

**58. PROFILE ON THE PRODUCTION OF NATURAL
ADHESIVES**

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I. SUMMARY

This profile envisages the establishment of a plant for the production of natural adhesive with a capacity of 500 tons per annum. Natural adhesive is used to bond items together.

The country's requirement of liquid natural adhesive is largely met through import. The present (2012) demand for natural adhesive is estimated at 1,655 tons. The demand for the product is projected to reach 3,266 tons and 5,757 tons by the year 2018 and year 2023, respectively.

The principal raw materials required are animal bones and tissues of animals from slaughterhouses and butcheries.

The total investment cost of the project including working capital is estimated at Birr 16.27 million. From the total investment cost, the highest share (Birr 12.29 million or 75.55%) is accounted for by fixed investment cost followed by initial working capital (2.57 million or 15.81%) and pre-operation cost (Birr 1.41 million or 8.64%). From the total investment cost, Birr 2.36 million or 6.37% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 18.37% and a net present value (NPV) of Birr 6.96 million, discounted at 10%.

The project can create employment for 31 persons. The establishment of such a factory will have a foreign exchange saving effect on the country by substituting current imports. The project will also create forward and backward linkage with the manufacturing sector and livestock sector respectively and also generate 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. Natural adhesives are made from organic sources such as vegetable matter, starch (dextrin), natural resins or from animals e.g. casein or animal glue. They are often referred to as bio-adhesives. Production of bone-based glue is recommended for the envisaged plant.

Animal glue is an adhesive that is created by prolonged boiling of animal connective tissue. These protein colloid glues are formed through hydrolysis of the collagen from skins, bones, tendons, and other tissues, similar to gelatin.

Animal glue was the most common woodworking glue for thousands of years until the advent of synthetic glues such as polyvinyl acetate (PVA) and other resin glues in the 20th century. Today it is used primarily in specialty applications such as lathery, pipe organ building, piano repairs, and antique restoration. Glass artists take advantage of hide glue's ability to bond with glass, applying hide glue to glass. As the glue hardens it shrinks, chipping the glass.

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, dextrin 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 natural adhesive the share of glues based on starches and dextrin from the total import in the recent three years has been computed and found to be about 25%. Hence, the current effective demand for natural adhesives is estimated at 1,655 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 18% 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 NATURAL ADHESIVE (TONS)

Year	Projected demand
2013	1,853
2014	2,076
2015	2,325
2016	2,604
2017	2,917
2018	3,266
2019	3,658
2020	4,098
2021	4,589
2022	5,140
2023	5,757

The demand for natural adhesives will increase from 1,853 tons in the year 2013 to 3,266 tons and 5,757 tons by the year 2018 and year 2023, respectively.

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. Production Capacity

Considering the scarcity of animal bone, which is the main raw material for the envisaged plant, an annual plant capacity of 500 tons was selected for the plant even though the demand for the product is high.

The envisaged plant will have a capacity to produce 500 tons of adhesive by working one shift per day and 300 working days in a year. The working days are set by assuming provisions for maintenance and repair works.

2. Production Program

The plant would start operation by utilization 70%, 85% and 100% of its capacity during the first, second and third years of operation respectively. Gradual capacity build up is envisaged considering the time required for skill development in operational and market penetration. The production program of the envisaged plant is given in Table 3.3.

Table 3.3

PRODUCTION PROGRAMME OF THE ENVISAGED ANIMAL GLUE PLANT

Sr.No.	Item Description	1st year	2nd year	3rd-10th year
1	Production of animal glue (tons)	350	425	500
2	Capacity utilization (%)	70	85	100

IV. MATERIAL AND INPUTS

A. RAW AND AUXILIARY MATERIAL

The major raw material for the production of animal glue is animal bones and tissues of animals from Slaughter Houses and Butcheries. In addition, the animal remains including ears, tails, scraps of hide or skin, scrapings from the fleshy sides of hides, tendons, bones, and feet from leather industries. The auxiliary raw material required is polyethylene bag of 5kg and carton for 25kg net. The total annual cost of raw and auxiliary materials is estimated at Birr 10,300,000. All the raw and auxiliary materials will be sourced locally. The details are shown in Table 4.1.

Table 4.1

ANNUAL REQUIREMENT OF RAW AND AUXILIARY MATERIALS AND COST

Sr.No.	Item Description	Quantity	LC(000' Birr)	FC('000 Birr)	Total Cost ('000 Birr)
1	Bones and other remains of animals	4,000	11,000	-	10,000
2	Packing Material(polyethylene bag and carton)	20,000	300	-	300
	Total		11,300		10,300

B. UTILITIES

Utilities required for the production of animal glue are electricity, fuel oil and water. The total annual cost of utilities is estimated at Birr 1,928,000. The annual quantities and cost of utilities are estimated as shown in Table 4.2.

Table 4.2
ANNUAL UTILITIES REQUIREMENT & COST

Sr.No.	Description	Qty	Total Cost (‘000 Birr)
1	Electric Power(kWh)	360,000	288.8
2	Water(m ³)	30,000	300.0
3	Fuel oil	90,000	1,339.2
	Total		1,928.0

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

In the manufacture of animal glue the fibrous protein, collagen, present in the hide, skin, or bone, is altered by heating in water, forming the reversible colloid, which is glue or gelatin or both. Essentially, animal glue is impure gelatin. Gelatin, by extraction at a lower temperature, does not, during digestion, give rise to the same liquid end products as glue, and consequently it has greater jellying power.

The commercial process consists in taking hide or skin trimmings from the leather industry, together with scrapings from the flesh side, and soaking and washing them in pure water to soften the collagen and to remove dirt. The stock is then immersed for several days in increasing concentrations of limewater to affect swelling of skin fiber, and is finally washed in water to remove the bulk of the lime. Final traces of lime are usually removed by treatment with weak solutions of acids, such as hydrochloric or acetic acid, and the stock is finally boiled. Boiling or leaching the stock is accomplished in open tanks or in autoclaves under pressure. In either system the stock is leached with three or four treatments or runs of water, using increasing temperatures with each successive run. Open-tank treatments usually start at 160°F(70°C.).Weak

glue liquors are sometimes clarified at this point in the process by treatment with sulfurous acid, alum, or phosphoric acid.

If white glue is desired, zinc oxide is added. The weak liquor from the boiling treatment is concentrated in vacuum evaporators and dried by 1) chilling in to blocks and drying on nets, 2) chilling into sheets and drying on nets, or 3) forming “pearls” by chilling in non-aqueous liquor. Bone stock is normally treated somewhat differently to prepare what is known as acidulated bone, or ossein. After degreasing with solvents, 8 percent hydrochloric acid solution is applied to the bone to dissolve the mineral constituents, principally calcium phosphate, leaving a soft cartilaginous material, collagen, which retains the original shape of the bone fragment being treated. After the residual acid is washed out from this soft collagen, it is dried, yielding commercial ossein. Hide, sinew, and ossein stocks are usually boiled by the open-tank method, whereas untreated bones are given pressure boiling in autoclaves.

2. Environmental Impact Assessment

The liquid waste to be generated during the production process shall be contained and treated in a specially designed water treatment unit before discharging it in order to minimize adverse impact to the environment. The cost of waste water treatment system is included in the cost of machinery and equipment.

B. ENGINEERING

1. Machinery and Equipment

The total cost of machinery and equipment is estimated at about Birr 8.50 million out of which about Birr 6.37 million will be required in foreign currency. The major machinery and equipment to be installed in the envisaged plant are listed in Table 5.1.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT

Sr. No.	Description	Qty
1	Washer	2
2	Soaking tank	2
3	Liming tank	2
4	Neutralization tank	2
5	Autoclave	2
6	Solvent extraction unit	1
7	Steam extraction unit	1
8	Storage tank	2
9	Concentrator	1
10	Boiler	1
11	Waste water treatment unit	Set

2. Land, Building and Civil Works

The total land requirement for the plant would be around 1,500 m², out of which 800 m² will be built –up area for offices, store and production buildings. The cost of construction is estimated to be Birr 3.2 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/m ²
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 399,000 of which 10% or Birr 39,900 will be paid in advance. The remaining Birr 359,100 will be paid in equal installments with in 28 years i.e. Birr 12,825 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENT

A. HUMAN RESOURCE REQUIREMENT

The plant will require about 31 workers at the beginning of the plant operation. The total cost of human resource is estimated at Birr 790,500. The breakdown of human resource allocation and corresponding labor cost is indicated in Table 6.1.

Table 6.1**HUMAN RESOURCE REQUIREMENT AND ANNUAL LABOR COST (IN BIRR)**

Sr. No.	Position Description	Req. No.	Monthly Salary	Annual Salary
1	General Manager	1	6,000	72,000
2	Secretary	1	1,500	18,000
3	Personnel	1	2,500	30,000
4	Accountants	2	6,000	72,000
5	Purchaser	2	5,000	60,000
6	Sales man	2	5,000	60,000
7	Production supervisor	1	6,000	72,000
8	Cashier	1	1,000	12,000
9	Operators	3	4,500	54,000
10	Assistant operators	3	2,700	32,400
11	Laborers	4	2,400	28,800
12	Mechanic	2	3,000	36,000
13	Electrician	2	3,000	36,000
14	Store keeper	1	500	6,000
15	Driver	2	1,800	21,600
16	Guard	3	1,800	21,600
	Sub-total	31	52,700	632,400
	Workers benefit (25 % of basic salary)		13,175	158,100
	Total		65,875	790,500

B. TRAINING REQUIREMENT

Animal glue processing is not complicated process and hence one month training by the expert of machinery supplier during erection and commissioning for operators, mechanic and electricians on the product quality and operation and maintenance of machinery is sufficient.

The cost of such training is estimated at Birr 50,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the natural 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 and 70% equity
Tax holidays	3 years
Bank interest	10%
Discount cash flow	10%
Accounts receivable	30 days
Raw material local	30 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 16.27 million (see Table 7.1). From the total investment cost ,the highest share (Birr 12.29 million or 75.55%) is accounted by fixed investment cost followed by initial working capital (2.57 million or 15.81%) and pre operation cost (Birr 1.41 million or 8.64%). From the total investment cost Birr 2.36 million or 6.37% 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	39.90		39.90	0.25
1.2	Building and civil work	3,200.00		3,200.00	19.67
1.3	Machinery and equipment	2,130.00	6,370.00	8,500.00	52.25
1.4	Vehicles	450.00		450.00	2.77
1.5	Office furniture and equipment	100.00		100.00	0.61
	Sub total	5,919.90	6,370.00	12,289.90	75.55
2	Pre operating cost *				
2.1	Pre operating cost	342.06		342.06	2.10
2.2	Interest during construction	1,064.28		1,064.28	6.54
	Sub total	1,406.34		1,406.34	8.64
3	Working capital **	2,572.05		2,572.05	15.81
	Grand Total	9,898.29	6,370.00	16,268.29	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 2.11 million. However, only the initial working capital of Birr 1.41 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 10.99 million (see Table 7.2). The cost of raw material account for 69.33% of the production cost. The other major components of the production cost are depreciation, financial cost and utility, which account for 7.79 %, 6.36% and 4.83%, respectively. The remaining 11.69 % is the share of 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 FOUR)**

Items	Cost (in 000 Birr)	%
Raw Material and Inputs	10,300	61.43
Utilities	1,928	11.50
Maintenance and repair	425	2.53
Labor direct	632	3.77
Labor overheads	158	0.94
Administration Costs	150	0.89
Land lease cost	0	0.00
Cost of marketing and distribution	300	1.79
Total Operating Costs	13,894	82.86
Depreciation	1,996	11.91
Cost of Finance	1,024	5.24
Total Production Cost	16,914	100.00

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 will grow from Birr 775 thousand to Birr 2.68 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 21.31 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 7,507,500$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break -even Sales Value}}{\text{Sales revenue}} \times 100 = 54\%$$

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 6 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 18.37% 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 6.96 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 31 persons. The project will generate Birr 6.01 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 and back ward linkage with the manufacturing sector and livestock sector respectively and also generates income for the Government in terms of tax revenue and 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	7,210	8,755	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300
Utilities	1,350	1,639	1,928	1,928	1,928	1,928	1,928	1,928	1,928	1,928
Maintenance and repair	298	361	425	425	425	425	425	425	425	425
Labour direct	443	538	632	632	632	632	632	632	632	632
Labour overheads	111	134	158	158	158	158	158	158	158	158
Administration Costs	105	128	150	150	150	150	150	150	150	150
Land lease cost	0	0	0	0	13	13	13	13	13	13
Cost of marketing and distribution	300	300	300	300	300	300	300	300	300	300
Total Operating Costs	9,815	11,854	13,894	13,894	13,906	13,906	13,906	13,906	13,906	13,906
Depreciation	1,996	1,996	1,996	1,996	1,996	138	138	138	138	138
Cost of Finance	0	1,171	1,024	878	732	585	439	293	146	0
Total Production Cost	11,812	15,022	16,914	16,768	16,634	14,630	14,483	14,337	14,191	14,044

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	12,513	16,088	17,875	17,875	17,875	17,875	17,875	17,875	17,875	17,875
Less variable costs	9,515	11,554	13,594	13,594	13,594	13,594	13,594	13,594	13,594	13,594
VARIABLE MARGIN	2,997	4,533	4,282	4,282	4,282	4,282	4,282	4,282	4,282	4,282
in % of sales revenue	23.95	28.18	23.95	23.95	23.95	23.95	23.95	23.95	23.95	23.95
Less fixed costs	2,296	2,296	2,296	2,296	2,309	451	451	451	451	451
OPERATIONAL MARGIN	701	2,237	1,985	1,985	1,972	3,831	3,831	3,831	3,831	3,831
in % of sales revenue	5.60	13.90	11.11	11.11	11.03	21.43	21.43	21.43	21.43	21.43
Financial costs		1,171	1,024	878	732	585	439	293	146	0
GROSS PROFIT	701	1,066	961	1,107	1,241	3,245	3,392	3,538	3,684	3,831
in % of sales revenue	5.60	6.63	5.37	6.19	6.94	18.16	18.97	19.79	20.61	21.43
Income (corporate) tax	0	0	0	332	372	974	1,017	1,061	1,105	1,149
NET PROFIT	701	1,066	961	775	868	2,272	2,374	2,477	2,579	2,681
in % of sales revenue	5.60	6.63	5.37	4.34	4.86	12.71	13.28	13.86	14.43	15.00

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	12,632	16,211	16,101	17,888	17,875	17,875	17,875	17,875	17,875	17,875	17,875	6,689
Inflow funds	12,632	3,698	13	13	0	0	0	0	0	0	0	0
Inflow operation	0	12,513	16,088	17,875	17,875	17,875	17,875	17,875	17,875	17,875	17,875	0
Other income	0	0	0	0	0	0	0	0	0	0	0	6,689
TOTAL CASH OUTFLOW	12,632	13,513	15,048	16,940	16,567	16,475	16,929	16,826	16,724	16,621	15,056	0
Increase in fixed assets	12,632	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	2,634	559	559	0	1	0	0	0	0	0	0
Operating costs	0	9,515	11,554	13,594	13,594	13,606	13,606	13,606	13,606	13,606	13,606	0
Marketing and Distribution cost	0	300	300	300	300	300	300	300	300	300	300	0
Income tax	0	0	0	0	332	372	974	1,017	1,061	1,105	1,149	0
Financial costs	0	1,064	1,171	1,024	878	732	585	439	293	146	0	0
Loan repayment	0	0	1,463	1,463	1,463	1,463	1,463	1,463	1,463	1,463	0	0
SURPLUS (DEFICIT)	0	2,697	1,053	948	1,308	1,400	946	1,049	1,151	1,254	2,819	6,689
CUMULATIVE CASH BALANCE	0	2,697	3,750	4,698	6,006	7,406	8,353	9,401	10,553	11,806	14,626	21,315

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	12,513	16,088	17,875	17,875	17,875	17,875	17,875	17,875	17,875	17,875	6,689
Inflow operation	0	12,513	16,088	17,875	17,875	17,875	17,875	17,875	17,875	17,875	17,875	0
Other income	0	0	0	0	0	0	0	0	0	0	0	6,689
TOTAL CASH OUTFLOW	15,204	10,361	12,400	13,894	14,227	14,278	14,880	14,924	14,968	15,012	15,056	0
Increase in fixed assets	12,632	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	2,572	546	546	0	1	0	0	0	0	0	0	0
Operating costs	0	9,515	11,554	13,594	13,594	13,606	13,606	13,606	13,606	13,606	13,606	0
Marketing and Distribution cost	0	300	300	300	300	300	300	300	300	300	300	0
Income (corporate) tax		0	0	0	332	372	974	1,017	1,061	1,105	1,149	0
NET CASH FLOW	-15,204	2,151	3,687	3,982	3,648	3,597	2,995	2,951	2,907	2,863	2,819	6,689
CUMULATIVE NET CASH FLOW	-15,204	13,053	-9,366	-5,384	-1,736	1,861	4,856	7,807	10,714	13,578	16,397	23,086
Net present value	-15,204	1,956	3,047	2,991	2,492	2,233	1,691	1,514	1,356	1,214	1,087	2,579
Cumulative net present value	-15,204	13,248	-10,201	-7,210	-4,718	-2,485	-794	720	2,077	3,291	4,378	6,957

NET PRESENT VALUE 6,957
INTERNAL RATE OF RETURN 18.37%
NORMAL PAYBACK 6 years