation	0	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050	25,526,050
Salvage Value	0	0	0	0	0	0	0	35,783,550
Working Capital	0	0	0	0	0	0	0	235,825,746
TOTAL CASH INFLOW	0	290,641,824	366,874,829	477,194,236	597,983,410	657,031,486	717,798,814	1,051,980,655
<u>Cash outflow</u>								
Fixed assets								
Factory Building	196,350,000	0	0	0	0	0	0	0
Plant Equipment & Machinery	152,685,500	0	0	0	0	0	0	0
Office Equipment & Furniture	8,800,000	0	0	0	0	0	0	0
Total	349,035,500	0	0	0	0	0	0	0
Current assets	235,825,746	0	0	0	0	0	0	0
Principal repayment	0	0	94,857,726	94,857,726	94,857,726	94,857,726	94,857,726	0
Total cash outflow	584,861,246	0	94,857,726	94,857,726	94,857,726	94,857,726	94,857,726	0
NET CASH FLOW	-584,861,246	290,641,824	272,017,102	382,336,510	503,125,684	562,173,759	622,941,088	1,051,980,655
NET PRESENT VALUE	459,976,743							
INTERNAL RATE OF RETURN	60.28	%						

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