

**56. PROFILE ON THE PRODUCTION OF LACTIC  
ACID**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of lactic acid with a capacity of 15 tons per annum. The product is used in cultured dairy products as acidulant, flavoring and preservative, for de-liming of hides in leather processing, in textile dyeing, for the production of biodegradable polymers etc.

The country's requirement of lactic acid is met through import. The present (2012) demand for lactic acid is estimated at 9 tons. The demand for the product is projected to reach 16.83 tons and 28.36 tons by the year 2018 and 2023, respectively.

The principal raw materials required are milk whey, hydrated lime, sulphuric acid and ion-exchange resin. Ion-exchange resin has to be imported while the other raw materials are locally available.

The total investment cost of the project including working capital is estimated at Birr 6.49 million. From the total investment cost, the highest share (Birr 5.57 million or 85.79%) is accounted by fixed investment cost followed by pre operation cost ( Birr 742.36 thousand or 11.43%) and initial working capital (Birr 180.63 thousand or 2.78%). From the total investment cost Birr 2.13 million or 32.91% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 23.87% and a net present value (NPV) of Birr 4.38 million, discounted at 10%.

The project can create employment for 18 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 mining and chemical manufacturing sectors and also generates income for the Government in terms of tax revenue and payroll tax.

## **II. PRODUCT DESCRIPTION AND APPLICATION**

Lactic acid (2-hydroxy propanoic acid) is a colorless or yellowish, odorless and hygroscopic syrupy liquid. It is miscible with water or ethanol. It occurs widely in nature. It is the principal acid constituent of sour milk and a normal constituent of blood and muscle tissue of animals. It is a very important industrial chemical used in cultured dairy products as acidulant, flavoring, and preservative, for delimiting of hides in leather processing, textile dyeing for the production of biodegradable polymers, in making plastics, solvents, inks, and lacquers and as calcium lactate in pharmaceuticals.

Lactic acid is also used for the production of lactate esters, propylene glycol, propylene oxide, acrylic acid, 2,3-pentanedione, propanoic acidacetaldehyde, and dilactide (3, 15). It has also been increasing in importance as a feedstock for manufacture of polylactic acid (PLA), which could be a good substitute for synthetic plastic derived from petroleum feedstock.

## **III. MARKET STUDY AND PLANT CAPACITY**

### **A. MARKET STUDY**

#### **1. Past Supply and Present Demand**

Lactic acid is produced commercially for use in pharmaceuticals, soft drinks, foods, and in leather tanning. The country's requirement of lactic acid is entirely met through import. The quantity and value of lactic acid imported in the past ten years is presented in Table 3.1.

**Table 3.1**  
**IMPORTED LACTIC ACID**

<b>Year</b>	<b>Qty (Tons)</b>	<b>Value (Birr)</b>
2002	0.45	34,692
2003	0.30	35,163
2004	1.35	171,036
2005	1.28	113,474
2006	3.44	285,137
2007	4.34	300,352
2008	3.10	326,434
2009	3.40	267,541
2010	4.73	359,661
2011	8.20	1,243,590

*Source:- Ethiopian Revenues and Customs Authority.*

As can be seen from Table 3.1, the supply of lactic acid for the past ten years has been increasing annually although there were minor fluctuations. The increasing trend can be easily observed when the data set is analyzed by dividing the years in to three broad periods. Accordingly, during the period 2002-2005 the yearly average level of import was as low as 0.84 ton. During the four consecutive years i.e. 2006--2009, the annual average volume of import has increased to 3.57 tons, which is more than four fold compared to the previous four years average. By the year 2010 and 2011 the imported quantity has increased to 4.73 tons and 8.2 tons. This indicates that supply of the product from import has increased by 39% and 73% during 2010 and 2011 compared to year 2009 and 2010, respectively.

By taking year 2011 as a base and applying a 10% growth rate the present (year 2012) demand for lactic acid is estimated at 9 tons.

## 2. Demand Projection

The demand for lactic acid is dependent on the development of the manufacturing sector, particularly the pharmaceuticals, food, and soft drinks sub sectors. The demand projection is, therefore, made based on GDP growth rate of 11%. The demand projected for lactic acid is presented in Table 3.2.

**Table 3.2**  
**PROJECTED DEMAND FOR LACTIC ACID (TONS)**

<b>Year</b>	<b>Projected Demand</b>
2013	10.00
2014	11.09
2015	12.31
2016	13.66
2017	15.17
2018	16.83
2019	18.68
2020	20.74
2021	23.02
2022	25.55
2023	28.36

The demand for lactic acid will grow from 10 tons in the year 2013 to 16.83 tons and 28.36 tons by the year 2018 and 2023, respectively.

## 3. Pricing and Distribution

Based on the CIF value of year 2011 and considering other import related costs the factory gate price recommended for lactic acid is Birr 192,000 per ton. Since the product is an industrial raw material where its end users are easily identifiable direct sale without involving other intermediaries is recommended.

## B. PLANT CAPACITY & PRODUCTION PROGRAM

### 1. Plant Capacity

The annual production capacity of the project is 15,000 kg of lactic acid per annum, based on 300 working days per annum and 3 shifts per day.

### 2. Production Program

At the initial stage of the production period, the plant requires some years to penetrate the market. Therefore, in the first and second year of production, the capacity utilization rate will be 70% and 90%, respectively. In the third year and then after, full production shall be attained. The production program is indicated in Table 3.3.

**Table 3.3**  
**PRODUCTION PROGRAM**

Sr. No.	Product	Production Year		
		1	2	3 -10
1	Lactic acid (Tons)	10.5	13.5	15
2	Capacity utilization rate (%)	70	90	100

## IV. RAW MATERIAL AND INPUTS

### A. RAW AND AUXILIARY MATERIALS

The production of lactic acid involves fermentation of a carbohydrate with suitable mineral and proteinaceous nutrients in the presence of an excess of calcium carbonate. In this profile, the source of carbohydrate is the by-product of dairy industry, milk whey. In addition, hydrated lime, sulphuric acid, activated carbon and ion-exchange resins are used. The total annual cost of raw material is estimated at Birr 581,730. The annual requirement and cost of raw material at full capacity operation is indicated in Table 4.1.

**Table 4.1****ANNUAL RAW AND AUXILIARY MATERIALS REQUIREMENT AND COST**

Sr. No.	Raw Material	UOM	Qty	Cost ('000 Birr)		
				FC	LC	Total
1	Milk whey	Ton	375	-	375.00	375.00
2	Lime	Ton	15	-	45.00	45.00
3	Sulphuric acid	Ton	10	-	100.00	100.00
4	Other chemicals, activated carbon, ion-exchange resins, etc.	-	-	26.44	5.29	31.73
5	Packing materials (200 kg barrels)	Pcs	75	-	30.00	30.00
	<b>Grand Total</b>	-	-	<b>26.44</b>	<b>555.29</b>	<b>581.73</b>

**B. UTILITIES**

Electricity, furnace oil and water are utilities of the proposed project. The total annual cost of utilities is estimated at Birr 291,670. The annual consumption and cost of these inputs is indicated in Table 4.2.

**Table 4.2****ANNUAL UTILITYIES REQUIREMENT & COST (AT FULL CAPACITY)**

Sr.No.	Utility	Unit	Qty	Cost ('000 Birr)
1	Electricity	kWh	57,500	33.35
2	Furnace oil	lt	14,000	208.32
3	Water	m <sup>3</sup>	5,000	50.00
	<b>Total</b>	-	-	<b>291.67</b>



## **V. TECHNOLOGY AND ENGINEERING**

### **A. TECHNOLOGY**

#### **1. Process Description**

Milk whey is charged into the fermentor. It is inoculated with culture and is heated to 45°C. The mixture is allowed to ferment for 7 days. After fermentation, a slight excess of calcium hydroxide is added to bring the lactic acid into its calcium salt. The batch is taken into a coagulation tank and is heated to 85-90°C. The solution is allowed to stand, drained and filtered. After filtration, the crystals of calcium lactate are dried in pans. The remainder of the concentrated calcium lactate solution is evaporated and filtered to remove calcium sulfate. Technical grade 44% lactic acid is produced by further evaporation and filtration.

#### **2. Environmental Impact**

Calcium sulfate to be generated as a byproduct during the production of lactic acid is the only solid waste but calcium sulfate (gypsum) can be sold to the construction companies or chalk producing companies. Therefore, the envisaged plant does not have any adverse impact on environment.

### **B. ENGINEERING**

#### **1. Machinery and Equipment**

The cost of machinery and equipment is estimated to be Birr 2,850,000, of which Birr 2,137,500 is required in foreign currency. The list of machinery and equipment for the envisaged project is indicated in Table 5.1.

**Table 5.1**  
**LIST OF MACHINERY & EQUIPMENT**

Sr. No.	Description	No.
1	Fermentor	1
2	Crystallizer	1
3	Centrifuges	2
4	Coagulation tank	1
5	Neutralization tank	1
6	Filter press	1
7	Evaporator	1
8	Carbon treated tank	1
9	Boiler	1
10	Ion exchange tank	1
11	Vacuum pump	1
12	Stage tanks	3

## **2. Land, Building and Civil Works**

The total land required for the plant is 800 m<sup>2</sup>, out of which the built-up area is 400 m<sup>2</sup>. The cost of building is estimated at Birr 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 m<sup>2</sup>, 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 m<sup>2</sup> 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 m<sup>2</sup>. 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 m<sup>2</sup>. 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 m<sup>2</sup> (see Table 5.2).

**Table 5.2**

**NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA**

<b>Zone</b>	<b>Level</b>	<b>Floor Price/m<sup>2</sup></b>
Central Market District	1 <sup>st</sup>	1686
	2 <sup>nd</sup>	1535
	3 <sup>rd</sup>	1323
	4 <sup>th</sup>	1085
	5 <sup>th</sup>	894
Transitional zone	1 <sup>st</sup>	1035
	2 <sup>nd</sup>	935
	3 <sup>rd</sup>	809
	4 <sup>th</sup>	685
	5 <sup>th</sup>	555
Expansion zone	1 <sup>st</sup>	355
	2 <sup>nd</sup>	299
	3 <sup>rd</sup>	217
	4 <sup>th</sup>	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 m<sup>2</sup> 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**

<b>Scored Point</b>	<b>Grace Period</b>	<b>Payment Completion Period</b>	<b>Down Payment</b>
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 m<sup>2</sup> is estimated at Birr 212,800 of which 10% or Birr 21,280 will be paid in advance. The remaining Birr 191,520 will be paid in equal installments with in 28 years i.e. Birr 6,840 annually.

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

### **A. HUMAN RESOURCE REQUIREMENT**

The plant will employ a total of 18 persons. The total annual labor cost is estimated at Birr 336,000. The list of human resource and corresponding labor cost are indicated in Table 6.1

**Table 6.1**  
**HUMAN RESOURCE REQUIREMENT & LABOUR COST**

<b>Sr. No.</b>	<b>Manpower</b>	<b>Req. No.</b>	<b>Monthly Salary (Birr)</b>	<b>Annual Salary (Birr)</b>
1	General manager	1	5,000	60,000
2	Accountant	1	2,000	24,000
3	Production head	1	4,000	48,000
4	Chemist	1	2,000	24,000
5	Operators	3	3,000	36,000
6	Ass. Operators	3	2,400	28,800
7	General service	8	4,000	48,000
	<b>Sub-total</b>	<b>18</b>	<b>22,400</b>	<b>268,800</b>
	Benefits (25% BS)		5,600	67,200
	<b>Total</b>	<b>18</b>	<b>28,000</b>	<b>336,000</b>

## **B. TRAINING REQUIREMENT**

Training of labor force shall be carried out during plant erection and commissioning by the experts of machinery supplier. The cost of training is estimated at Birr 40,000.

## **VII. FINANCIAL ANALYSIS**

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

Construction period	1 year
Source of finance	30 % equity & loan70%
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 6.49 million (see Table 7.1). From the total investment cost, the highest share (Birr 5.57 million or 85.79%) is accounted by fixed investment cost followed by pre operation cost ( Birr 742.36 thousand or 11.43%) and initial working capital (Birr 180.63 thousand or 2.78%). From the total investment cost Birr 2.13 million or 32.91% is required in foreign currency.

**Table 7.1**

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

<b>Sr. No.</b>	<b>Cost Items</b>	<b>Local Cost</b>	<b>Foreign Cost</b>	<b>Total Cost</b>	<b>% Share</b>
<b>1</b>	<b>Fixed investment</b>				
1.1	Land Lease	21.28		21.28	0.33
1.2	Building and civil work	2,000.00		2,000.00	30.80
1.3	Machinery and equipment	712.50	2,137.50	2,850.00	43.88
1.4	Vehicles	450.00		450.00	6.93
1.5	Office furniture and equipment	250.00		250.00	3.85
	<b>Sub -total</b>	<b>3,433.78</b>	<b>2,137.50</b>	<b>5,571.28</b>	<b>85.79</b>
<b>2</b>	<b>Pre operating cost *</b>				
2.1	Pre operating cost	317.50		317.50	4.89
2.2	Interest during construction	424.86		424.86	6.54
	<b>Sub -total</b>	<b>742.36</b>		<b>742.36</b>	<b>11.43</b>
<b>3</b>	<b>Working capital**</b>	<b>180.63</b>		<b>180.63</b>	<b>2.78</b>
	<b>Grand Total</b>	<b>4,356.77</b>	<b>2,137.50</b>	<b>6,494.27</b>	<b>100</b>

\* *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 253.35 thousand. However, only the initial working capital of Birr 180.63 thousand 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 2.83 million (see Table 7.2). The cost of raw material and utility account for 30.76% of the production cost. The other major components of the production cost are depreciation, financial cost and labor which account for 29.18%, 14.40% and 9.47%, respectively. The remaining 16.19 % 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)**

<b>Items</b>	<b>Cost (in 000 Birr)</b>	<b>%</b>
Raw Material and Inputs	581.73	20.49
Utilities	291.67	10.27
Maintenance and repair	142.50	5.02
Labor direct	268.80	9.47
Labor overheads	67.20	2.37
Administration Costs	100.00	3.52
Land lease cost	-	-
Cost of marketing and distribution	150.00	5.28
<b>Total Operating Costs</b>	<b>1,601.90</b>	<b>56.42</b>
Depreciation	828.50	29.18
Cost of Finance	408.93	14.40
<b>Total Production Cost</b>	<b>2,839.33</b>	<b>100</b>

## 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 ranges from Birr 504 thousand to Birr 1.29 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 10.74 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 1,649,240$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break - even Sales Value}}{\text{Sales revenue}} \times 100 = 46\%$$

## 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 23.87% 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 4.38 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 18 persons. The project will generate Birr 3.09 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 mining and chemical manufacturing sectors 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	407	524	582	582	582	582	582	582	582	582
Utilities	204	263	292	292	292	292	292	292	292	292
Maintenance and repair	100	128	143	143	143	143	143	143	143	143
Labour direct	188	242	269	269	269	269	269	269	269	269
Labour overheads	47	60	67	67	67	67	67	67	67	67
Administration Costs	70	90	100	100	100	100	100	100	100	100
Land lease cost	0	0	0	0	7	7	7	7	7	7
Cost of marketing and distribution	150	150	150	150	150	150	150	150	150	150
<b>Total Operating Costs</b>	<b>1,166</b>	<b>1,457</b>	<b>1,602</b>	<b>1,602</b>	<b>1,609</b>	<b>1,609</b>	<b>1,609</b>	<b>1,609</b>	<b>1,609</b>	<b>1,609</b>
Depreciation	829	829	829	829	829	105	105	105	105	105
Cost of Finance	0	467	409	351	292	234	175	117	58	0
<b>Total Production Cost</b>	<b>1,995</b>	<b>2,753</b>	<b>2,839</b>	<b>2,781</b>	<b>2,729</b>	<b>1,947</b>	<b>1,889</b>	<b>1,831</b>	<b>1,772</b>	<b>1,714</b>

Appendix 7.A.3INCOME 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
<b>Sales revenue</b>	2,499	3,213	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570
Less variable costs	1,016	1,307	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452
<b>VARIABLE MARGIN</b>	<b>1,483</b>	<b>1,906</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>	<b>2,118</b>
in % of sales revenue	59.33	59.33	59.33	59.33	59.33	59.33	59.33	59.33	59.33	59.33
Less fixed costs	979	979	979	979	985	262	262	262	262	262
<b>OPERATIONAL MARGIN</b>	<b>504</b>	<b>928</b>	<b>1,140</b>	<b>1,140</b>	<b>1,133</b>	<b>1,856</b>	<b>1,856</b>	<b>1,856</b>	<b>1,856</b>	<b>1,856</b>
in % of sales revenue	20.17	28.88	31.92	31.92	31.73	52.00	52.00	52.00	52.00	52.00
Financial costs		467	409	351	292	234	175	117	58	0
<b>GROSS PROFIT</b>	<b>504</b>	<b>460</b>	<b>731</b>	<b>789</b>	<b>841</b>	<b>1,623</b>	<b>1,681</b>	<b>1,739</b>	<b>1,798</b>	<b>1,856</b>
in % of sales revenue	20.17	14.33	20.47	22.10	23.55	45.45	47.09	48.72	50.36	52.00
Income tax	0	0	0	237	252	487	504	522	539	557
<b>NET PROFIT</b>	<b>504</b>	<b>460</b>	<b>731</b>	<b>552</b>	<b>588</b>	<b>1,136</b>	<b>1,177</b>	<b>1,218</b>	<b>1,258</b>	<b>1,299</b>
in % of sales revenue	20.17	14.33	20.47	15.47	16.48	31.82	32.96	34.11	35.25	36.40

**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
<b>TOTAL CASH INFLOW</b>	<b>5,889</b>	<b>3,128</b>	<b>3,220</b>	<b>3,573</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>1,899</b>
Inflow funds	5,889	629	7	3	0	0	0	0	0	0	0	0
Inflow operation	0	2,499	3,213	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570	0
Other income	0	0	0	0	0	0	0	0	0	0	0	1,899
<b>TOTAL CASH OUTFLOW</b>	<b>5,889</b>	<b>1,796</b>	<b>2,563</b>	<b>2,622</b>	<b>2,773</b>	<b>2,738</b>	<b>2,913</b>	<b>2,872</b>	<b>2,832</b>	<b>2,791</b>	<b>2,166</b>	<b>0</b>
Increase in fixed assets	5,889	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	205	55	27	0	1	0	0	0	0	0	0
Operating costs	0	1,016	1,307	1,452	1,452	1,459	1,459	1,459	1,459	1,459	1,459	0
Marketing cost	0	150	150	150	150	150	150	150	150	150	150	0
Income tax	0	0	0	0	237	252	487	504	522	539	557	0
Financial costs	0	425	467	409	351	292	234	175	117	58	0	0
Loan repayment	0	0	584	584	584	584	584	584	584	584	0	0
<b>SURPLUS (DEFICIT)</b>	<b>0</b>	<b>1,333</b>	<b>657</b>	<b>951</b>	<b>797</b>	<b>832</b>	<b>657</b>	<b>698</b>	<b>738</b>	<b>779</b>	<b>1,404</b>	<b>1,899</b>
<b>CUMULATIVE CASH BALANCE</b>	<b>0</b>	<b>1,333</b>	<b>1,989</b>	<b>2,940</b>	<b>3,737</b>	<b>4,569</b>	<b>5,226</b>	<b>5,923</b>	<b>6,662</b>	<b>7,441</b>	<b>8,845</b>	<b>10,745</b>

**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
<b>TOTAL CASH INFLOW</b>	<b>0</b>	<b>2,499</b>	<b>3,213</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>3,570</b>	<b>1,899</b>
Inflow operation	0	2,499	3,213	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570	0
Other income	0	0	0	0	0	0	0	0	0	0	0	1,899
<b>TOTAL CASH OUTFLOW</b>	<b>6,069</b>	<b>1,214</b>	<b>1,481</b>	<b>1,602</b>	<b>1,839</b>	<b>1,861</b>	<b>2,096</b>	<b>2,113</b>	<b>2,131</b>	<b>2,148</b>	<b>2,166</b>	<b>0</b>
Increase in fixed assets	5,889	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	181	48	24	0	1	0	0	0	0	0	0	0
Operating costs	0	1,016	1,307	1,452	1,452	1,459	1,459	1,459	1,459	1,459	1,459	0
Marketing cost	0	150	150	150	150	150	150	150	150	150	150	0
Income tax		0	0	0	237	252	487	504	522	539	557	0
<b>NET CASH FLOW</b>	<b>-6,069</b>	<b>1,285</b>	<b>1,732</b>	<b>1,968</b>	<b>1,731</b>	<b>1,709</b>	<b>1,474</b>	<b>1,457</b>	<b>1,439</b>	<b>1,422</b>	<b>1,404</b>	<b>1,899</b>
<b>CUMULATIVE NET CASH FLOW</b>	<b>-6,069</b>	<b>-4,785</b>	<b>-3,053</b>	<b>-1,084</b>	<b>646</b>	<b>2,355</b>	<b>3,830</b>	<b>5,287</b>	<b>6,726</b>	<b>8,148</b>	<b>9,553</b>	<b>11,452</b>
Net present value	-6,069	1,168	1,432	1,479	1,182	1,061	832	748	672	603	541	732
Cumulative net present value	-6,069	-4,902	-3,470	-1,991	-809	252	1,084	1,832	2,503	3,107	3,648	4,380

NET PRESENT VALUE 4,380

INTERNAL RATE OF  
RETURN 23.87%

PAYBACK 4 years