78. PROFILE ON PRODUCTION OF FATTY ACIDS

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I. SUMMARY

This profile envisages the establishment of a plant for the production of fatty acids with a capacity of 6,000 tonnes per annum.

The present demand for the proposed product is estimated at 7,656 per annum. The demand is expected to reach at 26,431 by the year 2025.

The plant will create employment opportunities for 44 persons.

The total investment requirement is estimated at about Birr 15.89 million, out of which Birr 9.54 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 27 % and a net present value (NPV) of Birr 12.55 million discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Fatty acid is a product manufactured by splitting oils and fats. It is mainly used for the industrial production of soaps. Both saturated (e.g., steric acid) and unsaturated (e.g., oleic acid) fatty acids have long been employed in many industries as both free acids, and more frequently as salts. The salts are used in the manufacture of lubricating greases, and paper sizing. Fatty acids are also important raw materials in the production of higher alcohols and synthetic surfactants (detergents). In the present study, the main use of fatty acids is envisaged to be as a raw materials for the soap industries.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

The major application of fatty acids is in the manufacturing of soap. However, even though

the local soap manufacturing industry is expanding rapidly, the demand for the product is met through import. Table 3.1 shows annual import of fatty acid during the period 2000 to 2006.

Table 3.1

IMPORT OF FATTY ACID (TONNE)

Year	Import
2000	12916
2001	13144
2002	4103
2003	10390
2004	6079
2005	8710
2006	5445

Source; *External Trade Statistics.*

As shown in Table 3.1, import of fatty acid fluctuates from year to year without any discernible growth trend. Hence, in the absence of a trend in the import data, it is considered as reasonable to assume that the average import during the last four years (2003 – 2006) approximates the present (2007) demand for the product. Accordingly, the present demand for fatty acid is estimated at 7656 tonnes.

2. Projected Demand

The future demand for fatty acid depends mainly on the growth of end user industries. Hence, future demand for the product is contingent upon growth of the national economy, especially the manufacturing sector.

Assuming that the manufacturing sector will grow by a rate higher than the average national economic growth rate of 6-7% in the recent past, future demand for fatty acid is projected to grow by 10% annually. The demand projection executed with this assumption is as shown in Table 3.2.

Table 3.2

PROJECTED DEMAND FOR FATTY ACIDS (TONNES)

Year	Projected Demand
2008	8,422
2009	9,264
2010	10,190
2011	11,209
2012	12,330
2013	13,563
2014	14,919
2015	16,411
2016	18,052
2017	19,858
2018	21,843
2019	24,028
2020	26,431

3. Pricing and Distribution

Based on the average CIF value of imported dextrin and other costs (duty, port handling, inland transport and bank charges) the ex factory price is proposed to be Birr 4,750 per tonne.

Since fatty acid is an intermediate product, the distribution of the product is more convenient if it is direct. Penetration of domestic market will be facilitated through advertisement by creating awareness as well as sales promotional measures.

B. PLANT CAPACITY AND PRODUCTION ON PROGRAMME

1. Plant Capacity

Considering to cover about 60% of the projected demand , it is proposed to establish a processing plant with a daily capacity of 20 tonnes or about 6000 tonnes of fatty acids per year considering 300 working days and providing the remaining days of the year for maintenance and unexpected down times.

2. Production Programme

The plant is envisaged to operate in two shifts per day for 300 working days per year. Considering the time required to acquire plant operation experience and market penetration, it is envisaged that the plant will start production at 75% of its full capacity in the first year, and at 85% and l00% during the second and the third years of its operation, respectively.

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

Natural oils, such as palm oil, and rapeseed oil are good raw materials from which fatty acids can be produced. Palm oil is not locally produced, therefore, has to be imported. Rape seed oil is locally produced. However, it is used for cooking and moreover, it is expensive for use as a raw material for the production of fatty acids. The production of fatty acids will, therefore, be based on imported palm oil which is much cheaper than the locally available rape seed oil. Natural oil, palm oil in this case, is the only raw material required for the production of fatty acids.

The finished fatty acid is filled in drums or in tank truck and sold to the local soap manufacturing plants. The by-product, called "sweet water", is also sold in the same way.

The annual requirement of palm oil is estimated to be 7320 tonnes. Taking a price of Birr 3000 per tonne of palm oil delivered to Addis Ababa, the total cost is estimated to be Birr 22 million per annum.

It is assumed that 50% of the product will be sold in recycled drums and this requires about 500

drums per month which cost about Birr 100,000. In total, the annual cost of materials is estimated at about Birr 22.l million.

B. UTILITIES

The plant requires steam (3M Pa), electricity, water and fuel oil for its operation. The annual requirement of utilities is estimated to be about 6,400 tonnes of steam, 31753 kWh of electricity, 127,010 m^3 of water and 536 tonnes of fuel-oil. The total annual cost of utilities is valued at Birr 717,020.

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Process Description

There are two basic types of processes for the splitting (or hydrolysis) of natural oils to produce fatty acids. These are batch and continuous processes. The batch process is a process in which natural oil, water and steam are injected in a splitting autoclave and the hydrolysis reaction is completed in the autoclave batch-by-batch wise. The continuous process employs heat exchangers and a battery of continuous splitting autoclaves which make the hydrolysis process continuous.

Batch process is preferred for capacities below 50 tonnes of oil processed per day. Accordingly, a batch process is selected for the present project which will process about 25 tonnes of oil (20 tonnes of fatty acids) per day.

In the selected batch process, palm oil from storage is first pumped into a splitting autoclave into which water and steam are also injected. After completion of the hydrolysis reaction, the content of the reactor (autoclave) is transferred through expansion vessel into settlers. After proper separation by settling, the fatty acids are removed from the settlers.

The hydrolysis reaction also produces glycerine. The glycerine formed during the reaction is l0-l5% of the oil and is contained in the water phase. The glycerine ("sweet water") is concentrated to a glycerine content of l5-20% and, after separation by a centrifuge, is transferred to a storage tank.

2. Source of Technology

The technology for the production of fatty acids is widely available in China and India.

B. ENGINEERING

1. Machinery and Equipment

The major machineries and equipment required for the plant are listed in Table 5.1. The total cost of the machinery and equipment (landed in Addis Ababa) is estimated at Birr 9,545,000.

Table 5.1

LIST OF MACHINERY & EQUIPMENT REQUIRED FOR FATTY ACIDS MANUFACTURING PLANT

No.	Item	Quantity (pcs.)
l	Natural oil measuring vessel	1
2	Oil pumps	2
3	Autoclaves	2
4	Pumps	2
5	Flashing vessels	1
6	Settling tanks	2
7	Separators	2
8	Centrifuge	1
9	Condenser	1
10	Water demineralizing equipment	1 (Set)
11	Fatty acids storage tank	1
12	"sweet water" storage tank	1
13	Demineralize water tank	1
14	Natural Oil tanks	2
15	Oil pumps	2
l6	Steam boiler	1

2. Land, Building and Civil Works

The total land area required for the plant including open is estimated at 2400 m^2. The covered area is estimated to be 300 m^2. The production area could be partly of an open - air construction. However, a small building for control room, laboratory, social services and offices will be erected.

The building is assumed to be constructed from concrete hollow-blocks. The cost of building and other civil works is estimated at Birr 750,000. The annual cost of land rent is Birr 1,200.

3. Proposed Location

The envisaged plant shall be located in Tepi town, Yeki Woreda of Sheka Zone.

VI. MANPOWER AND TRAINING REQUIREMENTS

A. MANPOWER REQUIREMENT

The total manpower requirement of the plant is estimated at 44 persons. The breakdown is shown in Table 6.1. The total cost of manpower, including benefits, is about Birr l90, 500 per annum.

Table 6.1

MANPOWER REQUIREMENT AND LABOUR COST (BIRR)

Sr. No.	Category	Number	Monthly Salary	Annual Salary
1	Plant Manager	l	2,500	30,000
2	Industrial Chemist	l	l,500	18000
3	Machine operators	12	12x400	57600
4	Assistant operator	14	14x250	42000
5	Technicians	4	4 x 700	33,600
6	Assistant Technician	4	4 x 500	24000
7	Clerical & administration	4	4x 350	16800
8	Guards and cleaners	4	4 x 200	9600
	Total	**44**	**19300**	**231,600**

B. TRAINING REQUIREMENT

On-the-job training is required for proper operational skill development of the workers. The total cost of training is estimated at Birr 50,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the fatty acid project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30 days
Raw material, import	90 days
Work in progress	5 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 15.89 million, of which 29 per cent 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

Sr. No.	Cost Items	Total Cost ('000 Birr)
1	Land lease value	96.0
2	Building and Civil Work	750.0
3	Plant Machinery and Equipment	9,545.0
4	Office Furniture and Equipment	125.0
5	Vehicle	450.0
6	Pre-production Expenditure*	824.6
7	Working Capital	4,100.2
	Total Investment cost	**15,890.9**
	Foreign Share	29

** N.B Pre-production expenditure includes interest during construction (Birr 674.63 thousand) training (Birr 50 thousand) and Birr 100 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 24.90 million (see Table 7.2). The material and utility cost accounts for 91.61 per cent, while repair and maintenance take 0.60 per cent of the production cost.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)

Items	**Cost**	**%**
Raw Material and Inputs	22,100.00	88.73
Utilities	717.02	2.88
Maintenance and repair	150	0.60
Labour direct	138.96	0.56
Factory overheads	46.32	0.19
Administration Costs	92.64	0.37
Total Operating Costs	23,244.94	93.32
Depreciation	1124.5	4.51
Cost of Finance	538.22	2.16
Total Production Cost	**24,907.66**	**100**

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 including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 51\ \%$$

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 4 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 27% and the net present value at 8.5% discount rate is Birr 12.55 million.

D. ECONOMIC BENEFITS

The project can create employment for 44 persons. In addition to supply of the domestic needs, the project will generate Birr 8.28 million in terms of tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.