FOOD RESEARCH INSTITUTE

(CSIR)

FOOD RESEARCH INSTITUTE

TECHNICAL REPORT ON ELSA FOODS PRODUCTS

Prepared for

AFRICAN PROJECT DEVELOPMENT FACILITY

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To Mr. Philip Baidoo, we say, thank you for your assistance.

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EXECUTIVE SUMMARY

ELSA Foods is a small food processing company which produces dehydrated foods from root and tuber crops, plantain, maize and legumes. The company is aspiring to expand to medium scale processing factor.

The objective of this study is to undertake a technical assessment of Elsa Foods factory and assess the needs for improvement of the factory. The study also covers assessment of the status of existing equipment and other facilities; review of production processes; evaluation of quality of products and a collection of data for financial analysis; and finally identification of processing constraints and recommendations.

Cooking and drying facilities had low capacity which limited production output, space for operation activities was found limiting.

Inadequate working capital for procurement of raw material and other inputs was adversely affecting production levels.

Production technologies need to be improved and there is the need to enhance the skill of staff through training.

Elsa Foods company needs to have increased capacity to enhance satisfactory production levels.

1.0 INTRODUCTION

ELSA FOODS is one of the few agro-processing industries attempting to adopt and use improved technologies for processing dehydrated Ghanaian foods and pasta products on industrial basis. The factory plays a major role in reduction of post-harvest losses of plantain, cocoyam, yam, cassava and maize.

Products from this factory include dehydrated fermented maize-meal, cassava flour, kokonte flour, plantain fufu cocoyam fufu, yam fufu, weanimix (tombrown) and pasta products (macaroni, spaghetti and vermicelli).

The company is marketing its products through supermarkets and individual exporters. The challenge of export and local demand has not been met by the company due to limiting capacity of the factory.

To meet the challenging demand of products there is the need to review the processing steps, study seasonal availability of raw materials and increase the level of satisfactory operation.

The objective of this study is to undertake a technical assessment of ELSA FOODS factory and assess the needs for improvement of the factory.

2.0 TERMS OF REFERENCE

This working paper is supposed to provide the following:-

a. Review the production process and produce flow charts.
b. Provide information and data on raw materials and other inputs for achieving satisfactory level of operation.
c. Assess the market for raw materials and final products.
d. Provide production and other data for financial analysis of the company.

3.0 METHODOLOGY

The Food Research Institute (FRI) team visited the premises of Elsa Foods at Kpone to study production processes, procurement of raw materials, distribution channels for processed products, identify production facilities and gather data on sales figures.

The team also collected data from Ministry of Food and Agriculture, Statistics Services, Import Inspection Companies, Customs Excise and Preventive Service, Ministry of Trade and Industry, Ghana Export Promotion Council, Ghana Standards Board and Airline and Shipping Companies.

Supermarkets and other sales outlets where Elsa products are sold were visited to identify other competing products as well as to collect information on consumers reaction to Elsa Foods from the Sales Managers and Salesmen.

4.0 TECHNOLOGY OF FUFU PROCESSING

Plantain, cocoyam, yam, cassava are perishable food crops that are utilised in preparation of 'fufu'.

Fufu is an important traditional staple dish prepared by pounding of boiled starchy crops, plantain, cocoyam, yam and cassava. The traditional preparation method is time consuming and involves drudgery.

Fufu flours were developed as convenient intermediate products which require much shorter time for preparation.

The technology was developed by Food Research Institute and adopted by Elsa Foods. The fufu technology has many advantages. Some of the advantages are as follows:

a. Means of preservations of starchy roots, tubers and plantain.
b. A way of upgrading traditional technologies
c. Convenience - less preparation time
d. Long shelf life - product can stay on shelf for about 1 year

e. Reduction in bulk density - resulting in minimum cost of packaging and distribution

f. Reduction of fuel cost

g. Removal of drudgery of pounding with wooden mortar and pestle.

This technology is also of increasing employment opportunities and income.

The technology is based on the efficient dehydration of pre-cooked cocoyam, yam, plantain, cassava; milling and blending with cassava starch.

Fufu flours are for use in the home, restaurants and other group feeding in boarding institutions.

4.1 Yam Fufu Flour

Processing Procedure

The procedure is outlined schematically in figure 1.

Mature harvested yam tubers (white yam) is manually peeled and trimmed using stainless steel knives. Following peeling and trimming the yams are sliced thinly to promote uniformity of cooking.

Cooking is in boiling water using large cooking sauce pan. Each saucepan can take approximately ten tubers of yam and cooking time is about 40 minutes and the resultant chopped product is spread on trays. The trays are arranged on trolleys which are pushed into cabinet dryers for drying. Optimum drying temperature is 70°C for 12 hours. The product is dried to about 10% moisture and milled in a hammer mill into fine flour. The yam flour is blended with cassava starch and sifted to obtain uniform blend. It is package in cellophane.

4.2 Plantain Fufu Flour

Plantain is a climacteric fruit that plays a major role in the food economy of Ghana. Heavy losses of plantain occur during transporting and distribution and there is the need to process it to extend shelf life.

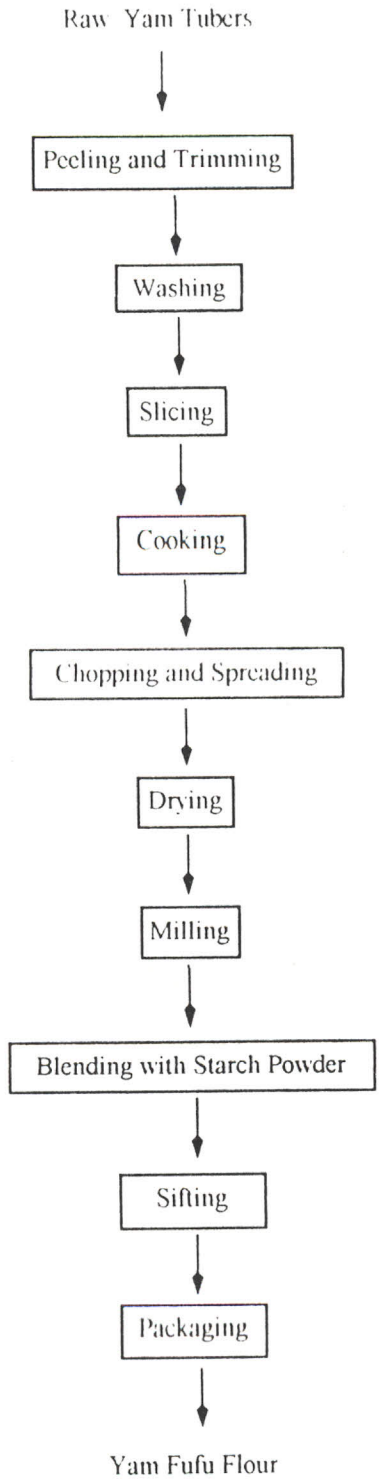

Fig. 1 Preparation of Yam Fufu Flour

Processing Procedure

Processing involves 10 unit operations as outline in the flow chart in Figure 2. Mature green plantain is used for processing of plantain fufu flour. Plantain fingers are blanched by immersion in hot water for ten minutes before peeling. Peeling is performed manually. The peel is a by-product used as animal feed. The peeled plantain fingers are washed, cut into small pieces manually with knives. The shape and sizes of pieces are like French fries. Cutting helps the cooking process. The small pieces are washed, and cooked in boiling water until soft usually 20-30 minutes. Cooking gelatinises starch, and inactivate enzymes. The cooked plantain is spread on trays, which are arranged on trolleys and dried in hot air cabinet dryers at 65°C for 12 to 15 hours or until the moisture content is less than 10%. This is cooled and milled in a hammer mill to fine flour. It is blended with cassava starch, dried cooked cassava flour, sifted and packaged as plantain fufu flour.

4.3 Cocoyam Fufu Flour

Among the roots and tubers, cocoyam has the longest shelf-life. It is generally boiled and eaten as ampesi or fried for direct consumption. Alternative way to reduce post-harvest losses of cocoyam is to process it into cocoyam fufu flour.

Processing Procedure

The processing steps are shown on Figure 3 and is similar to yam fufu flour. Cocoyam is peeled, washed, cooked, chopped and spread thinly on trays for drying in a hot air cabinet dryers at 65°C to get product of moisture about 10%.

It is milled in a hammer mill to fine flour and blended with starch powder. It is sifted and packaged as cocoyam fufu flour.

4.4 Cassava Starch Manufacture

Cassava starch is used in formulation of fufu flours. However it can be used as thickener in soups and gravies.

Processing Procedure

Peeled, washed cassava tubers are mechanically grated to obtain a mash. The mash is diluted with water to a slurry to facilitate screening. Fibrous material is retained on screen and starch milk passes through the screen. The starch milk is poured into plastic containers which are used as settling vats to

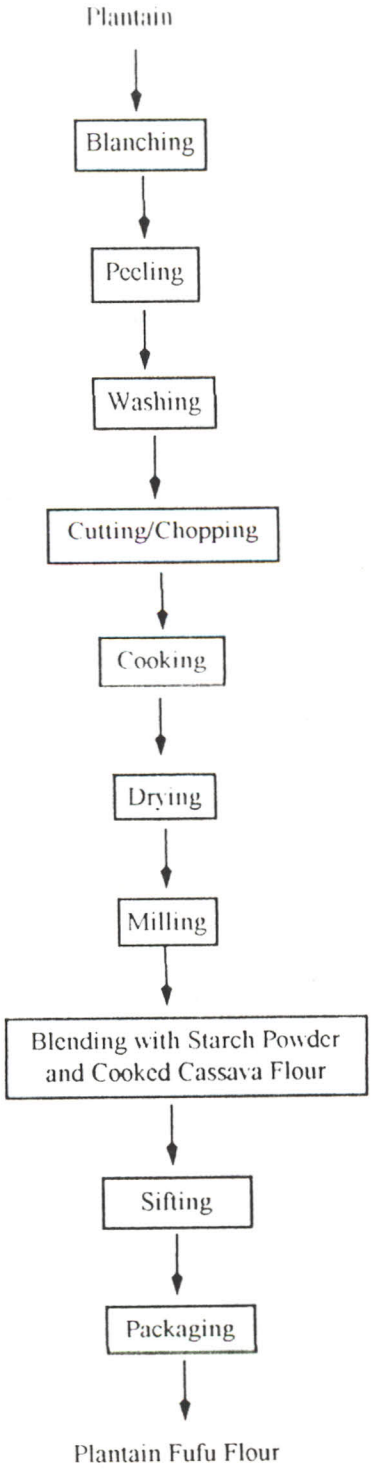

Fig. 2 Preparation of Plantain Fufu Flour

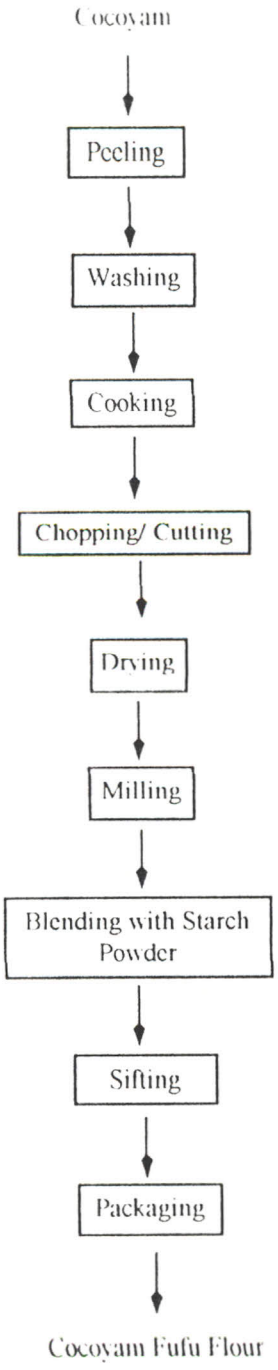

Fig. 3 Preparation of Cocoyam Fufu Flour

settle starch granules. Settling starch is followed by dewatering. The starch cake resulting is washed pressed to remove excess water. The starch cake is dried in a cabinet dryer at 40oC for 10 hours to obtain cassava starch of moisture contain less than 10%. This is milled to fine powder and packaged for subsequent usage as ingredient in fufu blending.

4.5 Cooked Cassava Flour

Cooked cassava flour and cassava starch are ingredients in fufu flour manufacture. They improve the textural properties of the fufu flours during reconstitution.

Peeled washed cassava is cooked, dried, milled, sifted and packaged as cooked cassava flour. It is not sold as such but used in formulation of fufu flour.

5.0 FERMENTED CASSAVA FLOUR

Fermented Cassava Flour is an intermediate product used alone or blended with fermented maize meal in preparation of banku or apkle.

Processing Procedure

The processing steps are outlined in figure 5. Peeling and washing of cassava is followed by grating into a mash. The cassava mash is packed in nylon sacks for pressing and fermentation. Fermentation is for a period of 3 days. Fermented mash is pressed to remove excess water and spread on trays for drying at 55°C in a cabinet batch dryer for 12 - 15 hours. The dried product is hammer milled, sifted to remove fibrous material and to improve the appearance. This is weighed and packaged in cellophane bags as fermented cassava flour.

6.0 KOKONTE PROCESSING PROCEDURE

Figure 6 is a flow diagram for preparation of kokonte flour.

Mature freshly harvested cassava is used for processing kokonte. The cassava tubers are peeled manually, washed several times to remove dirt; sliced manually and steeped in excess water for one day (24 hours) at room temperature in plastic containers. The steeped cassava slices are withdrawn

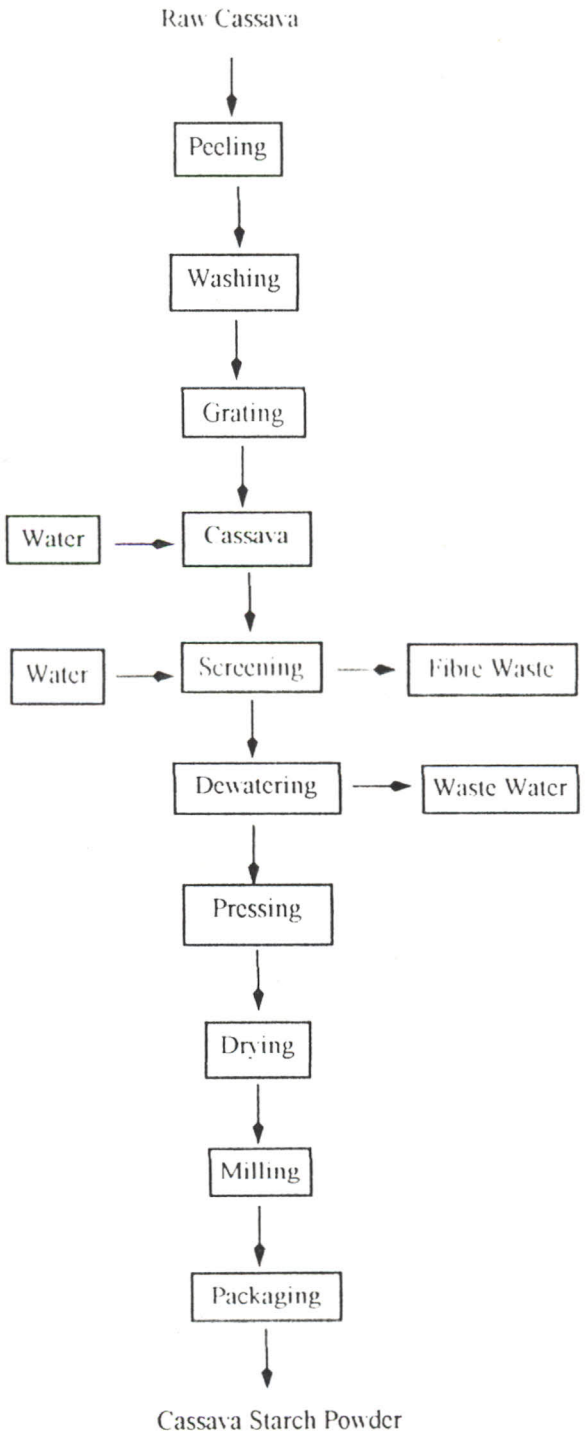

Fig 4. Preparation of Cassava Starch Powder

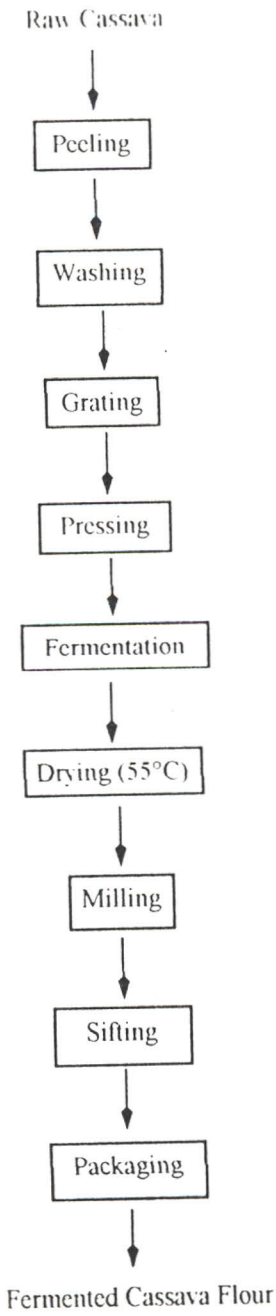

Fig. 5 Preparation of Fermented Cassava Flour

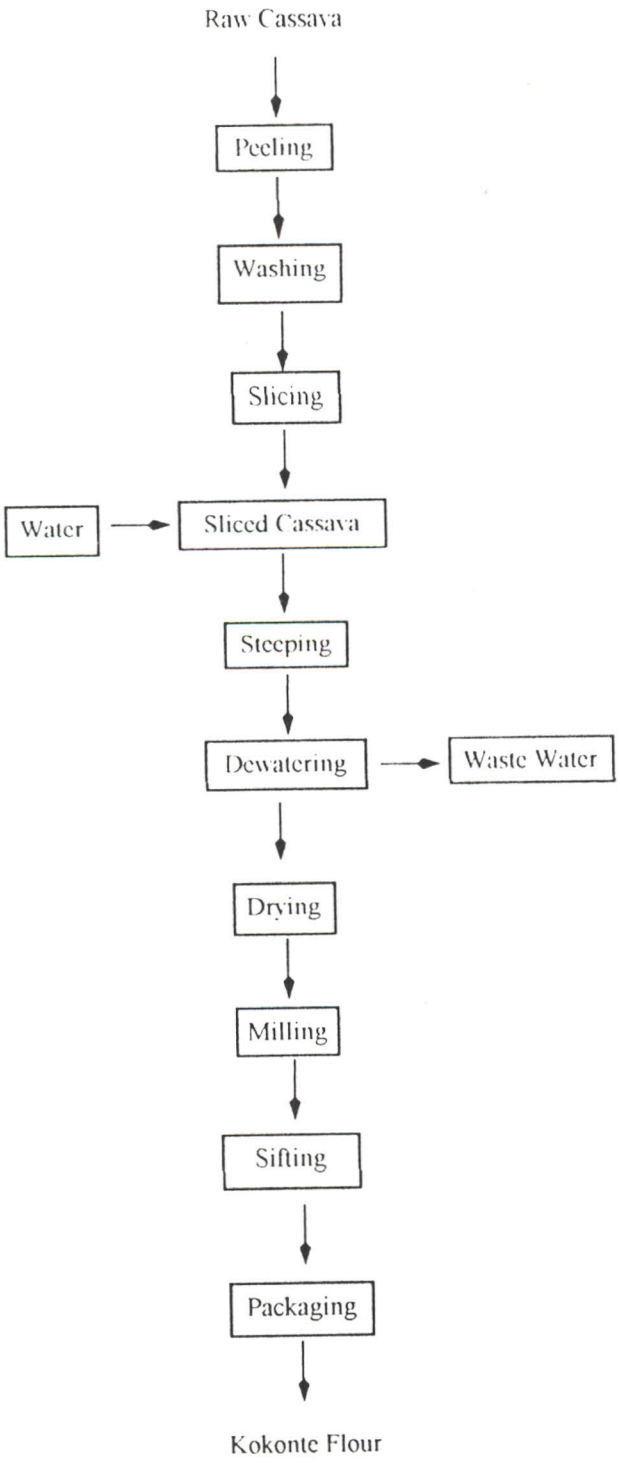

Fig. 6 Preparation of Kokonte Flour

from steeping water, dried at 50oC in a hot-air cabinet dryer. The dried cassava is milled in a hammer mill, sifted and packaged as snow white kokonte flour.

7.0 FERMENTED MAIZE MEAL

In Ghana, maize is a significant crop and is used for human consumption and for animal feeding. Most of the maize for human consumption is wet milled and fermented to improve flavour of maize foods.

Processing Procedure

The sequence of operations is shown in Figure 7.

After cleaning and sorting, the cleaned maize is steeped in water at room temperature for 3 days. During steeping, the maize grains absorbs moisture to about 40 - 45%. Steeping softens the grain and assist the milling process.

The grain is milled to flour using attrition mill. Maize dough is prepared by addition of water to the milled flour, and packed in plastic containers. Fermentation period is 3 days.

The wet fermented maize dough is spread on trays and allowed to dry in a cabinet dryer at 55°C to 12 hours. It is milled to improve appearance and packaged as dehydrated fermented maize meal.

8.0 WINIMIX (WEANING FOOD PREPARATION)

This dehydrated formulation is for babies and family members. It is a blend of cereal and legumes.

Figure 8 is a flow diagram for preparation of weanimix. The process is initiated by removal of defective grains, stones and unwanted materials. A mechanical roaster is used to roast maize, cowpea, and groundnuts. The roasted groundnut is dehulled and blending with the roasted cowpeas and roasted maize in the right proportions. This is milled with attrition mill and sifted to improve appearance. It is packaged as Winimix.

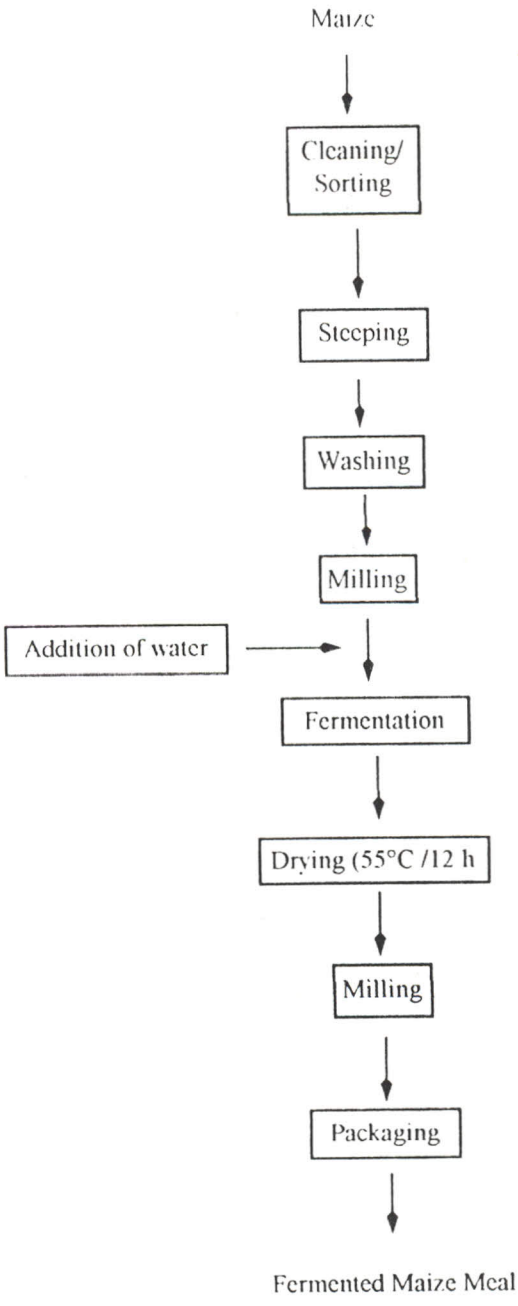

Fig. 7 Preparation of Dehydrated Fermented Maize Meal

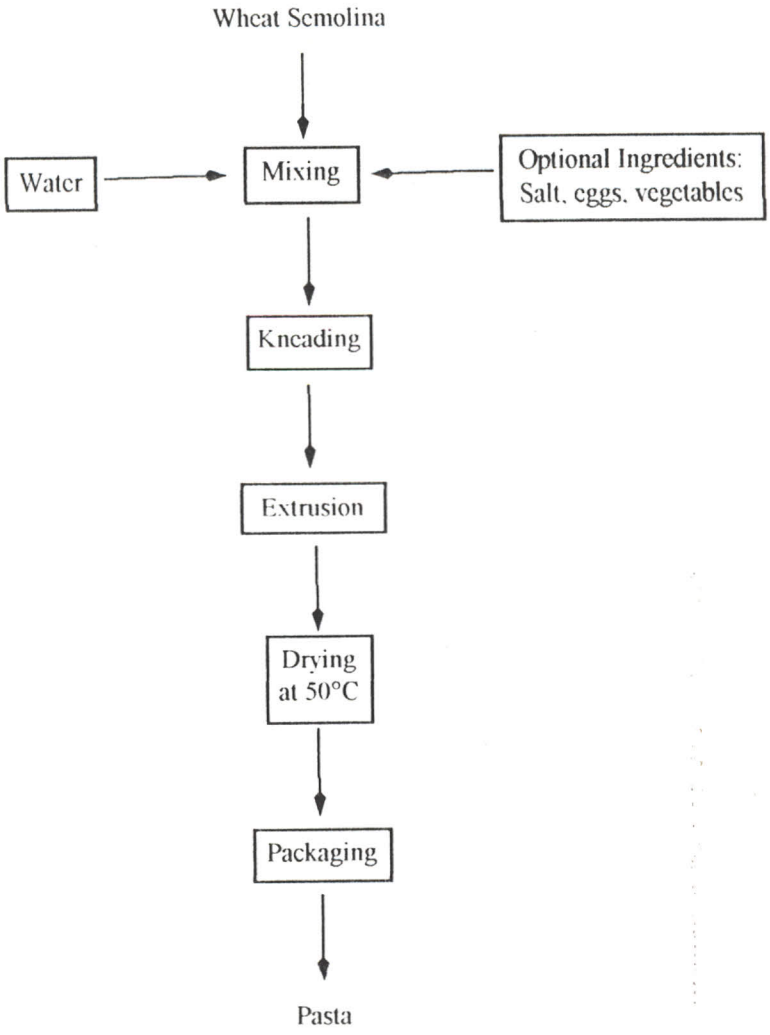

Fig. 8 Preparation of Pasta

9.0 PASTA PRODUCTS

Pasta Manufacture

The basic ingredients for pasta products are semolina, wheat flour and water. Optional ingredients are salt, eggs, soyflour and vegetables. Sequence of preparation is shown in figure 9.

In pasta preparation, water is added to semolina and wheat flour to make a stiff dough of approximately 30% moisture. After a period of rest, the dough is kneaded to get a plastic mass. The mass is extruded through the extruder die in such a way that products come in shapes, such as tubes, shells, etc. The extruded product is cut into required length and dried in a cabinet dryer. The resulting product is packaged in cellophane.

10.0 MAJOR CHARACTERISTICS OF ELSA FOODS PRODUCTS

All products are low moisture foods with long shelf life, very convenient and hygienic. Packaging is attractive.

In the absence of standards for products of Elsa Foods and on the basis of satisfactory results obtained from quality tests, the Ghana Standards Board has given exception certificate for processing and sale for Elsa products. The following subsections are details of characteristics of Elsa Foods products.

10.1 Elsa Pasta Products

Elsa Foods company was bread flour of medium strength instead of Durum wheat flour which is suitable for pasta production. For this reason, swelling capacity and other quality characteristics are not optimal. The moisture content ranges from 10 - 12%. The microbial quality of products tested was within acceptable range with no pathogenic micro-organisms.

10.2 Elsa Fufu Flours

These include plantain, cocoyam and yam fufu flours. They are free flowing fine flours with moisture less than 10%. Upon reconstitution (by adding water with continuos stirring with wooden ladle) on a medium heat, stiff smooth fufu similar to pounded fufu is obtained. Cocoyam and yam fufu have acceptable colours but the colour of plantain need to be improved. Microbial quality of product is within acceptable range.

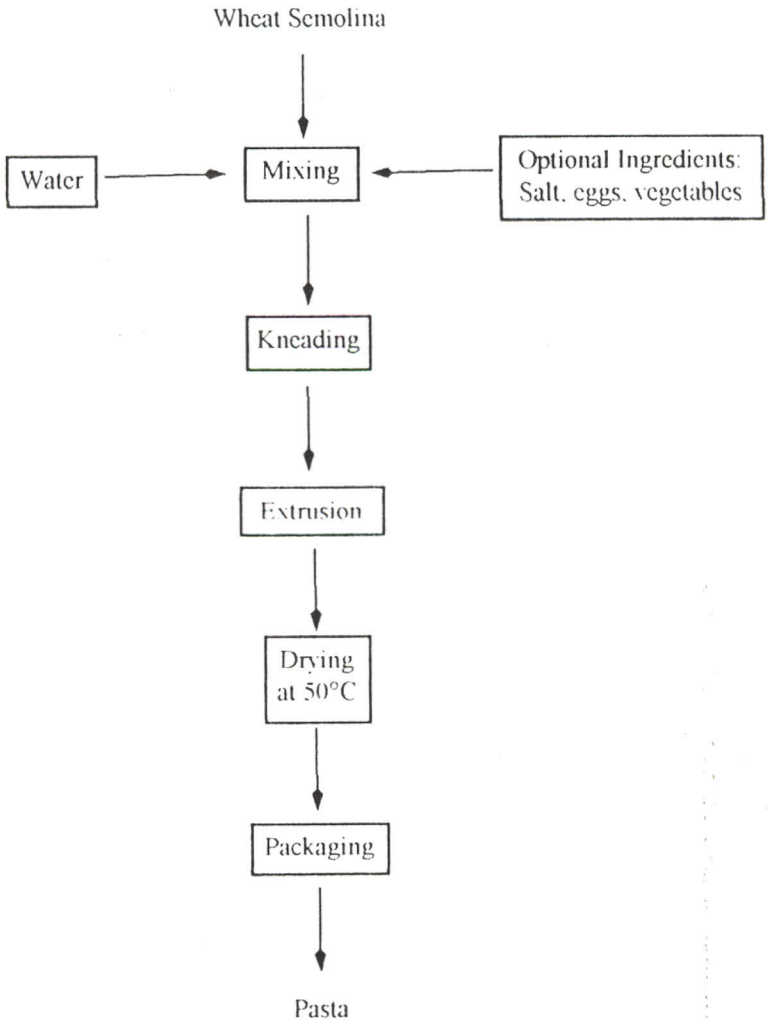

Fig. 8 Preparation of Pasta

10.3 Elsa Snow-White Kokonte

It is a convenient food in the form of free flowing cassava flour with mild acid flavour. It has off-white colour. Kokonte flour when added to boiling water with continuous stirring on low heat produces stiff paste. It has a good shelf life and moisture is below 10%. It is affordable and free from fibrous material.

10.4 Cassava Flour

This is dry free flowing fermented cassava flour. It is produced from fermented grated cassava mash. It has pH of 4.0 and low moisture content less than 10% which is suitable for long storage.

10.5 Fermented Maize Meal

Dehydrated fermented maize meal is off-white, and has sour flavour and is mealy. It has pH of about 4.2. The total acidity is 1.5% lactic acid. This is an intermediate maize product with versatility in many food applications such as akasa, kenkey, banku, apkle and weaning formulations.

10.6 Winimix (Fortified Tombrown)

This is low-cost vegetable protein based weaning food. Its moisture is 5.6% and has nutty flavour as a result of roasting of beans, ground and cassava. It is light brown in colour. The samples tested have protein content of about 14% and as weaning food, the protein content needs to be increased to at least 15%.

11.0 PRODUCTION AND OTHER DATA FOR FINANCIAL ANALYSIS

Presently, the major limiting factors to increased production are the cooking and drying facilities. For satisfactory level of production to be achieved, there is the need to install a fast dryer with a capacity of at least 1,200 kg/8hrs and industrial pressure cookers. The estimated satisfactory production outputs within a month period are 10 tonnes fufu flours, 5 tonnes kokonte, 4.2 tonnes fermented maize meal, 4 tonnes cassava meal and 1 tonne fortified tom brown. Based on a 6 - day a week, 48 weeks a year working regime a total of 288 days a year is used for processing. The remaining days are used for maintenance, repairs, holidays, etc. Averagely, production cycle per month is about 7.

Working capital (3 months direct operation and administration costs) needed is approximately ¢200m. Details of various costs components and revenue estimates are outlined as follows:

EXISTING FIXED ASSETS COSTS

SCHEDULE A : LAND & BUILDING

	$	¢'000
Land	2,000.00	4,400.00
Building	108,333.00	238,332.60
Shop	300.00	660.00
Total	110,633.00	243,392.60

Footnote: Exchange Rate of a Dollar ($) = ¢2,200

SCHEDULE B : PLANT EQUIPMENT AND MACHINERY

ITEM	QTY	UNIT COST ($)	TOTAL COST ($)	TOTAL COST (¢'000)
Grater	1	593	593	1304.60
Cabinet Dryer (Cap. 500kg/15-16 hrs)	2	4665	9,330	20526.00
Attrition Mill	1	1,000	1,000	2200.00
Chudden Hammer Mill	1	3,500	3,500	7700.00
Hammer Mill, Cyclone Filter & Mixer			22,470	49434.00
Local Hammer Mill	1	1,500	1,500	3300.00
Plat form Scale	1	466	466	1025.20
Domestic Scale	4	162.5	650	1430.00
Industrial & Domestic Gas			500	1100.00
Gas Burner	3	100	300	660.00
Cassava Press	1	600	600	1320.00
Fryer	1	600	600	1320.00
Sealing Machines (Astrapac)	3	-	350	770.00
Sealing Machine (Gandus)	2	125	250	550.00
Air Compressor	1	1167	1167	2,567.40
Plastic Bowls	6	-	85	187.00
Plastic Containers	80	-	550	1,210.00
Water Tank	1	100	100	220.00
Big Coal Pot	1	5	5	11.00
Iron Pot	1	50	50	110.00
Strainers	15	-	70	154.00
Basins	5	27.5	137.5	302.50
Wheelbarrow	1	55	55	121.00
Baskets (Large)	6	6	36	79.20
Cooking Pans	6	27.5	165	363.00
Aluminium Bowls	14	-	450	990.00
Knives	12	2.5	30	66.00
Kitchen Stools	5	6	30	66.00
Chopping Board	5	14	70	154.00
Plastic Buckets	7	25	175	385.00
Water Drums	5	20	100	220.00
Bath Tubs	3	100	300	660.00
Kitchen Sinks	2	33.5	67	147.40
Industrial Pipes & Fittings	1	-	2,000	4400.00
Pasta Dryers & Machine	-	-	70,000	154,000.00
Push Trolley	-	-	75	165.00
Total			117,826.5	259,218.30

SCHEDULE C : MOTOR VEHICLE

	Qty	Total Cost ($)	Total Cost (¢'000)
Motor Vehicle	1	2666	5865.20

SCHEDULE D : OFFICE EQUIPMENT & FURNITURE

ITEM	QTY	UNIT COST ($)	TOTAL COST ($)	TOTAL COST (¢'000)
Table Top Freezer	1	400	400	880.00
Table Fan	1	20	20	44.00
Lap Top High Screen Computer	1	1200	1200	2640.00
Printer	1	400	400	880.00
Fax	1	550	550	1210.00
Tables, Chairs, Desk & Cupboards	-	-	1895	4169.00
Total			4,465	9823.00

PROJECTED VARIABLE COSTS AND REVENUE ESTIMATES

SCHEDULE E : INPUT AND OUTPUT PER MONTH

Input	Unit Price/Kg (¢'000)	Cost (¢'000)	Output	Ex-Factory Price/Kg	Revenue (¢'000)
5000 kg plantain	825	4,125.00	1250 kg plantain flour		
2000 kg cassava	200	400.00	500 kg cassava flour		
6818 kg cassava	200	1,363.60	750 kg starch		
Sub-Total		5,888.60	2500kg plantain fufu	7,200.00	18,000.00
5000 kg yam	920	4,600.00	1250 kg yam flour		
11,364 kg cassava	200	2,272.8	1250 kg starch		
Sub-Total		6,872.80	2500 kg yam fufu	6,800	17,000.00
10,000 kg cocoyam	900	9,000.00	2500 kg cocoyam flour		
22,728 kg cassava	200	4,546.6	2500 kg starch		
Sub-Total		13,545.60	5000 kg cocoyam	6,800	34,000.00
16,000 kg cassava	200	3,200.00	4000 kg fermented cassava meal	1,800	7,200.00
5,000 kg maize	500	2,500.00	4200 kg fermented maize meal	1,800	7,560.00
Sub-Total		5,700.00			
300 kg (cowpea) 60 kg groundnut 833 kg maize	1,500 1,842 500	450.00 110.52 416.50	1000 kg Fortified Tom Brown	2,000	2,000.00
Sub-Total		977.02			
20,000 kg cassava	200	4,000.00	5000 kg kokonte	1,800	9,000.00
Total		36,984.02			94,760.00

SCHEDULE F: ADMINISTRATIVE COST PER MONTH

	Total Cost (¢'000)
Indirect Labour	3,850.00
Stationery & Printing	35.00
Communication	52.00
Legal & Audit Fees	195.83
Clearing & Sanitation	45.00
Sub total	4,177.83
Contingency, 10%	417.78
Total	4,595.61

SCHEDULE G: LABOUR REQUIREMENT

I. INDIRECT LABOUR

Category	Number	Salary Rate Per Month (¢'000)
Managing Director	1	800.00
General Manager	1	600.00
Marketing Supervisor	1	350.00
Sales Men	3	450.00
Security Officer	1	100.00
Purchasing Officer	1	200.00
Mechanic	1	100.00
Driver	2	200.00
Subtotal		2800.00
Social Security Fund, 12.5%		350.38
Perquisites 25%		700.00
Total		3850.00

II. DIRECT LABOUR

Category	Number	Salary Rate Per Month (¢'000)
Production supervisor	1	300.00
Skilled Staff	3	450.00
Semi-Skilled Staff	9	900.00
Casual Labour	10	600.00
Subtotal		2,250.00
Social Security Fund 12.5%		281.25
Perquisites 25%		562.50
Total		3,093.75

SCHEDULE H: DIRECT OPERATING COST PER MONTH

Item	Cost (¢'000)
Direct Labour	3,093.75
Raw Material	36,984.02
Packaging Material	9,480.00
Vehicle Running	1,000.00
Utilities	
Electricity	200.00
Water	20.00
Gas	600.00
Sub total	51,377.77
10% Contingency	5,137.78
Total	56,515.55

12.0 PROCESSING CONSTRAINTS IDENTIFIED

The constraints identified include:

1. The cabinet dryers have long periods of drying (12 - 15 hours).

2. Unavailable bigger capacity cooking utensils.

3. The presence space for handling raw material is inadequate and too close to the drying and milling facilities.

4. Pollution control is a pressing problem as a result of water and solid waste disposal. Most of the processing activities use a lot of water and the facility for disposal of liquid waste is lacking. The level of pollution could be a source of contamination of the food products.

5. Lack of working capital for purchase of raw materials and investment capital for expansion of processing activities.

13. 0 RECOMMENDATIONS

a. It is recommended that a shed is constructed for handling raw materials. This shed should have facilities for washing, peeling, cutting, grating and pressing.

b. Cooking area should have good ventilation to dissipate heat and steam easily. Cooking vats or industrial pressure cookers of appropriate sizes should be installed to handle large batches of raw materials.

c. Properly managed and organised storage facility should be provided for raw materials. For the finished products, there should be appropriate warehouse. The space for raw materials should be different from the space for finished products.

d. For dehydration purposes it is recommended that a dryer with capacity of at least 1200 kg of dehydrated products a day of about 8 hours, is installed.

e. To prevent environmental pollution, infrastructure (septic/retention tanks) for liquid waste collection need to be constructed. This was also indicated in the recommendation proposed by Tema Municipal Assembly when contacted by Elsa for assistance. Grass and

shady trees should be planted on the compound to prevent entry of soil and dust into the factory.

f. Funds are needed for purchasing of raw materials and expansion of the factory (Appendix III).

Appendix I

FOOD RESEARCH INSTITUTE

ANALYSIS DIVISION

Microbiology Section

LABORATORY REPORT

Origin of Sample: ELSA FOODS Ref. No.: Lab. No.: 097/323-333
Address: ACCRA
Description of Sample: PROCESSED MAIZE, CASSAVA & FLOUR PRODUCTS
Date Received:
Purpose: QUALITY ASSESSMENT OF ELSA FOODS
Results:

LAB NO	DESCRIPTION	TOTAL VIABLE COUNT/G PCA 30OC	MOULD & YEAST COUNT/G MA 30OC	COLIFORMS MACKONKEY 37OC	E COLI	SALMONELLA 37OC	PH	DOMINANT FLORA
097/323	FERMENTED MAIZE FLOUR	$1,5X10^3$	<10	Not Found in 0.1g	Not Found	-	4.2	Bacillus spp. Lacto bacillua app
097/324	ELSA KOKONTE	$8,0X10^6$	$1,0X10^3$	Found in 0.1g	"	-	5.1	Mucor, Aspergillus & Bacillus spp
097/325	ELSA TOM BROWN	$1,0X10^4$	$1,0X10^1$	Not Found in 0.1g	"	-	6.1	Mucor, Yeast & Bacillus spp.
097/326	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 6016)	$3,0X10^3$	$2,0X10^1$	Not Found in 0.1g	"	Not Found in 25g	5.6	Mucor, Rhizopus & Bacillus spp.
097/327	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 0026)	$1,0X10^5$	$1,0X10^2$	Found in 0.1g	"	"	6.2	Mucor & Bacillus spp.
097/328	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 0028)	$4,0X10^3$	$4,0X10^2$	Not Found	"	"	6.0	Aspergillus & Bacillus spp
097/329	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 0036A)	$2,0X10^3$	$3,0X10^1$	Found in 0.1g	"	"	6.3	Penicillium & Bacillus spp.

097/330	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 0036B)	$2,0 \times 10^5$	$7,0 \times 10^1$	Found in 0.1g	"	"	6.3	Penicillium Aspergillus & Bacillus spp.
097/331	RICH HOME MADE FLOUR PRODUCT (BATCH NO.0036C)	$3,5 \times 10^3$	$2,0 \times 10^2$	Not Found in 0.1g	"	"	5.2	Penicillium, Yeast Aspergillus & Bacillus spp.
097/332	RICH HOME MADE FLOUR PRODUCT (BATCH NO. 0036D)	$1,0 \times 10^4$	$1,0 \times 10^2$	Found in 0.1g	"	"	6.1	Aspergillus & Bacillus spp.
097/333	PAONE PASTA	$1,5 \times 10^5$	<10	Not Found	"	"	6.4	Bacillus spp.

COMMENTS: E Coli and Salmonella were not isolated in the samples examined.

Supervised By: J. Tete-Marmon
Service Charge: ¢ 354,880.00
Date: 30/9/97
To: ELSA FOODS

Signature: J. Tete-Marmon

Signed:
MS. MARY HALM
HD. ANALY. DIV.

Appendix II

FOOD RESEARCH INSTITUTE

ANALYSIS DIVISION

Microbiology Section

LABORATORY REPORT

Origin of Sample: RMS. OSEI-YAW Ref. No.: Lab. No.: 91-101/97
Address: c/o FRI, Box M.20
Description of Sample: (1) PASTA PRODUCTS: EL-01-05
(2) FUFU PRODUCTS - FFC-01; FFY-01
(3) TOM BROWN - WIN - 01;
(4) KOKONTE - K.K - 01
(5) FERMENTED MAIZE MEAL

Date Received:

Purpose: (1) PROXIMATE ANALYSIS (2) TOTAL ACIDITY

Results:

	MOISTURE %	ASH %	FAT %	PROTEIN %	CARBOHYDRATE %	ENERGY KCAL/100G	TOTAL ACIDITY AS LACTIC-ACID %
EL-01	11.1	0.5	1.4	12.9	74.1	361	
EL-02	11.5	1.2	1.7	13.9	71.7	358	
EL-03	11.9	0.5	1.1	12.9	73.5	356	
EL-04	10.9	0.5	1.0	12.8	74.8	359	
EL-05	10.8	0.6	1.1	14.0	73.5	360	
FFC-01	9.1	1.3	0.04	3.3			
FFP-01	9.3	1.0	0.2	2.2			
FFY-01	8.3	0.9	0.07	2.7			
KK-01	6.5	1.3	0.5	1.6			
WIN-01	5.6	1.9	6.3	13.9			
FERMEN ED MAIZE MEAL		1.1		10.1			1.6

COMMENTS:

Supervised By: N.A. ASARE
Service Charge: ¢ 770,000.00
Date: 14/10/97
To: MRS OSEI-YAW, FRI

Signature:

Signed:
MS MARY HALM
HD. ANALY. DIV.

APPENDIX III OTHER FACILITIES NEEDED (PRICES IN US DOLLARS $)

1. Production	
Dryer (min. Capacity 1200 kg/8hrs)	70,000.00
Industrial pressure Cookers	30,000.00
Bag - Stitching Machine	500.00
Generator	25,000.00
Roaster for Maize, Groundnut, Cowpea	2,500.00
Sub-Total	**128,000.00**
2. Building	
Painting of Whole Plant and Tiling of Show - Room Walls, Floors, Sinks	3,500.00
Bathtubes for Steeping of Maize, Etc.	200.00
Installation of Permanent Stair Case to Top Floor of Mill	1,000.00
Installation of Security Fence Above Mill	500.00
Fixing of Win-breakers Above Windows (To Prevent Water Leakage)	1,000.00
Fixing of Remaining Doors and Locks	1,000.00
Movable Mosquito Nets for Easy Washing	300.00
Additional Insect Proof Door for Back Entrance	500.00
Industrial Vacuum Cleaner	1,000.00
Industrial Fire Extinguishers	1,000.00
Extension (Space for New Dryer, Separation of Cooking,/washing and Milling/drying Area)	10,000.00
Sub-Total	**20,000.00**
3. Compound	
Two 4,500l Water Tanks	1,500.00
One 1,000l Water Tank with Tank Overhead and Water Pump	1,500.00
Ceramic Filter Unit for Water Tank	2,000.00
Fence Wall and Man-holes for Waste Water	5,000.00
Gravelling, Planting of Grass and Shade Trees	3,000.00
Sub-Total	**13,000.00**
4. Administration	
Telephone & Installation	**400.00**
5. Vehicles	
Two Vans for Workers and Deliveries	**25,454.00**