21. PROFILE ON DRY – MILLING OF MAIZE

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I. SUMMARY

This profile envisages the establishment of a plant for the production of 500 tonnes of dry-milled maize per annum.

The present demand for proposed product is estimated at 2,598 tonnes and it is projected to reach at 3,491 tonnes by the year 2014.

The plant will create employment opportunities for 15 persons.

The total investment requirement is estimated at Birr 4.02 million, out of which Birr 777,920 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 15% and a net present value (NPV) of Birr 1.15 million, discounted at 10.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Maize is the dominant cereal crop in different parts of the world such as East, Central and South Africa. It also grows in West Africa. Maize is a staple crop, especially in lowlands of Ethiopia. It is milled into maize flour by using the wet milling and dry milling processes. Maize flour obtained by milling of the grains of maize is a source of carbohydrates.

Primary products derived from dry milling of maize are maize flour and maize grits. Other products are oil and by-products for animal feed. The endosperm fractions are characterized by their particulate dimensions and sizes which affect composition and utilization.

Maize flour (with granular size of particle < 0.2 mm) is particularly valuable as an ingredient of pancake mixes, baby foods, cookies, biscuits, ice cream cones and binders for loaf-type sandwich meats.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Maize is an important food staple as a source of carbohydrates. Maize flour is obtained by milling grains of maize. The quality of flour is generally measured through weight per unit of volume, size of kernels, moisture content and absence of blemish. Milling grades of flour are usually blended to standard grades or special grades. Maize is a staple crop in lowlands of Ethiopia, which is produced into maize flour by using traditional flour making. The dry milling of maize reduces waste, time and energy.

Milled maize is produced at home and by grain mills. Officially, available statistics covers the common wheat flour categorizing all other milled products of grains together. Therefore, in order to estimate the demand for milled maize, the consumption approach is considered.

According to the 1999/2000 Household Income, Consumption and Expenditure Survey conducted by the CSA, unmilled maize consumption per household was 62.88 kg for rural areas and 9.325 kg for urban areas, annually. The total consumption per household for rural and urban areas was 145.53 kg and 41,306 kg, respectively. The total country level consumption was 130.416 kg. The quantity of milled and unmilled maize consumption is presented in Table 3.1.

Table 3.1
QUANTITY OF FOOD , DRINKS AND TOBACCO CONSUMED BY DOMESTIC EXPENDITURE GROUP -COUNTRY LEVEL
UNMILLED AND MILLED MAIZE CONSUMPTION (GRAM)

Expenditure Item	Urban	Rural	Country Level
Unmilled Maize (per House Hold)	9,325	62,859	55,093
Milled Maize (per House Hold)	41,306	145,537	130,416

Based on the house hold consumption of milled maize, the total consumption is detailed in Table 3.2

Table 3.2
TOTAL MILLED MAIZE CONSUMPTION (1999/2000)

Benshangul-Gumuz	Household Units	Milled Maize Consumption	
		Per household(Kg)	Total (Tonnes)
Urban	10,736	41.306	443
Rural	131,600	145.137	19,100
Total	**142,336**	**130.416**	**18,563**
County Level			
Urban	1,652,429	41,306	68,255
Rural	9,812,265	145.537	1,428,047
Total	**11,464,688**	**130.416**	**1,495,178**

The total country level consumption for milled maize was 1,495,178 tonnes, while the Benshangul Gumuz regional consumption was 18,563 tonnes. The respective urban and rural consumption of milled maize for the region were 443 and 19,100 tonnes, respectively. For the propose of this study, however, the urban consumption and 10% of the rural consumption are considered since the rural population around urban areas cause mills at urban centers. The total consumption of milled maize was, therefore, 443X0.1X1,100 = 2,353 tonnes.

Applying an average rate of 3% growth in population, the current effective demand, based on the consumption level, is estimated at 2,598 tonnes.

2. Projected Demand

The demand for milled maize is determined by the growth in population. As a staple food in the region, milled maize will have increasing demand along with the population. Demand for milled maize is, therefore, assumed to grow by 3%.

Table 3.3
PROJECTED DEMAND FOR MILLED MAIZE

Year	Demand (Tonnes)
2005	2,675
2006	2,755
2007	2,838
2008	2,923
2009	3,011
2010	3,101
2011	3,194
2012	3,290
2013	3,389
2014	3,491

3. Pricing and Distribution

The price of milled maize depends on the unmilled maize price which varies from season to season. For the propose of financial analysis, an average factory-gate price of Birr 2.75 per kg is adopted. The product will be directly delivered and served to consumers.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The envisaged plant will have a capacity of producing 500 tonnes of dry-milled maize flour per annum, working 250 days a year and a single shift of 8 hours each.

2. Production Programme

The plant is expected to start operation at 80% of its rated capacity in the first year and the production will reach 90% of the rated capacity in the second year. Full production capacity will be achieved in the third year and onwards.

IV. MATERIALS AND INPUTS

A. RAW AND AUXILIARY MATERIALS

The principal raw material required by the envisaged plant is maize. In view of high nutritional value, it is desirable that maize mills should produce whole meal flour. Since the milling losses, as flour dust, during pulverization of the maize grain and scalping through a fine steel or brass screen does not exceed 1% of the intake quantity, the requirement of raw maize at full capacity of the plant will be 500 tonnes + (0.01 x 500 tonnes) = 505 tonnes per annum.

The total annual cost of raw material is estimated at Birr 404,000.

The major auxiliary materials required by the plant are 50 kg polypropylene bags and sewing thread which are locally available. The annual requirement for polypropylene bag is 10,000 pieces, while that of sewing thread is 39 reels.

The total annual cost of pp bags at 100% capacity utilization rate is estimated at 38,000, while that of sewing thread is estimated to be Birr 741.

B. UTILITIES

The major utilities required by the plant are electricity, water and lubricants. The estimated annual cost of utilities at 100% capacity utilization rate and the corresponding costs are given in Table 4.1.

Table 4.1

ANNUAL UTILITIES REQUIREMENT AND ESTIMATED COSTS

Sr. No.	Description	Unit of Measure	Qty	Cost (Birr)
1.	Electric power	kWh	10,000	4,730
2.	Water	m^3	2,000	4,000
3.	Lubricants	kg	20	400
	Total	-	-	**9,130**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

A great advantage of machine milling over pounding is that the relatively hard and tough peels and embryos are thoroughly broken up and incorporated in the meal, together with the starch. The starch provides calories for energy but the peels and embryos supply oil and protein, giving almost balanced human food, after cooking. This whole meal does not keep well due to the oil in the embryos going rancid, so a farmer has to go fairly frequently to the mill with his maize.

Machine mills can separate out the peels and embryos which are valuable concentrates for stock-feeding; the fairly pure starch then keeps for longer periods but it has little nutritional value. In view of the deteriorating relation of food

production to population in Africa, it is desirable that maize mills should produce whole meal. Milled maize is becoming popular and is being produced in increasing quantities. It can replace the white maize meal preferred by the higher income groups.

The commonest forms of power mills are hammer mills and plate mills. They are single-stage; a stator with an internal power-driven rotor which pulverizes the grains of maize, the meal escaping through a fine steel or brass screen. The loss, as flour dust, is low, under 1 per cent, a notable improvement on hand pounding.

Roller mills are manufactured mainly for the production of fine corn-flour. The peels and embryos are discarded and used for stock feed.

2. Source of Technology

Maize dry milling technology and equipment can be acquired from different manufacturers or suppliers in various countries such as India, China, Italy, etc. The following firm can be one of such suppliers:-

Forsberg Agritech India pvt. ltd.
GIDC, Makarpura, Baroda 390 010, India
Fax +(91) - 265 - 2638583

B. ENGINEERING

1. Machinery & Equipment

The production machinery and equipment required by the plant and their estimated costs are given in Table 5.1.

Table 5.1

MACHINERY AND EQUIPMENT REQUIREMENT WITH THEIR ESTIMATED COSTS

Sr. No.	Description	Qty. (No.)	Cost, '000 Birr		
			FC	LC	Total
1	Decorticator	1	156,960	17,440	174,400
2	Screen separator	1	45,000	5,000	50,000
3	Spiral separator	1	27,000	3,000	30,000
4	Grader (sorter)	1	81,000	9,000	90,000
5	Hydrator	1	27,000	3,000	30,000
6	Grain polisher	1	36,000	4,000	40,000
7	Screw conveyor	3	54,000	6,000	60,000
8	Intake hopper	1	4,500	500	5,000
9	Weigher	2	40,500	4,500	45,000
10	Grinder with in mount sieve	1	63,000	7,000	70,000
11	Collecting hopper	1	3,600	400	4,000
	FOB Cost		538,560	59,840	598,400
	Freight, Insurance, Inland transport, Bank and customs charges, etc.			179,520	179,520
	Total Landed Cost		**538,560**	**239,360**	**777,920**

2. Land, Buildings and Civil Works

The total area of land required by the plant is estimated to be 2,500 square meters, the land lease cost at a lease rate of Birr 2 per m^2 and 70 years of land holding is estimated at Birr 350,000. The total land lease cost is assumed to be paid in advance. The total built -up area will be 1,200 square meters and the cost of buildings and civil works at a unit cost of Birr 1400 per m^2 is estimated at Birr1,680,000.

3. Proposed Location

Since the expected consumers of the plant's product are mainly the urban dwellers, it is advisable to establish the plant in main towns of the region such as Assossa, Chagni and others.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The total manpower requirement of the plant is 15 persons. Details of manpower requirement and estimated annual labour cost including fringe benefit are shown in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ESTIMATED ANNUAL LABOUR COST

Sr. No.	Description	Number of Persons	Salary (Birr)	
			Monthly	Annual
1	Supervisor	1	1,000	12,000
2	Secretary	1	600	7,200
3	Operators	3	400	14,400
4	Mechanic	1	500	7,200
5	Cleaning workers	2	400	4,800
6	Store keeper	1	500	6,000
7	Salesman	1	500	6,000
8	Accountant	1	700	8,400
9	Cashier	1	550	6,600
10	Personnel	1	600	7,200
11	Driver	1	500	6,000
12	Guards	2	400	4,800
	Sub-Total	**15**	**7,550**	**90,600**
	Employees benefit (20% of basic salary)	-	1,510	18,120
	Grand Total	**-**	**9,060**	**108,720**

B. TRAINING REQUIREMENT

Three operators and one mechanic should be given a one week on-the-job training in one of the local flour mills. The training cost is estimated at Birr 40,000.

VII. FINANCIAL ANALYSIS

The financial analysis of dry milled maize project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	2 years
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	10.5%
Discounted cash flow	10.5%
Repair and maintenance	5 % of the total plant and machinery
Accounts receivable	30 days
Raw material, local	30 days
Work in progress	1 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total initial investment cost of the project including working capital is estimated at Birr 4.02 million, out of which about 13% will be required in foreign currency. Details are indicated in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST ('000 BIRR)

Sr. No.	Cost Items	Foreign Currency	Local Currency	Total
1	Land	-	437.50	437.50
2.	Building and Civil Work	-	1,680.00	1,680.00
3.	Plant Machinery and Equipment	538.56	239.36	777.92
4.	Office Furniture and Equipment	-	75.00	75.00
5.	Vehicle	-	250.00	250.00
6.	Pre-production Expenditure	-	613.73	613.73
	Total Investment cost	**538.56**	**3,295.59**	**3,834.15**
7	Working Capital	-	186.70	186.70
	Grand Total	**538.56**	**3,482.29**	**4,020.85**

B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 1.06 million (see Table 7.2). The material and utility cost accounts for 43 per cent while repair and maintenance take 3.7 per cent of the production cost.

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* *Pre-production expenditure include interest during construction (Birr 513,730), training (Birr 40,000) and costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

Table 7.2

ANNUAL PRODUCTION COST ('000 BIRR)

Items	Year			
	3	4	7	10
Raw Material and Inputs	354.19	398.13	442.74	442.74
Labour direct	43.49	48.88	54.36	54.36
Utilities	7.30	8.21	9.13	9.13
Maintenance and repair	31.12	34.98	38.90	38.90
Labour overheads	14.50	16.29	18.21	18.21
Administration cost	28.99	32.59	36.24	36.24
Total Operating Costs	**479.59**	**539.09**	**599.49**	**599.49**
Depreciation	245.54	245.54	245.54	175.54
Cost of Finance	297.99	279.74	212.65	122.13
Total Production Cost	**1023.12**	**1064.37**	**1057.68**	**897.16**

C. FINANCIAL EVALUATION

1. Profitability

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as the percentage of net profit to total sales, net profit to equity (return on equity) and net profit plus interest to total investment (return on total investment) will show an increasing trend throughout the production life of the project.

The income statement and other profitability indicators show that the project is viable.

2. Break-even Analysis

The break-even point of the project is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 32\ \%$$

3. Pay-Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 7 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 15 % and the net present value at 10.5% discount rate is Birr 1.15 million.

D. ECONOMIC BENEFITS

The project can create employment opportunities for 15 persons. In addition to supply of the domestic needs, the project will generate Birr 1.85 million in terms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue.