

**54. PROFILE ON THE PRODUCTION OF
INDUSTRIAL ADHESIVE**

TABLE OF CONTENTS

		<u>PAGE</u>
I.	SUMMARY	54-2
II.	PRODUCT DESCRIPTION & APPLICATION	54-3
III.	MARKET STUDY AND PLANT CAPACITY	54-4
	A. MARKET STUDY	54-4
	B. PLANT CAPACITY & PRODUCTION PROGRAM	54-7
IV.	MATERIALS AND INPUTS	54-7
	A. RAW & AUXILIARY MATERIALS	54-7
	B. UTILITIES	54-8
V.	TECHNOLOGY & ENGINEERING	54-9
	A. TECHNOLOGY	54-9
	B. ENGINEERING	54-11
VI.	MANPOWER & TRAINING REQUIREMENT	54-15
	A. MANPOWER REQUIREMENT	54-15
	B. TRAINING REQUIREMENT	54-16
VII.	FINANCIAL ANALYSIS	54-17
	A. TOTAL INITIAL INVESTMENT COST	54-17
	B. PRODUCTION COST	54-19
	C. FINANCIAL EVALUATION	54-19
	D. ECONOMIC & SOCIAL BENEFITS	54-21

I. SUMMARY

This profile envisages the establishment of a plant for the production of industrial adhesive with a capacity of 1,000 tons per annum. An adhesive is a material, usually in a liquid or semi-liquid state, that adheres or bonds items together.

The country's requirement of industrial adhesive is met through import. The present (2012) demand for industrial adhesive is estimated at 4,965 tons. The demand for industrial adhesive is projected to reach 6,975 tons and 12,293 by the year 2018 and year 2020, respectively. Furthermore, the demand will reach at a level of 8,750 tons by the year 2023.

The principal raw materials required are starch, caustic soda, hydrochloric acid, borax, calcium chloride and formaldehyde. Starch and caustic soda are locally available while the other raw materials have to be imported.

The total investment cost of the project including working capital is estimated at Birr 12.25 million. From the total investment cost, the highest share (Birr 6.37 million or 52.02%) is accounted by fixed investment cost followed by initial working capital (Birr 4.57 million or 37.32%) and pre operation cost (Birr 1.30 million or 10.66%). From the total investment cost, Birr 2.62 million or 21.41% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 34.69% and a net present value (NPV) of Birr 23.69 million, discounted at 10%.

The project can create employment for 78 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 forward linkage with the manufacturing sector and backward linkage with the mining sector and chemical manufacturing sub sector and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APPLICATION

An adhesive or stick on is a material, usually in a liquid or semi-liquid state, that adheres or bonds items together. Adhesives come from either natural or synthetic sources. The types of materials that can be bonded are vast but they are especially useful for bonding thin materials. Adhesives cure (harden) by either evaporating a solvent or by chemical reactions that occur between two or more constituents.

In contrast to household or office applications where relatively few adhesives are used, many adhesives are used in industry and a lot of these are tailor-made for special requirements or processing. An industrial adhesive has to fulfill the following requirements:

- Fast and safe bonding of the materials,
- Cost-saving production tool ,and
- Compatibility with the existing production lines.

Among the available natural and synthetic industrial adhesive, starch adhesive is envisaged for this profile since the raw material is abundantly available and the adhesive has a wider application. Starch adhesive is a natural polymeric product and is found in many processes either as an adhesive.

Although starch and dextrin have been used as adhesives for many decades, there are several important reasons why these natural adhesives will not be entirely replaced by synthetic products. The following advantages ensure that they will continue to fill particular niches in the marketplace.

- Good availability ,
- Relatively low cost,
- Stable quality ,
- Good adhesion to cellulose and many porous substrates ,
- Insoluble in oils and fats ,
- Non-toxic and biodegradable, and
- Heat resistant.

Starch Adhesive is used in paper, corrugated cardboard, gypsum wall board, paper bags, single and multi-wall, carton and case sealing, paper and board tube winding, laminated paper board, gummed tape and paper (wallpaper), textile sizing, pharmaceuticals and personal care products, Paints, inks and toners manufacturing.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

The data source for import statistics i.e. Ethiopian Revenue and Customs Authority, classifies import of adhesives under the following headings

- 35052000 – Glues based on starches, dextrans or other modified starches;
- 35061000 – Products put up as glues or adhesives for retail sale =<1 kg ;
- 35069100 – Adhesives based on polymers or on rubber; and
- 35069900 – Prepared glues and other prepared adhesives.

A summary of the above four types of adhesives imported during the period 2000 – 2011 is presented in Table 3.1.

Table 3.1
IMPORT OF ADHESIVES

Year	Qty. (Tons)	Value ('000 Birr)
2000	1,614	15,028
2001	1,842	22,076
2002	1,495	16,453
2003	2,115	25,496
2004	2,310	30,536
2005	3,542	39,332
2006	3,920	48,995
2007	4,418	58,298
2008	4,858	74,084
2009	4,490	78,082
2010	6,163	140,209
2011	5,658	149,713

Source: - Ethiopian Revenues and Customs Authority

Table 3.1 reveals that import of adhesives has been consistently increasing from period to period, except a slight decline in the year 2002, year 2003 and year 2011 compared to their respective previous years. The yearly average level of import which was only 1,651 tons during the period 2000--2002 has reached nearly 6,000 tons by the 2010/11. Generally, during the past 12 years import volume has shown an annual average growth rate of 17%.

To estimate the present (year 2012) demand, a 17% growth rate, which is observed in the past 12 years, is applied. Accordingly, the total presented demand for adhesives is computed to be 6,620 tons. In order to arrive at the demand specifically for industrial adhesive the share of glues based on polymers from the total import in the recent three years has been computed and found to be about 75%. Hence, the current effective demand for natural adhesives is estimated at 4,965 tons.

2. Demand Projection

Adhesives are used in almost all sectors of the manufacturing sector. It is used to bond two or more surfaces together and is economical compared to other methods. Adhesives are widely used in the wood, metal, paper, textiles, leather, rubber, glass and other activities of the manufacturing sector. Hence, the demand for adhesives will grow parallel with the expansion of the manufacturing sector. The manufacturing sector of Ethiopia is projected to grow by about 20% per annum. A 12% annual growth rate, which is smaller than the observed trend in the past and the forecast of the manufacturing sector, is applied in projecting the future demand (see Table 3.2).

Table 3.2**PROJECTED DEMAND FOR INDUSTRIAL ADHESIVE (TONS)**

Year	Projected demand
2013	5,561
2014	6,228
2015	6,975
2016	7,812
2017	8,750
2018	9,800
2019	10,976
2020	12,293
2021	13,768
2022	15,420
2023	17,271

As could be seen from Table 3.2, the demand for industrial adhesives will grow from 5,561 tons to 6,975 tones and 12,293 by the year 2018 and year 2020, respectively. Furthermore, the demand will reach at a level of 8,750 tons by the year 2023.

3. Pricing and distribution

Based on the CIF price of year 2011 and considering other import related costs a factory- gate price of Birr 31,752 per ton is recommended.

Although the product is an industrial input, the end -users of the product are numerous and their geographical distribution is very wide. Hence, the product has to reach the final consumer through distributors or through distributor and retailer.

B. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

The demand for industrial adhesive grows from 5,561 tons in year 2013 to 8,750 tons by the year 2023, as indicated in the market study. The plant is proposed to produce 1,000 tons per annum of starch based industrial adhesive considering the market study, minimum economies of scale, investment cost, period for implementation and full capacity attainment. The plant will operate single shifts of 8 hours each per day for 300 days in a year.

2. Production Program

The production program is worked out by deducting Sundays and public holidays and assuming that maintenance works will be carried out during off-production hours. The plant is assumed to start its operation at 75% of its rated full capacity and progressively increase to 85% and 100% in the second and third year, respectively. The production programme is provided in Table 3.3.

Table 3.3

PRODUCTION PROGRAMME

Year	1	2	3-10
Capacity Utilization (%)	75	85	100
Production of industrial adhesive (ton)	750	850	1,000

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

The major raw material required for starch based industrial adhesive is starch. Other raw materials required in small amount are caustic soda, hydrochloric acid, borax, calcium chloride and formaldehyde. Packing material is also the auxiliary raw materials required for the envisaged project. The total annual cost of raw material for the project at full capacity operation is estimated at Birr 17,577,000. The raw material requirements and costs are shown in Table 4.1.

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

Sr. No.	Description	Qty. (tons)	Annual Cost ('000 Birr)		
			FC	LC	Total
1	Starch	970	-	13,386	13,386
2	Caustic Soda	15	-	225	225
3	HCl	15	105	-	105
4	Borax	15	510	-	510
5	Formaldehyde	6	126	-	126
6	Calcium chloride	25	225	-	225
7	Packing material(50kg	20,000	-	3,000	3,000
	Grand Total		965	16,611	17,577

B. UTILITIES

The major utilities of the proposed plant are electricity, furnace oil and water. The total annual cost of utility is estimated at Birr 1,697,200. The annual utility requirement and cost are indicated in Table 4.2.

Table 4.2**ANNUAL UTILITIES REQUIREMENT & COST**

Sr. No.	Description	UOM	Qty	Cost (Birr)
1	Electricity	kWh	140,000	81,200
2	Furnaces oil	Lt.	75,000	1,116,000
3	Water	m ³	50,000	500,000
	Total			1,697,200

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Production of industrial adhesive based on starch includes the following simple processing steps:

➤ **Weighing**

The raw materials are weighed accurately according to the formulation.

➤ **Gelatinization**

The base material i.e. the starch is gelatinized in the reactor using caustic soda. Heating in water is the simplest method of breaking up starch granules. On heating in water, starch granules first swell and then burst open with a resulting thickening of the suspension. The temperature at which this thickening of the suspension occurs is called the gelation temperature. For most starches in pure water, gelation occurs between 57 and 72°C. In this form, the starch is not a true solution but a colloidal suspension.

The heating process can take one of two forms. In the first, salts (usually the chlorides of metals such as calcium, magnesium and zinc) are added to a suspension of the starch in water, and the adhesive is produced by controlling temperature and the time of stirring. In the second and primary method, caustic soda is added to the starch suspension; the product is neutralized with acids later in the process.

The starch paste now has a high viscosity and acts as an adhesive. If the concentration of the starch is above 7%, then the cooked paste is very viscous and difficult to pump. Above 15% starch solids content, the cooked paste forms an immobile rubbery mass on cooling. Suspensions with a higher amylose/amylopectin ratio will have a higher viscosity.

Pregelation starch is produced by physical modification of the starch to impart the ability to form a paste easily in cold water. The process consists of heating the starch slurry to a temperature above the gelation temperature and then quickly drying the starch before retardation can occur. The main process equipment used is a heated-drum drier or hot roll.

Unmodified starches, such as those produced by the steps outlined previously, come in powder form (pregelation) or as high-viscosity, low-solids content pastes that do not show a stable viscosity with time. Therefore, several treatments have been developed to provide liquid adhesives that are not subject to retrogradation and have a viscosity and rheology more suitable for many applications. These treatment methods include alkali treatment, acid treatment and oxidation.

The gelation temperature can be lowered by the addition of an alkali, such as sodium hydroxide, to the starch suspension. If sufficient alkali is added, the starch can be induced to gel at room temperature.

➤ **Acidification**

The gelatinized starch is acidified to normalize its PH. A pre-determined quantity of acid is sprayed on the gelatinized starch by means of an atomizer jet to give the required PH. Additional catalysts such as inorganic salts may be added at this stage. Acid modification of starch is achieved by heating the starch at 49-54°C with small amounts of aqueous mineral acid, followed by neutralization with a base. This tends to make for a much thinner solution at the same solids content when compared to unmodified starch. Starches prepared in this manner are often known as thin-boiling or high-fluidity starches. Acid modification is often used when applications require higher solids content but a controlled, lower viscosity.

➤ **Mixing**

Oxidization of starch is usually obtained by treatment with aqueous alkaline hypochlorite. A starch suspension at pH 8-10 is treated with hypochlorite (5-10% Cl based on starch) for a long enough time to produce the desired viscosity. Acid is liberated during the reaction, so base must be added to maintain the pH for optimum reactivity. Dried oxidized starch is generally whiter than unmodified starch. Because of the low color, these starches are often used for the sizing and coating of printing papers. These oxidized or chlorinated starches behave similarly to acid-modified starches. However, the oxidized starch has greater tack and adhesive character and, thus, is often used in adhesive applications.

Preservatives and extenders are added and the mixture mixed thoroughly to obtain homogeneous product. Solution of preservative such as formaldehyde is added to the mixture to obtain homogeneous product. To prevent conversion of the adhesive proceeding further than desired, it is immediately discharged from the mixer and cooled.

➤ **Packaging**

The product is packaged in plastic containers ready for sale.

2. Environmental Impact Assessment

The technology of production of industrial adhesive based on starch does not have an adverse environmental impact.

B. ENGINEERING

1. Machinery and Equipment

The total cost of machinery and equipment is estimated at Birr 3.5 million, out of which Birr 2.625 million is required in foreign currency. The list of machinery and equipment required is shown in Table 5.1.

Table 5.1

LIST OF MACHINERY AND EQUIPMENT

Description	Quantity
Storage tanks	4
Blender mixer	2
Acidification Tank	1
Centrifuge	1
Vacuum dryer	1
Cooling tower	1
Ball mill	1
Small boiler	1
Auxiliary Equipment (Compressor, pipes, fillings, etc)	set

2. Land, Building and Civil Works

The total land requirement is 1,000 m². The total built-up area of the plant is estimated to be 400 m². The cost of civil works is estimated at Birr 1.6 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 5,000 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 266,000 of which 10% or Birr 26,600 will be paid in advance. The remaining Birr 239,400 will be paid in equal installments with in 28 years i.e. Birr 8,550 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENT**A. HUMAN RESOURCE REQUIREMENT**

The total human resource requirement of the plant is estimated to be 28. The total annual cost of labor is estimated at Birr 586,500. The human resource list and salary costs are shown in Table 6.1.

Table 6.1**HUMAN RESOURCE REQUIREMENT AND LABOR COST**

Sr. No.	Description	Req. No. of Persons	Monthly Salary	Annual Salary
1	General manager	1	6,000	72,000
2	Executive secretary	1	2,000	24,000
3	Accountant	2	5,000	60,000
4	Casher	1	900	10,800
5	Purchasing and sales officer	2	5,000	60,000
6	Personnel	1	2,000	24,000
7	Production and technical head	1	3,000	36,000
8	Supervisor	1	2,000	24,000
9	Operator technician	4	4,800	57,600
10	Assistant operator technician	4	3,600	43,200
11	Messenger and cleaner	4	1,600	19,200
12	Guard	4	1,600	19,200
13	Driver	2	1,600	19,200
	Sub -total	28	39,100	469,200
	<i>Employees benefit (25% of basic salary)</i>		9,775	117,300
	Total		48,875	586,500

B. TRAINING REQUIREMENT

The production process is simple and does not require special training except basic orientation during plant erection and commissioning by experts of machinery supplier at project site.

VII. FINANCIAL ANALYSIS

The financial analysis of the industrial adhesive 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 12.25 million (see Table 7.1). From the total investment cost, the highest share (Birr 6.37 million or 52.02%) is accounted by fixed investment cost followed by initial working capital (Birr 4.57 million or 37.32%) and pre operation cost (Birr 1.30 million or 10.66%). From the total investment cost, Birr 2.62 million or 21.41% 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	26.60		26.60	0.22
1.2	Building and civil work	1,600.00		1,600.00	13.05
1.3	Machinery and equipment	875.00	2,625.00	3,500.00	28.55
1.4	Vehicles	900.00		900.00	7.34
1.5	Office furniture and equipment	350.00		350.00	2.86
	Sub- total	3,751.60	2,625.00	6,376.60	52.02
2	Pre operating cost *				
2.1	Pre operating cost	505.00		505.00	4.12
2.2	Interest during construction	802.00		802.00	6.54
	Sub- total	1,307.00		1,307.00	10.66
3	Working capital **	4,575.48		4,575.48	37.32
	Grand Total	9,634.08	2,625.00	12,259.08	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 6.08 million. However, only the initial working capital of Birr 4.57 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 22.63 million (see Table 7.2). The cost of raw material account for 77.65% of the production cost. The other major components of the production cost are utility, depreciation and financial cost, which account for 7.50%, 4.77% and 3.41%, respectively. The remaining 6.68 % is the share of and labor, 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 (000 Birr)	%
Raw Material and Inputs	17,577.00	77.65
Utilities	1,697.20	7.50
Maintenance and repair	175.00	0.77
Labor direct	469.20	2.07
Labor overheads	117.30	0.52
Administration Costs	250.00	1.10
Land lease cost	-	-
Cost of marketing and distribution	500.00	2.21
Total Operating Costs	20,785.70	91.82
Depreciation	1,080.00	4.77
Cost of Finance	771.92	3.41
Total Production Cost	22,637.62	100

C. FINANCIAL EVALUATION

1. Profitability

Based on the projected profit and loss statement, the project will generate a profit through out its operation life. Annual net profit after tax will grow from Birr 3.88 million to Birr 4.80 million during the life of the project. Moreover, at the end of the project life the accumulated net cash

flow amounts to Birr 47.06 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 5,873,960$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break- even Sales Value}}{\text{Sales revenue}} \times 100 = 21\%$$

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 2 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 34.69 % 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 23.69 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 28 persons. The project will generate Birr 13.11 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 forward linkage with the manufacturing sector and backward linkage with the chemical 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	13,183	14,940	17,577	17,577	17,577	17,577	17,577	17,577	17,577	17,577
Utilities	1,273	1,443	1,697	1,697	1,697	1,697	1,697	1,697	1,697	1,697
Maintenance and repair	131	149	175	175	175	175	175	175	175	175
Labour direct	352	399	469	469	469	469	469	469	469	469
Labour overheads	88	100	117	117	117	117	117	117	117	117
Administration Costs	188	213	250	250	250	250	250	250	250	250
Land lease cost	0	0	0	0	9	9	9	9	9	9
Cost of marketing and distribution	500	500	500	500	500	500	500	500	500	500
Total Operating Costs	15,714	17,743	20,786	20,786	20,794	20,794	20,794	20,794	20,794	20,794
Depreciation	1,080	1,080	1,080	1,080	1,080	99	99	99	99	99
Cost of Finance	0	882	772	662	551	441	331	221	110	0
Total Production Cost	16,794	19,705	22,638	22,527	22,426	21,334	21,224	21,114	21,004	20,893

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

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Sales revenue	20,813	23,588	27,750	27,750	27,750	27,750	27,750	27,750	27,750	27,750
Less variable costs	15,214	17,243	20,286	20,286	20,286	20,286	20,286	20,286	20,286	20,286
VARIABLE MARGIN	5,599	6,345	7,464	7,464	7,464	7,464	7,464	7,464	7,464	7,464
in % of sales revenue	26.90	26.90	26.90	26.90	26.90	26.90	26.90	26.90	26.90	26.90
Less fixed costs	1,580	1,580	1,580	1,580	1,589	608	608	608	608	608
OPERATIONAL MARGIN	4,019	4,765	5,884	5,884	5,876	6,857	6,857	6,857	6,857	6,857
in % of sales revenue	19.31	20.20	21.20	21.20	21.17	24.71	24.71	24.71	24.71	24.71
Financial costs		882	772	662	551	441	331	221	110	0
GROSS PROFIT	4,019	3,883	5,112	5,223	5,324	6,416	6,526	6,636	6,746	6,857
in % of sales revenue	19.31	16.46	18.42	18.82	19.19	23.12	23.52	23.91	24.31	24.71
Income tax	0	0	0	1,567	1,597	1,925	1,958	1,991	2,024	2,057
NET PROFIT	4,019	3,883	5,112	3,656	3,727	4,491	4,568	4,645	4,723	4,800
in % of sales revenue	19.31	16.46	18.42	13.17	13.43	16.18	16.46	16.74	17.02	17.30

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	6,882	26,231	23,593	27,758	27,750	27,750	27,750	27,750	27,750	27,750	27,750	7,876
Inflow funds	6,882	5,418	5	8	0	0	0	0	0	0	0	0
Inflow operation	0	20,813	23,588	27,750	27,750	27,750	27,750	27,750	27,750	27,750	27,750	0
Other income	0	0	0	0	0	0	0	0	0	0	0	7,876
TOTAL CASH OUTFLOW	6,882	21,132	20,338	23,575	24,117	24,047	24,263	24,186	24,108	24,031	22,851	0
Increase in fixed assets	6,882	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	4,616	610	915	0	1	0	0	0	0	0	0
Operating costs	0	15,214	17,243	20,286	20,286	20,294	20,294	20,294	20,294	20,294	20,294	0
Marketing cost	0	500	500	500	500	500	500	500	500	500	500	0
Income tax	0	0	0	0	1,567	1,597	1,925	1,958	1,991	2,024	2,057	0
Financial costs	0	802	882	772	662	551	441	331	221	110	0	0
Loan repayment	0	0	1,103	1,103	1,103	1,103	1,103	1,103	1,103	1,103	0	0
SURPLUS (DEFICIT)	0	5,099	3,256	4,183	3,633	3,703	3,487	3,564	3,642	3,719	4,899	7,876
CUMULATIVE CASH BALANCE	0	5,099	8,354	12,537	16,170	19,874	23,361	26,926	30,567	34,286	39,185	47,061

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	20,813	23,588	27,750	27,750	27,750	27,750	27,750	27,750	27,750	27,750	7,876
Inflow operation	0	20,813	23,588	27,750	27,750	27,750	27,750	27,750	27,750	27,750	27,750	0
Other income	0	0	0	0	0	0	0	0	0	0	0	7,876
TOTAL CASH OUTFLOW	11,457	16,319	18,650	20,786	22,353	22,392	22,719	22,752	22,785	22,818	22,851	0
Increase in fixed assets	6,882	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	4,575	605	907	0	1	0	0	0	0	0	0	0
Operating costs	0	15,214	17,243	20,286	20,286	20,294	20,294	20,294	20,294	20,294	20,294	0
Marketing cost	0	500	500	500	500	500	500	500	500	500	500	0
Income tax		0	0	0	1,567	1,597	1,925	1,958	1,991	2,024	2,057	0
NET CASH FLOW	-11,457	4,494	4,938	6,964	5,397	5,358	5,031	4,998	4,965	4,932	4,899	7,876
CUMULATIVE NET CASH FLOW	-11,457	-6,963	-2,024	4,940	10,336	15,695	20,726	25,724	30,689	35,621	40,519	48,396
Net present value	-11,457	4,086	4,081	5,232	3,686	3,327	2,840	2,565	2,316	2,092	1,889	3,037
Cumulative net present value	-11,457	-7,371	-3,290	1,942	5,628	8,955	11,795	14,360	16,676	18,768	20,656	23,693

NET PRESENT VALUE 23,693
INTERNAL RATE OF
RETURN 34.69%
PAYBACK 2 years