# 20. PROFILE ON COFFEE ROASTING, GRINDING AND PACKING

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## I. SUMMARY

This profile envisages the establishment of a plant for the production of 94 tonnes of roasted, grounded and packed coffee per annum.

The current demand for the envisage product is estimated at 324 tonnes per annum and it is projected to reach at 480 tonnes by the year 2014.

The project will create employment for about 27 persons.

The total investment cost of the project is estimated at Birr 2.15 million, out of which Birr 511,500 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 21% and a net present value (NPV) of Birr 1.46 million, discounted at 10.5%.

## II. PRODUCT DESCRIPTION AND APPLICATION

Coffee is a common name for any of a genus of trees of the madder family, and also for their seeds (beans) and for the beverage brewed from them. The Arabicas and Rubastas are the two major types of commercial coffee. In order to meet wide consumer appeal, coffee liquor is extracted from properly ground coffee beans that are expertly roasted from properly sorted green coffee.

The principal physiological effects of coffee are due to caffeine, an alkaloid that acts as a mild stimulant. Depending upon the granular size and heterogeneity of the particles size, there are two distinct categories of ground coffee. The first category is made up of uniform particles of average size from which small powdery particles have been separated. The second category of brewed coffee consists of grounds made up of particles of various sizes of, which upto 50 per cent are of very small size.

# III. MARKET STUDY AND PLANT CAPACITY

## A. MARKET STUDY

### 1. Past Supply and Present Demand

Coffee is served at least once in most of Ethiopian households. The coffee ceremony at home is more cultural than the mare need of drinking coffee. Roasting coffee is a craft by itself taken seriously by every household.

Accordingly in Ethiopia as coffee is usually made at home, the official statistics on milled coffee does not represent the total supply of packed or milled coffee. In the near future households may began to buy packed (milled) coffee. However, the associated cultural impacts of the coffee ceremony will remain in fact for a long time making households out of the target market for packed coffee.

The supply of milled coffee is presented in Table 3.1. As can be seen from Table 3.1., the supply of milled coffee during the period 1989- 1994 was on average 94 tonnes with a steady annual growth rate of 127%.

**Table 3.1**

**MILLED COFFEE PRODUCTION (TONNES)**

| Year | Milled Coffee Production | Growth Rate % |
|---|---|---|
| 1989 | 16 | - |
| 1990 | 31 | 94 |
| 1991 | 34 | 10 |
| 1992 | 28 | -18 |
| 1993 | 156 | 457 |
| 1994 | 300 | 92 |

***Source :*** *- CSA*

The least square equation built for the five year supply is found to be:

$$Y = 51{,}114 + 84.73 \qquad R^2 = 0.7112$$

Accordingly, by using the above equation, the current effective demand for milled coffee is estimated at 324 tonnes.

## 2. Projected Demand

The demand for packed coffee (roasted ground and packed) is directly related with number of coffee serving bars. Literally bar means "house of coffee" or "*buna bet*" in Amharic indicating the formation of such a business as directly dependant on milled coffee. Hotels, restaurants and clubs also provide coffee to the public using packed coffee.

Urbanization is another factor for the growth in demand for packed coffee. However, the most determining factor is growth in the service industry particularly in bars, hotels and restaurants. The gross domestic production of trade, hotels and restaurants industrial sector is presented in Table 3.2.

**Table 3.2**

**GROSS DOMESTIC PRODUCT (GDP) OF TRADE, HOTELS AND RESTAURANTS INDUSTRIAL SECTOR AT CONSTANT 1980/81 FACTOR COST**

| Year | Million Birr | Growth Rate % |
|---|---|---|
| 1983 | 760.8 | - |
| 1984 | 648.4 | -14.77 |
| 1985 | 887.1 | 36.81 |
| 1986 | 945.2 | 6.55 |
| 1987 | 1027.7 | 8.73 |
| 1988 | 1115.5 | 8.54 |
| 1989 | 1208.9 | 8.37 |
| 1990 | 1263.3 | 4.50 |
| 1991 | 1343.9 | 6.38 |
| 1992 | 1396.6 | 3.92 |
| 1993 | 1469.2 | 5.20 |
| 1994 | 1519.3 | 3.41 |
| 1995 | 1528.4 | 0.60 |

As can be seen from Table 3.2, the sector achieved an average of about 7% growth rate between 1983 - 1985. In the projection of the demand for packed coffee only the recent five years are considered. The growth achieved during the period 1991 - 1992 by the trade, hotels and restaurants sector was about 4% and it is applied on the current effective demand. The projected packed coffee demand is presented in Table 3.3.

**Table 3.3**

**PROJECTED DEMAND FOR ROASTED, GROUND AND PACKED COFFEE (TONNES)**

| Year | Projected Demand | Unsatisfied Demand |
|---|---|---|
| 2005 | 337 | 37 |
| 2006 | 350 | 50 |
| 2007 | 364 | 64 |
| 2008 | 379 | 79 |
| 2009 | 394 | 94 |
| 2010 | 410 | 110 |
| 2011 | 426 | 126 |
| 2012 | 443 | 143 |
| 2013 | 461 | 161 |
| 2014 | 480 | 180 |

### 3. Pricing and Distribution

The price of roasted, ground and packed coffee at Addis Ababa is Birr 26 per kg.. The proposed price for the project understudy is Birr 23 per kg.

Distribution of the product should be handled by door to door van delivery to bars and restaurants in order to attract permanent customers.

## B. PLANT CAPACITY AND PRODUCTION PROGRAMME

### 1. Plant Capacity

Based on the market study, the production capacity of the envisaged plant is 94 tonnes of roasted, ground and packed coffee.

## 2. Production Programme

The annual production programme is formulated on the basis of the market forecast and selected plant capacity. It is assumed that the plant will achieve 70% and 85% capacity utilization rate in the first and second year, respectively. Full capacity will be reached in the third year and onwards. The production programme for total roasted, ground and packed coffee is shown in Table 3.4.

**Table 3.4**

**ANNUAL PRODUCTION PROGRAMME**

| Sr. No | Description | Production Programme | | |
|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 and onwards |
| 1. | Roasted ground and packed coffee, tons | 65.80 | 79.90 | 94.00 |
| 2. | Capacity utilization rate, % | 70 | 85 | 100 |

# IV. MATERIALS AND INPUTS

## A. RAW AND AUXILIARY MATERIALS

The principal raw material required by the plant is clean green coffee. During roasting process the green coffee beans loose weight due to evaporation of water. The extreme limits of the weight loss termed as “a loss in the fire” are between 14 and 23 per cent of the initial weight of coffee beans. Elimination of the silver skin of coffee beans that amounts from 0.2% to 0.4% and the release of certain volatile elements also occurs during roasting.

Taking the above mentioned weight loss into account, the annual requirement for green coffee at 100 per cent capacity utilization rate is estimated to be 94 tonnes +(0.22 x 94 tonnes) = 114.68 tonnes). Annual cost of green coffee at a rate of 10,000 per tonne will amount to Birr 1,146,800.

The major auxiliary materials in the production of roasted, ground and packed coffee comprise packing materials of various type and quality. The packing materials to be used by the plant are paper bag, corrugated paper box with carton panel, and gumming paper.

The proposed package sizes of printed paper bag for packing of roasted and ground coffee are 500 gm, 1000 gm and 1,500 gm which are planned to constitute 35%, 50% and 15% of the total roasted and ground coffee respectively.

The estimated annual requirement for printed paper bag at 100 per cent capacity utilization rate and the corresponding cost estimates are given in Table 4.3.

Paper bag of required size, quality and desired number of colours can be available from local private or public paper factories on an order basis.

**Table 4.3**

**ANNUAL PAPER BAG REQUIREMENT AND COST ESTIMATES**

| **Package Size (gm)** | **Total Roasted Ground Coffee (kg)** | **Paper bag Requirement (pcs)** | **Allowance for Damage (0.5%)** | **Total Requirement** | **Unit Cost (Birr)** | **Total Cost (Birr)** |
|---|---|---|---|---|---|---|
| 1 | 2 | 3=No.2x1,000 / No. 1 | 4 | 5 = 3+4 | 6 | 7 |
| 500 | 32,900 | 65,800 | 329 | 66,129 | 1.00 | 66,129 |
| 1000 | 47,000 | 47,000 | 235 | 47,235 | 1.00 | 47,235 |
| 1500 | 14,100 | 9,400 | 47 | 9,447 | 1.00 | 9,447 |
| **Grand Total** | **94,000** | **-** | **-** | **-** | **-** | **122,811** |

The estimated annual requirement for corrugated paper box and panel at 100 per cent capacity utilization rate, the optimum corrugated paper box sizes for each package size and cost estimates are given in Table 4.4.

**Table 4.4**

**ANNUAL REQUIREMENT FOR CORRUGATED PAPER BOX AND PANEL AND THEIR COST ESTIMATES**

| Package Size of Paper bag (gm) | Specific Volume of product-filled paper bag ($m^3$/package) | Number of Paper bag per box (pc) | Weight of Product per box (kg) | Annual Roasted Ground Coffee output (kg) | Annual Requirement | | Unit Cost Birr/ box (panel) | Total Cost Birr/ box (panel) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Box (pcs) | Panel (pcs) | | |
| 1 | 2 | 3 | 4=1x3 1,000 | 5 | 6=5/4 | 7=6 | 8 | 9=6x8 (7X8) |
| 500 | $8.05x10^4$ | 20 | 10 | 32,900 | 3,290 | 3,290 | 2.07<br>0.41 | 6,810<br>1,349 |
| 1000 | $1.61x10^3$ | 15 | 15 | 47,000 | 3,134 | 3,134 | 3.12<br>0.69 | 9,778<br>2,162 |
| 1,500 | $2.41x10^3$ | 10 | 15 | 14,100 | 940 | 940 | 3.20<br>0.63 | 3,008<br>592 |
| **Grand Total** | | | | **94,000** | | | | **23,699** |

The estimated annual requirement for gumming paper and respective cost estimates at 100 per cent capacity utilization rate are given in Table 4.5.

**Table 4.5**

**ANNUAL REQUIREMENT FOR GUMMING PAPER AND THEIR COST ESTIMATES**

| Package Size of Paper bag (gm) | Annual Requirement for Corrugated Paper box (pc) | Estimated Length per Roll of Gumming Paper (m) | Annual Requirement for Gumming Paper (roll) | Unit (Cost) Birr/roll | Total Cost (Birr ) |
|---|---|---|---|---|---|
| 500 | 3,290 | 18 | 156 | 25 | 3,900 |
| 1000 | 3,134 | 18 | 187 | 25 | 4,675 |
| 1,500 | 940 | 18 | 55 | 25 | 1,375 |
| **Grand Total** | | | | **398** | **9,950** |

Gumming paper of desired size and quality is available in rolls at the local market.

## B. UTILITIES

The major utility required by the plant is electricity. Annual electric consumption of the plant at 100 per cent capacity utilization rate is estimated at 11,573 kWh and the estimated cost at the rate of Birr 0.4736 per kWh will amount to Birr 5,481.

Potable water will be required for personal use and quality control laboratory. Annual water requirement is estimated to be 150 cubic meter. Annual cost of water at the rate of Birr 2.00 per cubic meter amounts to Birr 300.

# V. TECHNOLOGY AND ENGINEERING

## A. TECHNOLOGY

### 1. Production Process

Coffee processing involves three distinct operations, *viz* roasting, grinding and packing. Clean coffee, prior to roasting is blended in desired proportions.

The aromatic qualities of coffee only become apparent once the beans have been exposed to high temperatures during pyrolysis or roasting.

Experts place the roasting zone between $180^{o}$ C and $240^{o}$C the optimum temperature being between $210^{o}$C and 230 $^{o}$C. Above this temperature, over-roasting begins. In general, four principal groups of reactions occur during roasting: dehydration (deprive of moisture), hydrolysis (breaking down of water molecules in hydrogen and oxygen elements), desmolysis and catalysis (for aiding the speeding up of chemical process).

The roasting process normally lasts for between 12 and 15 minutes. In slow roasting techniques, it requires about 25 minutes. While roasting gives coffee its taste and aroma, it also changes the bean in certain ways.

The beans lose weight due to evaporation of water from the green coffee. About 0.2-0.4 percent silver skin is also eliminated due to roasting.

Roasting induces the endosperm to increasing volume due to the formation and expansion of gas between 180$^{o}$C and 220$^{o}$C.This is manifested in a volumetric increase of about 50 to 80 percent, the extremes being between 30 and 100 percent. The bean becomes porous and crumbles when pressure is applied.

The minerals in coffee do not change noticeably during roasting , but their relative content increases when the water and volatile organic components disappear.

When the desired colour is reached, the coffee is discharged into the cooling bin where it is cooled upto room temperature.

The major post-roasting operations comprise sorting, coating or glazing, blending, packing and beverage preparing.

The roasted coffee is sometimes sorted to eliminate beans that are pale (too light) or charred (too dark).

Coffee beans are blended after roasting if there is too great a variation in type.

Roasted coffees rapidly lose their flavour and aroma. In order to avoid this, sufficiently airtight packaging should be used which can preserve the qualities of the coffee for a longer period of time.

## 2. Source of Technology

The following firm could be a possible supplier of the required machines.

Queens land, New South Wales.

Butany Road, Green Square, NSW.

Australia 2015.

Fax: 6129692-0400.

## B. ENGINEERING

### 1. Machinery and Equipment

The total cost of machinery and equipment is estimated at Birr 511.500, out of which Birr 485,925 will be required in foreign currency. Detailed list of machinery and equipment and their cost estimates are given in Table 5.1.

**Table 5.1**

**LIST OF MACHINERY AND EQUIPMENT AND ALONG WITH THEIR ETIMATED COSTS**

| Sr. No | Description | Qty. | Unit Cost (Birr) | Total Cost (Birr) | | |
|---|---|---|---|---|---|---|
| | | | | F.C | L.C | Total |
| | **A. Machinery and Equipment** | | | | | |
| 1 | Coffee Roaster | 1 | 106,395 | 101,076 | 5,319 | 106,395 |
| 2 | Coffee Mixer | 1 | 31,872 | 30,278 | 1,594 | 31,872 |
| 3 | Coffee Grinder | 6 | 31,306 | 178,444 | 9,392 | 187,836 |
| 4 | Automatic Packing m/c | 1 | 65,767 | 62,479 | 3,288 | 65,767 |
| 5 | Automatic Packing m/c | 1 | 94,156 | 89,448 | 4,708 | 94,156 |
| 6 | Screw Conveyor | 1 | 8,712 | 8,276 | 436 | 8,712 |
| 7 | Goose type Conveyor | 1 | 16,762 | 15,924 | 838 | 16,762 |
| | **Grand Total** | | | **485,925** | **25,575** | **511,500** |

### 2. Land, Buildings and Civil Works

The total land area required for the coffee processing plant is 1,000 square meters. The total built-up area is estimated at 500 square meters. The total cost of buildings and civil works, at the rate of Birr 2,000 Per $m^2$, is estimated at Birr 700,000. On the other hand, the total cost of land lease, at the rate of Birr 2 per $m^2$ and for a period of 70 years, is estimated at Birr 140,000. The total land lease cost is assumed to be paid in advance.

## VI. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

The coffee roasting, grinding & packing plant will create job opportunities for 27 persons.

The proposed manpower requirement and the estimated annual labour cost including fringe benefits is given in Table 6.1.

**Table 6.1**

**MANPOWER REQUIREMENT AND ANNUAL LABOUR COST**

| Sr. No. | Description | Req. No. | Monthly Salary (Birr) | Annual Salary (Birr) |
|---|---|---|---|---|
| 1 | General Manager | 1 | 2,000 | 24,000 |
| 2 | Secretary | 1 | 700 | 8,400 |
| 3 | Quality Controller | 1 | 700 | 8,400 |
| 4 | Finance and Administrative Head | 1 | 1,500 | 18,000 |
| 5 | Commercial Head | 1 | 1,500 | 18,000 |
| 6 | Production and Technical Head | 1 | 1,600 | 19,200 |
| 7 | Personnel and General Service | 1 | 750 | 9,000 |
| 8 | Accountant | 1 | 700 | 8,400 |
| 9 | Cashier | 1 | 600 | 6,000 |
| 10 | Sales Clerk | 1 | 400 | 4,800 |
| 11 | Transit Worker | 1 | 600 | 7,200 |
| 12 | Production Supervisor | 1 | 900 | 10,800 |
| 13 | Machine Operator | 2 | 1,000 | 12,000 |
| 14 | Electrician | 1 | 600 | 7,200 |
| 15 | Mechanic | 1 | 600 | 7,200 |
| 16 | Production Clerk | 1 | 400 | 4,800 |
| 17 | Store Keeper | 1 | 500 | 6,000 |
| 18 | Purchaser | 1 | 500 | 6,000 |
| 19 | Maintenance Section Head | 1 | 900 | 10,800 |
| 20 | Guard | 2 | 400 | 4,800 |
| | **Total** | **27** | **16,750** | **201,000** |
| | Employees' Benefit (20% of Salary) | | 3,350 | 40,200 |
| | **Grand Total** | | **20,100** | **241,200** |

**B. TRAINING REQUIREMENT**

The quality controller and production supervisor should be given on-the-job training for a duration of one month by experts of the supplier of the machinery and equipment. The three machine operators should also obtain a 15 days on –the – job training on how to operate the equipment and handle the inputs. The estimated training cost is Birr 18,563.

## VII. FINANCIAL ANALYSIS

The financial analysis of the coffee roasting, grinding & packing 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 | 2 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 2.15 million, of which about 29% will be required in foreign currency. The major breakdown of the total initial investment cost is shown in Table 7.1

**Table 7.1**

**INITIAL INVESTMENT COST ('000 BIRR)**

| Sr. No. | Cost Items | Foreign Currency | Local Currency | Total |
|---|---|---|---|---|
| 1 | Land | - | 140.00 | 140.00 |
| 2. | Building and Civil Work | - | 700.00 | 700.00 |
| 3. | Plant Machinery and Equipment | 485.93 | 25.56 | 511.50 |
| 4. | Office Furniture and Equipment | - | 50.00 | 50.00 |
| 5. | Vehicle | - | 225.00 | 225.00 |
| 6. | Pre-production Expenditure* | - | 345.21 | 345.21 |
| | **Total Investment cost** | **485.93** | **1,485.78** | **1,971.71** |
| 7 | Working Capital | - | 187.10 | 187.10 |
| | **Grand Total** | **485.93** | **1,672.89** | **2,158.81** |

## B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 1.85 million (see Table 7.2). The material and utility cost accounts for 70 per cent while repair and maintenance take 2 per cent of the production cost.

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* *Pre-production expenditure include interest during construction (Birr 270,210 thousand), training (Birr 18,563), 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 | 1,112.05 | 1,240.87 | 1,303 | 1,303 |
| Labour direct | 102.91 | 114.83 | 120.60 | 120.60 |
| Utilities | 4.93 | 5.50 | 5.78 | 5.78 |
| Maintenance and repair | 33.34 | 37.20 | 39.08 | 39.08 |
| Labour overheads | 34.30 | 38.28 | 40.20 | 40.20 |
| Administration cost | 68.60 | 76.55 | 84.40 | 84.40 |
| **Total Operating Costs** | **1,356.13** | **1,513.23** | **1,589.32** | **1,589.32** |
| Depreciation | 153.15 | 153.15 | 153.15 | 93.15 |
| Cost of Finance | 156.74 | 147.14 | 111.85 | 64.24 |
| **Total Production Cost** | **1,666.02** | **1,813.52** | **1,854.32** | **1,746.71** |

## 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 profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the life-time of the project.

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

**2. Break-even Analysis**

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

$$Be = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 30\ \%$$

**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 5 years.

**4. Internal Rate of Return and Net Present Value**

Based on the cash flow statement, the calculated IRR of the project is 21 % and the net present value at 10.5% discount rate is Birr 1.46 million.

**D. ECONOMIC BENEFITS**

The project can create employment for 27 persons. In addition to supply of the domestic needs, the project will generate Birr 1.61 million interms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue.