

**68. PROFILE ON THE PRODUCTION OF SODIUM
BICARBONATE**

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I. SUMMARY

This profile envisages the establishment of a plant for the production of sodium bicarbonate with a capacity of 6,000 tons per annum. The major application of sodium bicarbonate is as baking soda.

The country's requirement of sodium bicarbonate is met through import. The present (2012) demand for sodium bicarbonate is estimated at 770 tons. The demand for the product is projected to reach 1,092 tons and 1,462 tons by the year 2018 and year 2023, respectively.

The principal raw materials required are soda ash and carbon dioxide, which are all available locally.

The total investment cost of the project including working capital is estimated at Birr 19.99 million. From the total investment cost the highest share (Birr 15.89 million or 79.50%) is accounted by fixed investment cost followed by pre operation cost (2.166 million or 10.83%) and initial working capital (Birr 1.93 million or 9.67%). From the total investment cost, Birr 8.37 million or 41.87% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 23.77% and a net present value (NPV) of Birr 13.38 million, discounted at 10%.

The project can create employment for 39 persons. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. The project will also create backward and forward linkage with the chemical and food manufacturing sub sectors and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APPLICATION

Sodium bicarbonate is a white crystalline powder (NaHCO_3) better known as baking soda. It is classified as an acid salt, formed by combining an acid (carbonic) and a base (sodium hydroxide), and it reacts with other chemicals as a mild alkali. At temperatures above 300

degrees Fahrenheit (149 degrees Celsius), baking soda decomposes into sodium carbonate (a more stable substance), water, and carbon dioxide.

The native chemical and physical properties of baking soda account for its wide range of applications, including cleaning, deodorizing, buffering, and fire extinguishing. Baking soda neutralizes odors chemically, rather than masking or absorbing them. Consequently, it is used in bath salts and deodorant body powders. Baking soda tends to maintain a pH of 8.1 (7 is neutral) even when acids, which lower pH, or bases, which raise pH, are added to the solution. Its ability to tabletize makes it a good effervescent ingredient in antacids and denture cleaning products. Sodium bicarbonate is also found in some anti-plaque mouth-wash products and toothpaste. When baking soda is used as a cleaner in paste form or dry on a damp sponge, its crystalline structure provides a gentle abrasion that helps to remove dirt without scratching sensitive surfaces. Its mild alkalinity works to turn up fatty acids contained in dirt and grease into a form of soap that can be dissolved in water and rinsed easily. Baking soda is also used as a leavening agent in making baked goods such as bread or pancakes. When combined with an acidic agent (such as lemon juice), carbon dioxide gas is released and is absorbed by the product's cells. As the gas expands during baking, the cell walls expand as well, creating a leavened product.

In addition to its many home uses, baking soda also has many industrial applications. For instance, baking soda releases carbon dioxide when heated. Since carbon dioxide is heavier than air, it can smother flames by keeping oxygen out, making sodium bicarbonate a useful agent in fire extinguishers. Other applications include air pollution control (because it absorbs sulfur dioxide and other acid gas emissions), abrasive blasting for removal of surface coatings, chemical manufacturing, leather tanning, oil well drilling fluids (because it precipitates calcium and acts as a lubricant), rubber and plastic manufacturing, paper manufacturing, textile processing, and water treatment (because it reduces the level of lead and other heavy metals).

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Since there is no plant that manufactures sodium bicarbonate locally, the country's requirement is entirely met through import. Ethiopia imports most of its requirement of sodium bicarbonate mainly from China. Other suppliers of the product include India, Germany, United Kingdom, and France. Past supply of the product through import, which indicates the extent of demand, is presented in Table 3.1.

Table 3.1
IMPORT OF SODIUM BICARBONATE

| Year | Qty (Tons) | Value ('000 Birr) |
|-------------|------------------------|-------------------------------|
| 2000 | 124.5 | 293.5 |
| 2001 | 370.8 | 1,221.7 |
| 2002 | 22.0 | 87.8 |
| 2003 | 247.1 | 796.9 |
| 2004 | 140.0 | 532.6 |
| 2005 | 164.4 | 545.3 |
| 2006 | 269.5 | 1,022.2 |
| 2007 | 281.5 | 980.0 |
| 2008 | 656.9 | 2851.2 |
| 2009 | 486.6 | 2,696.1 |
| 2010 | 576.7 | 3,717.5 |
| 2011 | 663.9 | 6,030.4 |

Source: - Ethiopian Revenues and Customs Authority.

The 12 years time series data presented in Table 3.1 reveals that the imported quantity had generally an increasing trend although there were some fluctuations in certain years. The actual increasing trend can be clearly shown when the data set is analyzed by diving in to three years intervals. Accordingly, the yearly average volume of import which was 172.4 tons during the period 2000-2002 has increased to 241.3 tons during the period 2003-2005. Compared to the previous three years average the total growth rate is about 40% or a yearly average growth of 13%. Similarly, the yearly average quantity imported during the period 2006-2008 and 2009-2011 has increased to 402.6 tons and 575.7 tons, respectively.

The above figures indicate that the yearly average level of import during the period 2006-2008 has increased by a total of about 66% or by 20% annually compared to the previous three years average. Similarly, the yearly average volume of import during the period 2009-2011 is higher by a total of 43% or by 12% annually compared to the average imported volume during 2006 – 2008. Generally, in the past 12 years the annual average growth rate of import was around 16%.

The annual average growth of import observed during the past 12 years is applied to arrive at the present demand by taking year 2011 import as a base. Accordingly, present effective demand for sodium bicarbonate is set at 770 tons.

2. Demand Projection

The demand for sodium bicarbonate is mainly influenced by the growth the food manufacturing sub sector. The food manufacturing sector in turn is influenced by the general economic growth of the country in general and urban population growth. By considering the combined effect of the two factors ,a 6 % annual average growth rate is applied in forecasting the future demand. The results obtained based on this reasonable assumption is presented in Table 3.2.

Table 3.2**PROJECTED DEMAND FOR SODIUM BICARBONATE (TONS)**

| Year | Projected Demand |
|-------------|-------------------------|
| 2013 | 816 |
| 2014 | 865 |
| 2015 | 917 |
| 2016 | 972 |
| 2017 | 1,034 |
| 2018 | 1,092 |
| 2019 | 1,158 |
| 2020 | 1,227 |
| 2021 | 1,301 |
| 2022 | 1,379 |
| 2023 | 1,462 |

The demand for sodium bicarbonate will grow from 816 tons in the year 2013 to 1,092 tons and 1,462 tons by the year 2018 and year 2023, respectively.

3. Pricing and distribution

Based on the CIF value of imported sodium bicarbonate in the year 2011 and adding other associated costs with import a factory gate price of Birr 15,900 per ton is recommended for sales revenue projection and financial evaluation.

Sodium bicarbonate is largely consumed by bakeries and urban households for baking. Since the numbers of end users are relatively large and scattered in a wide geographical area the product has to reach the end users through distributors and retailers.

B. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

The demand for sodium bicarbonate rises from 816 tons in the year 2013 to 1,462 tons by the year 2023. Therefore, the plant is proposed to have a capacity of 1,000 ton/year, in 300 working days and operating in three shift of 8 hrs each considering the market study, period for project implementation and full capacity attainment, minimum economies of scale in the context of Ethiopia and availability of machinery in the world market.

2. Production Program

The production programme is set by considering just 300 working days per annum. The plant starts operation at 75% of its full capacity operation and progressively grow to 90% and full capacity operation in the second and third year and then after respectively. The production programme is shown in Table 3.3.

Table 3.3
PRODUCTION PROGRAM

| Year | 1 | 2 | 3-10 |
|---------------------------|-----|-----|-------|
| Capacity utilisation (%) | 75 | 90 | 100 |
| Sodium bicarbonate (tons) | 750 | 900 | 1,000 |

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

The major raw materials required for the production of sodium bicarbonate are soda ash and carbon dioxide, which are all available locally. The total annual cost of raw and auxiliary materials is estimated at Birr 7,270,000. The annual material requirement of the plant is shown in Table 4.1.

Table 4.1**ANNUAL RAW MATERIAL REQUIREMENT&COST**

| Sr. No. | Item | Qty | Total |
|----------------|---|------------|--------------|
| 1 | Soda ash (tons) | 630 | 4,410 |
| 2 | Carbon dioxide (tons) | 262 | 2,620 |
| 3 | Packing Materials (25 kg Polypropylene sacks) | 40,000 | 240 |
| | Total | | 7,270 |

B. UTILITIES

Utilities such as oil, water and electricity are required by the plant. The total cost of utilities is estimated at Birr 859,200. The annual consumption is shown in Table 4.2.

Table 4.2**ANNUAL CONSUMPTION OF UTILITIES**

| Sr. No | Utility | Unit | Annual Consumption | Cost ('000 Birr) |
|---------------|----------------|----------------|---------------------------|-------------------------|
| 1 | Kerosene | lt | 15,000 | 270.0 |
| 2 | Water | m ³ | 45,000 | 450.0 |
| 3 | Electricity | Kwh | 240,000 | 139.2 |
| | Total | | | 859.2 |

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Soda ash is dissolved in a rotary dissolver and the soda ash solution is filtered to remove any non-soluble materials and is then pumped through a feed tank to the top of a carbonating tower. Purified carbon dioxide is introduced into the bottom of the tower and held under pressure. As the saturated sodium solution moves through the tower, it cools and reacts with the carbon dioxide to form sodium bicarbonate crystals. These crystals are collected at the bottom of the tower and transferred to centrifuge, where excess solution (filtrate) is filtered out. The crystals are then washed in a bicarbonate solution, forming a cake-like substance ready for drying. The filtrate that is removed from the centrifuge is recycled to the rotary dissolver, where it is used to saturate more soda ash crystal.

The washed filter cake is then dried on either a continuous belt conveyor or in a vertical tube drier called a flash dryer.

Next, the dried crystals of sodium bicarbonate are separated into various grades by particle size. Standard grades of sodium bicarbonate and special grades are manufactured to meet customers' specific requirements, and particle size is the major determinant of grades. Powdered type 1 and fine granular type 2 have a wide range of uses in foods, chemicals, and pharmaceuticals. Granular grades type 4 and type 5 are found in foods and doughnuts, cleaning compounds, pharmaceuticals, and many other products. Industrial grade sodium bicarbonate is used in diverse applications, including oil well drilling fluids, fire extinguishing materials, and water treatment.

Each grade goes to a holding bin wherein atmosphere, carbon dioxide, and moisture content are controlled to "cure" the product. Once cured, the grades are ready to be packaged and transported.

2. Environmental Impact Assessment

The process does not have any adverse impact on environment since the technology selected is a closed circuit.

B. ENGINEERING

1. Machinery and Equipment

The total cost of this machinery and equipment is estimated at about Birr 11,160,000, out of which Birr 8,370,000 will be required in foreign currency. The list of machinery and equipment required by the envisaged plant is given in Table 5.1.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT

| Sr.No. | Item | Qty. |
|--------|------------------------|------|
| 1 | Soda ash silo | 1 |
| 2 | Rotary dissolving tank | 1 |
| 3 | Filter | 1 |
| 4 | Feed tank | 1 |
| 5 | Pump | 3 |
| 6 | Carbonating tower | 1 |
| 7 | Centrifuge | 1 |
| 6 | Flash dryer | 1 |
| 7 | Sieve | 1 |
| 8 | Product silo | 1 |
| 9 | Packing machine | 1 |

2. Land, Building and Civil Works

The total land requirement including sewers, storage, open spaces etc. is estimated to be 1,200 m². The major buildings and civil works include buildings for production, offices, workshops and warehouses. The total built up area required is about 700 m². Total cost of building and other civil works is estimated at Birr 3.5 million.

According to the Federal Legislation on the Lease Holding of Urban Land (Proclamation No 721/2004) in principle, urban land permit by lease is on auction or negotiation basis, however, the time and condition of applying the proclamation shall be determined by the concerned regional or city government depending on the level of development.

The legislation has also set the maximum on lease period and the payment of lease prices. The lease period ranges from 99 years for education, cultural research health, sport, NGO , religious and residential area to 80 years for industry and 70 years for trade while the lease payment period ranges from 10 years to 60 years based on the towns grade and type of investment.

Moreover, advance payment of lease based on the type of investment ranges from 5% to 10%.The lease price is payable after the grace period annually. For those that pay the entire amount of the lease will receive 0.5% discount from the total lease value and those that pay in installments will be charged interest based on the prevailing interest rate of banks. Moreover, based on the type of investment, two to seven years grace period shall also be provided.

However, the Federal Legislation on the Lease Holding of Urban Land apart from setting the maximum has conferred on regional and city governments the power to issue regulations on the exact terms based on the development level of each region.

In Addis Ababa, the City's Land Administration and Development Authority is directly responsible in dealing with matters concerning land. However, regarding the manufacturing sector, industrial zone preparation is one of the strategic intervention measures adopted by the City Administration for the promotion of the sector and all manufacturing projects are assumed to be located in the developed industrial zones.

Regarding land allocation of industrial zones if the land requirement of the project is below 5000 m² the land lease request is evaluated and decided upon by the Industrial Zone Development and Coordination Committee of the City's Investment Authority. However, if the land request is above 5,000 m² the request is evaluated by the City's Investment Authority and passed with recommendation to the Land Development and Administration Authority for decision, while the lease price is the same for both cases.

Moreover, the Addis Ababa City Administration has recently adopted a new land lease floor price for plots in the city. The new prices will be used as a benchmark for plots that are going to be auctioned by the city government or transferred under the new “Urban Lands Lease Holding Proclamation.”

The new regulation classified the city into three zones. The first Zone is Central Market District Zone, which is classified in five levels and the floor land lease price ranges from Birr 1,686 to Birr 894 per m². The rate for Central Market District Zone will be applicable in most areas of the city that are considered to be main business areas that entertain high level of business activities.

The second zone, Transitional Zone, will also have five levels and the floor land lease price ranges from Birr 1,035 to Birr 555 per m². This zone includes places that are surrounding the city and are occupied by mainly residential units and industries.

The last and the third zone, Expansion Zone, is classified into four levels and covers areas that are considered to be in the outskirts of the city, where the city is expected to expand in the future. The floor land lease price in the Expansion Zone ranges from Birr 355 to Birr 191 per m² (see Table 5.2).

Table 5.2

NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA

| Zone | Level | Floor Price/m² |
|-------------------------|-----------------|----------------------------------|
| Central Market District | 1 st | 1686 |
| | 2 nd | 1535 |
| | 3 rd | 1323 |
| | 4 th | 1085 |
| | 5 th | 894 |
| Transitional zone | 1 st | 1035 |
| | 2 nd | 935 |
| | 3 rd | 809 |
| | 4 th | 685 |
| | 5 th | 555 |
| Expansion zone | 1 st | 355 |
| | 2 nd | 299 |
| | 3 rd | 217 |
| | 4 th | 191 |

Accordingly, in order to estimate the land lease cost of the project profiles it is assumed that all new manufacturing projects will be located in industrial zones located in expansion zones. Therefore, for the profile a land lease rate of Birr 266 per m² which is equivalent to the average floor price of plots located in expansion zone is adopted.

On the other hand, some of the investment incentives arranged by the Addis Ababa City Administration on lease payment for industrial projects are granting longer grace period and extending the lease payment period. The criteria are creation of job opportunity, foreign exchange saving, investment capital and land utilization tendency etc. Accordingly, Table 5.3 shows incentives for lease payment.

Table 5.3

INCENTIVES FOR LEASE PAYMENT OF INDUSTRIAL PROJECTS

| Scored Point | Grace Period | Payment Completion Period | Down Payment |
|---------------------|---------------------|----------------------------------|---------------------|
| Above 75% | 5 Years | 30 Years | 10% |
| From 50 - 75% | 5 Years | 28 Years | 10% |
| From 25 - 49% | 4 Years | 25 Years | 10% |

For the purpose of this project profile, the average i.e. five years grace period, 28 years payment completion period and 10% down payment is used. The land lease period for industry is 60 years. Accordingly, the total land lease cost at a rate of Birr 266 per m² is estimated at Birr 319,200 of which 10% or Birr 31,920 will be paid in advance. The remaining Birr 287,280 will be paid in equal installments with in 28 years i.e. Birr 10,260 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENT

A. HUMAN RESOURCE REQUIREMENT

The plant requires a total of 39 persons. The total annual cost of labour is estimated at Birr 958,500. The human resource requirement of the plant and the monthly and annual salary expenditure are shown in Table 6.1.

Table 6.1
REQUIRED HUMAN RESORCE AND COST(BIRR)

| Sr. No. | Manpower | No. of Persons | Monthly Salary | Annual Cost |
|----------------|--|-----------------------|-----------------------|--------------------|
| 1 | General Manager | 1 | 8,000 | 96,000 |
| 2 | Technical Manager | 1 | 5,000 | 60,000 |
| 3 | Personnel | 1 | 3,000 | 36,000 |
| 4 | Production Head | 1 | 5000 | 60,000 |
| 5 | Supervisor | 1 | 3,000 | 36,000 |
| 6 | Chemist | 1 | 2,500 | 30,000 |
| 7 | Skilled operators | 6 | 9,000 | 108,000 |
| 8 | Semi-skilled Operators | 6 | 6,000 | 72,000 |
| 9 | Maintenance crew | 5 | 6,000 | 72,000 |
| 10 | Accountant | 2 | 5,000 | 60,000 |
| 11 | Sales and purchasing officer | 2 | 5,000 | 60,000 |
| 12 | Unskilled labour | 4 | 1,600 | 19,200 |
| 13 | General service workers | 8 | 4,800 | 57,600 |
| | Sub -total | 39 | 63,900 | 766,800 |
| | Employees benefit(25% of basic salary) | | 15,975 | 191,700 |
| | Total | | 79,875 | 958,500 |

B. TRAINING REQUIREMENT

The technical personnel of the plant should be trained by qualified engineers of the machinery supplier. The cost of training shall be Birr 45,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the sodium bicarbonate 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 | 10% |
| Discount cash flow | 10% |
| Accounts receivable | 30 days |
| Raw material local | 30 days |
| Raw material imported | 120 days |
| Work in progress | 1 day |
| Finished products | 30 days |
| Cash in hand | 5 days |
| Accounts payable | 30 days |
| Repair and maintenance | 5% of machinery cost |

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 19.99 million (see Table 7.1). From the total investment cost the highest share (Birr 15.89 million or 79.50%) is accounted by fixed investment cost followed by pre operation cost (2.166 million or 10.83%) and initial working capital (Birr 1.93 million or 9.67%). From the total investment cost, Birr 8.37 million or 41.87% is required in foreign currency.

Table 7.1**INITIAL INVESTMENT COST ('000 Birr)**

| Sr. No | Cost Items | Local Cost | Foreign Cost | Total Cost | % Share |
|----------|--------------------------------|------------------|-----------------|------------------|--------------|
| 1 | Fixed investment | | | | |
| 1.1 | Land Lease | 31.92 | | 31.92 | 0.16 |
| 1.2 | Building and civil work | 3,500.00 | | 3,500.00 | 17.51 |
| 1.3 | Machinery and equipment | 2,790.00 | 8,370.00 | 11,160.00 | 55.83 |
| 1.4 | Vehicles | 900.00 | | 900.00 | 4.50 |
| 1.5 | Office furniture and equipment | 300.00 | | 300.00 | 1.50 |
| | Sub total | 7,521.92 | 8,370.00 | 15,891.92 | 79.50 |
| 2 | Pre operating cost * | | | | |
| 2.1 | Pre operating cost | 858.00 | | 858.00 | 4.29 |
| 2.2 | Interest during construction | 1,307.78 | | 1,307.78 | 6.54 |
| | Sub total | 2,165.78 | | 2,165.78 | 10.83 |
| 3 | Working capital ** | 1,932.59 | | 1,932.59 | 9.67 |
| | Grand Total | 11,620.29 | 8,370.00 | 19,990.29 | 100 |

* *N.B Pre operating cost include project implementation cost such as installation, startup, commissioning, project engineering, project management etc and capitalized interest during construction.*

** *The total working capital required at full capacity operation is Birr 2.62 million. However, only the initial working capital of Birr 1.93 million during the first year of production is assumed to be funded through external sources. During the remaining years the working capital requirement will be financed by funds to be generated internally (for detail working capital requirement see Appendix 7.A.1).*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 14.01 million (see Table 7.2). The cost of raw material account for 51.89% of the production cost. The other major components of the production cost are depreciation, financial cost and labor which account for 19.65%, 9.89% and 6.13%, respectively. The remaining 12.44 % is the share of utility, repair and maintenance, labor overhead and administration cost. For detail production cost see Appendix 7.A.2.

Table 7.2**ANNUAL PRODUCTION COST AT FULL CAPACITY (YEAR THREE)**

| Items | Cost (in 000 Birr) | % |
|------------------------------------|-----------------------------------|--------------|
| Raw Material and Inputs | 7,270.00 | 52.36 |
| Utilities | 859.20 | 6.19 |
| Maintenance and repair | 334.80 | 2.41 |
| Labour direct | 766.80 | 5.52 |
| Labour overheads | 191.70 | 1.38 |
| Administration Costs | 150.00 | 1.08 |
| Land lease cost | - | - |
| Cost of marketing and distribution | 300.00 | 2.16 |
| Total Operating Costs | 9,872.50 | 71.10 |
| Depreciation | 2,753.60 | 19.83 |
| Cost of Finance | 1,258.73 | 9.07 |
| Total Production Cost | 13,884.83 | 100 |

C. FINANCIAL EVALUATION**1. Profitability**

Based on the projected profit and loss statement, the project will generate a profit throughout its operation life. Annual net profit after tax ranges from Birr 1.54 million to Birr 4.09 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 32.91 million. For profit and loss statement and cash flow projection see Appendix 7.A.3 and 7.A.4, respectively.

2. Ratios

In financial analysis financial ratios and efficiency ratios are used as an index or yardstick for evaluating the financial position of a firm. It is also an indicator for the strength and weakness of the firm or a project. Using the year-end balance sheet figures and other relevant data, the most important ratios such as return on sales which is computed by dividing net income by revenue, return on assets (operating income divided by assets), return on equity (net profit divided by equity) and return on total investment (net profit plus interest divided by total investment) has been carried out over the period of the project life and all the results are found to be satisfactory.

3. Break-even Analysis

The break-even analysis establishes a relationship between operation costs and revenues. It indicates the level at which costs and revenue are in equilibrium. To this end, the break-even point for capacity utilization and sales value estimated by using income statement projection are computed as followed.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 6,678,000$$

$$\text{Break - Even Capacity utilization} = \frac{\text{Break - even Sales Value}}{\text{Sales revenue}} \times 100 = 48.26\%$$

4. Pay-back Period

The pay -back period, also called pay – off period is defined as the period required for recovering the original investment outlay through the accumulated net cash flows earned by the project. Accordingly, based on the projected cash flow it is estimated that the project’s initial investment will be fully recovered within 4 years.

5. Internal Rate of Return

The internal rate of return (IRR) is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments or putting the money in a bank account. Accordingly, the IRR of this project is computed to be 23.77% indicating the viability of the project.

6. Net Present Value

Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an investment or project adds to the capital invested. In principle, a project is accepted if the NPV is non-negative.

Accordingly, the net present value of the project at 10% discount rate is found to be Birr 13.38 million which is acceptable. For detail discounted cash flow see Appendix 7.A.5.

D. ECONOMIC AND SOCIAL BENEFITS

The project can create employment for 39 persons. The project will generate Birr 9.60 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. The project will also create backward and forward linkage with the chemical and food manufacturing sub sector and also generates income for the Government in terms of payroll tax.

Appendix 7.A
FINANCIAL ANALYSES SUPPORTING TABLES

Appendix 7.A.2
PRODUCTION COST (in 000 Birr)

| Item | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 |
|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Raw Material and Inputs | 5,453 | 6,543 | 7,270 | 7,270 | 7,270 | 7,270 | 7,270 | 7,270 | 7,270 | 7,270 |
| Utilities | 644 | 773 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 |
| Maintenance and repair | 251 | 301 | 335 | 335 | 335 | 335 | 335 | 335 | 335 | 335 |
| Labour direct | 575 | 690 | 767 | 767 | 767 | 767 | 767 | 767 | 767 | 767 |
| Labour overheads | 144 | 173 | 192 | 192 | 192 | 192 | 192 | 192 | 192 | 192 |
| Administration Costs | 113 | 135 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Land lease cost | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 10 | 10 |
| Cost of marketing and distribution | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Total Operating Costs | 7,479 | 8,915 | 9,873 | 9,873 | 9,883 | 9,883 | 9,883 | 9,883 | 9,883 | 9,883 |
| Depreciation | 2,754 | 2,754 | 2,754 | 2,754 | 2,754 | 170 | 170 | 170 | 170 | 170 |
| Cost of Finance | 0 | 1,439 | 1,259 | 1,079 | 899 | 719 | 539 | 360 | 180 | 0 |
| Total Production Cost | 10,233 | 13,107 | 13,885 | 13,705 | 13,535 | 10,772 | 10,592 | 10,412 | 10,233 | 10,053 |

Appendix 7.A.3
INCOME STATEMENT (in 000 Birr)

| Item | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 |
|---------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Sales revenue | 11,925 | 14,310 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 |
| Less variable costs | 7,179 | 8,615 | 9,573 | 9,573 | 9,573 | 9,573 | 9,573 | 9,573 | 9,573 | 9,573 |
| VARIABLE MARGIN | 4,746 | 5,695 | 6,328 | 6,328 | 6,328 | 6,328 | 6,328 | 6,328 | 6,328 | 6,328 |
| in % of sales revenue | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 | 39.80 |
| Less fixed costs | 3,054 | 3,054 | 3,054 | 3,054 | 3,064 | 480 | 480 | 480 | 480 | 480 |
| OPERATIONAL MARGIN | 1,692 | 2,641 | 3,274 | 3,274 | 3,264 | 5,847 | 5,847 | 5,847 | 5,847 | 5,847 |
| in % of sales revenue | 14.19 | 18.46 | 20.59 | 20.59 | 20.53 | 36.78 | 36.78 | 36.78 | 36.78 | 36.78 |
| Financial costs | | 1,439 | 1,259 | 1,079 | 899 | 719 | 539 | 360 | 180 | 0 |
| GROSS PROFIT | 1,692 | 1,203 | 2,015 | 2,195 | 2,365 | 5,128 | 5,308 | 5,488 | 5,667 | 5,847 |
| in % of sales revenue | 14.19 | 8.40 | 12.67 | 13.80 | 14.87 | 32.25 | 33.38 | 34.51 | 35.64 | 36.78 |
| Income (corporate) tax | 0 | 0 | 0 | 658 | 709 | 1,538 | 1,592 | 1,646 | 1,700 | 1,754 |
| NET PROFIT | 1,692 | 1,203 | 2,015 | 1,536 | 1,655 | 3,590 | 3,715 | 3,841 | 3,967 | 4,093 |
| in % of sales revenue | 14.19 | 8.40 | 12.67 | 9.66 | 10.41 | 22.58 | 23.37 | 24.16 | 24.95 | 25.74 |

Appendix 7.A.4
CASH FLOW FOR FINANCIAL MANAGEMENT (in 000 Birr)

| Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Scrap |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| TOTAL CASH INFLOW | 16,750 | 15,234 | 14,324 | 15,909 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 6,009 |
| Inflow funds | 16,750 | 3,309 | 14 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Inflow operation | 0 | 11,925 | 14,310 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 0 |
| Other income | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,009 |
| TOTAL CASH OUTFLOW | 16,750 | 10,789 | 12,547 | 13,193 | 13,408 | 13,290 | 13,939 | 13,813 | 13,687 | 13,561 | 11,637 | 0 |
| Increase in fixed assets | 16,750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Increase in current assets | 0 | 2,001 | 395 | 264 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Operating costs | 0 | 7,179 | 8,615 | 9,573 | 9,573 | 9,583 | 9,583 | 9,583 | 9,583 | 9,583 | 9,583 | 0 |
| Marketing and Distribution cost | 0 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 0 |
| Income tax | 0 | 0 | 0 | 0 | 658 | 709 | 1,538 | 1,592 | 1,646 | 1,700 | 1,754 | 0 |
| Financial costs | 0 | 1,308 | 1,439 | 1,259 | 1,079 | 899 | 719 | 539 | 360 | 180 | 0 | 0 |
| Loan repayment | 0 | 0 | 1,798 | 1,798 | 1,798 | 1,798 | 1,798 | 1,798 | 1,798 | 1,798 | 0 | 0 |
| SURPLUS (DEFICIT) | 0 | 4,446 | 1,776 | 2,716 | 2,492 | 2,610 | 1,961 | 2,087 | 2,213 | 2,339 | 4,263 | 6,009 |
| CUMULATIVE CASH BALANCE | 0 | 4,446 | 6,222 | 8,938 | 11,430 | 14,040 | 16,001 | 18,088 | 20,302 | 22,641 | 26,904 | 32,913 |

Appendix 7.A.5
DISCOUNTED CASH FLOW (in 000 Birr)

| Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Scrap |
|---------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| TOTAL CASH INFLOW | 0 | 11,925 | 14,310 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 6,009 |
| Inflow operation | 0 | 11,925 | 14,310 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 15,900 | 0 |
| Other income | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,009 |
| TOTAL CASH OUTFLOW | 18,683 | 7,861 | 9,170 | 9,873 | 10,532 | 10,592 | 11,421 | 11,475 | 11,529 | 11,583 | 11,637 | 0 |
| Increase in fixed assets | 16,750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Increase in net working capital | 1,933 | 382 | 254 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Operating costs | 0 | 7,179 | 8,615 | 9,573 | 9,573 | 9,583 | 9,583 | 9,583 | 9,583 | 9,583 | 9,583 | 0 |
| Marketing and Distribution cost | 0 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 0 |
| Income (corporate) tax | | 0 | 0 | 0 | 658 | 709 | 1,538 | 1,592 | 1,646 | 1,700 | 1,754 | 0 |
| NET CASH FLOW | -18,683 | 4,064 | 5,140 | 6,028 | 5,368 | 5,308 | 4,479 | 4,425 | 4,371 | 4,317 | 4,263 | 6,009 |
| CUMULATIVE NET CASH FLOW | -18,683 | 14,618 | -9,478 | -3,450 | 1,918 | 7,225 | 11,704 | 16,129 | 20,500 | 24,817 | 29,080 | 35,089 |
| Net present value | -18,683 | 3,695 | 4,248 | 4,529 | 3,666 | 3,296 | 2,528 | 2,271 | 2,039 | 1,831 | 1,644 | 2,317 |
| Cumulative net present value | -18,683 | 14,988 | -10,740 | -6,211 | -2,545 | 751 | 3,279 | 5,550 | 7,589 | 9,420 | 11,064 | 13,380 |

| | |
|-------------------------|---------|
| NET PRESENT VALUE | 13,380 |
| INTERNAL RATE OF RETURN | 23.77% |
| NORMAL PAYBACK | 4 years |