

**75. PROFILE ON THE PRODUCTION OF SYNTHETIC  
RUBBER**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of synthetic rubber with a capacity of 1,500 tons per annum. Synthetic rubber an artificial rubber with better abrasion resistance, lower elasticity, poorer low-temperature behavior, better heat and aging resistance, excellent electrical insulation material similar to rubber.

The country`s requirement of synthetic rubber is met through import. The present (2012) demand for synthetic rubber is estimated at 1,023 tons. The demand for the product is projected to reach 1,812 tones and 3,530 tones by the years 2018 and 2025, respectively.

The principal raw materials required are styrene and butadiene which have to be imported.

The total investment cost of the project including working capital is estimated at Birr 160.90 million. From the total investment cost the highest share (Birr 119.81 million or 74.46%) is accounted by fixed investment cost followed by initial working capital (Birr 22.73 million or 14.13%) and pre operation cost (Birr 18.35 million or 11.41%). From the total investment cost Birr 69.45 million or 43.16% 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 65.56 million, discounted at 10%.

The project can create employment for 113 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 rubber products manufacturing sub sector and also generates income for the Government in terms of tax revenue and payroll tax.

## **II. PRODUCT DESCRIPTION AND APPLCIATION**

Synthetic rubber is any type of artificial elastomer, invariably a polymer. An elastomer is a material with the mechanical (or material) property that it can undergo much more elasticde formation under stress than most materials and still return to its previous size without permanent

deformation. Synthetic rubber serves as a substitute for natural rubber in many cases, especially when improved material properties are required.

Synthetic rubber can be made from the polymerization of a variety of monomers including isoprene (2-methyl-1,3-butadiene), 1,3-butadiene, chloroprene (2-chloro-1,3-butadiene), and isobutylene (methylpropene) with a small percentage of isoprene for cross-linking. These and other monomers can be mixed in various desirable proportions to be copolymerized for a wide range of physical, mechanical, and chemical properties. The monomers can be produced pure and the addition of impurities or additives can be controlled by design to give optimal properties. Polymerization of pure monomers can be better controlled to give a desired proportion of cis and trans double bonds.

Among the range of synthetic rubbers, styrene butadiene rubber is selected for this profile because of its wide application. Styrene butadiene rubber (SBR) is general purpose rubber with better abrasion resistance, lower elasticity, poorer low-temperature behavior, better heat and aging resistance, excellent electrical insulation material similar to rubber. It operates in temperatures from -40 to 100°C and is applicable to tire industry (treads and carcasses), conveyor belts, seals, and technical rubber products.

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

#### **A. MARKET STUDY**

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

In Ethiopia National Nucleus Project (NNP) for Rubber Plantation and Processing and Bebeke Coffee Plantation Enterprise are the only local natural rubber producers in the country. These organizations produce natural rubber latex which undergoes some processing and their final output is Ribbed Smoked Sheet (RSS). However, there are no local produces of synthetic rubber. Hence, import is the major source supply for synthetic rubber product. Table 3.1 shows the annual import of synthetic rubber for the period 2002 - 2011.

**Table 3.1**  
**IMPORT OF SYNTHETIC RUBBER (TONS)**

<b>Year</b>	<b>Total</b>
2002	539
2003	390
2004	328
2005	1,117
2006	906
2007	905
2008	942
2009	562
2010	1,437
2011	609

*Source: – Ethiopian Revenue and Customs Authority.*

As can be seen from Table 3.1, the total import of synthetic rubber though fluctuates from year to year shows a general increasing trend. During the first five years in the data set (2002 – 2006) the average import which was 656 tons has increased to an average of 891 tons during the next five years (2007 – 2011). Import of synthetic rubber during the two periods has increased by 36%.

Considering the nature of the supply data, it is assumed that the average import during the recent two years (2010 -2011) fairly approximates the present effective demand for the product. Accordingly, the present (2012) demand for synthetic rubber is estimated at 1,023 tons.

## **2. Demand Projection**

According to the Growth and Transformation Plan (GTP), the industrial sector is expected to grow at an average annual growth rate of 20% during the period 2011 – 2015. Taking this in to account and to be conservative an annual average growth rate of 10% is assumed for projecting the demand for synthetic rubber (see Table 3.2.).

**Table 3.2****PROJECTED DEMAND FOR SYNTHETIC RUBBER (TONS)**

<b>Year</b>	<b>Projected Demand</b>
2013	1,125
2014	1,237
2015	1,361
2016	1,497
2017	1,647
2018	1,812
2019	1,993
2020	2,192
2021	2,411
2022	2,653
2023	2,918
2024	3,210
2025	3,530

**3. Pricing and Distribution**

After assessing the current C.I.F price of synthetic rubber, an ex-factory price of Birr 92/kg is proposed for the envisaged project. The product can be distributed directly to end- users.

**B. PLANT CAPACITY & PRODUCTION PROGRAM****1. Plant Capacity**

The demand for synthetic rubber (styrene butadiene rubber) increases from 1,125 tons in the year 2013 to 2,918 tons in the year 2023. Therefore, by considering the market study, minimum economics of scale, and period required for implementation of the project and full capacity attainment, the annual production capacity of the project is proposed to be 1,500 tons of styrene butadiene rubber. This production capacity is 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 thereafter, 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	Styrene Butadiene production (tons)	1,050	1,350	1,500
2	Capacity utilization rate (%)	70	90	100

## IV. RAW MATERIAL AND INPUTS

### A. RAW AND AUXILIRY MATERIALS

The major raw materials required for the production of styrene butadiene are styrene and butadiene. In addition to these raw materials, packing material for finished product is required as auxiliary raw material for the production of styrene butadiene. The total annual cost of raw material is estimated at Birr 81.817 million. The annual requirement and cost of raw material at full operation capacity is indicated in Table 4.1.

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

Sr. No.	Raw Material	Unit of Measure	Qty.	Cost ('000 Birr)		
				FC	LC	Total
1	Styrene	Tons	427	17,800	-	17,800
2	Butadiene	Tons	1,280	56,017	-	56,017
3	Miscellaneous chemicals	LS	-	4,500	-	4,500
4	Packing material	LS	-		3,500	3,500
	<b>Total</b>		-	<b>78,317</b>	<b>3,500</b>	<b>81,817</b>

**B. UTILITIES**

Electricity, furnace oil and water are utilities of the proposed project. The total annual cost of utilities is estimated at Birr 10,498,500. The annual consumption and cost of these inputs is indicated in Table 4.2.

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

Sr. No.	Utility	Unit of Measure	Qty	Cost ('000 Birr)
1	Electricity	MWh	1,425	826.50
2	Fuel oil	Lt.	650,000	9,672.00
3	Water*	m <sup>3</sup>	500,000	-
	<b>Total</b>	-	-	<b>10,498.50</b>

*\*Water for the plant shall be obtained from bore hole to be developed by the plant and as a result the cost of water will be related to power consumption.*



## **V. TECHNOLOGY AND ENGINEERING**

### **A. TECHNOLOGY**

#### **1. Production Process**

Styrene and Butadiene are piped to the process area from the storage area. The Butadiene is passed through a caustic soda scrubber to remove the inhibitors which were added to prevent premature polymerization. The fresh Butadiene monomer streams are mixed with styrene, aqueous emulsifying agents, activator, catalyst, and modifier, and then fed to the first of a train of reactors. The reaction proceeds stepwise in the series of reactors to around 60% conversion of monomer to polymer. In the cold process, the reactants are chilled and the reactor temperature is maintained at 4 deg. C to 7 deg. C (40 deg. F to 45 deg. F) and pressure at 0 to 15 psig; in the hot rubber process, temperature and pressure are around 50 deg. C (122 deg. F) and 40 to 60 psig, respectively.

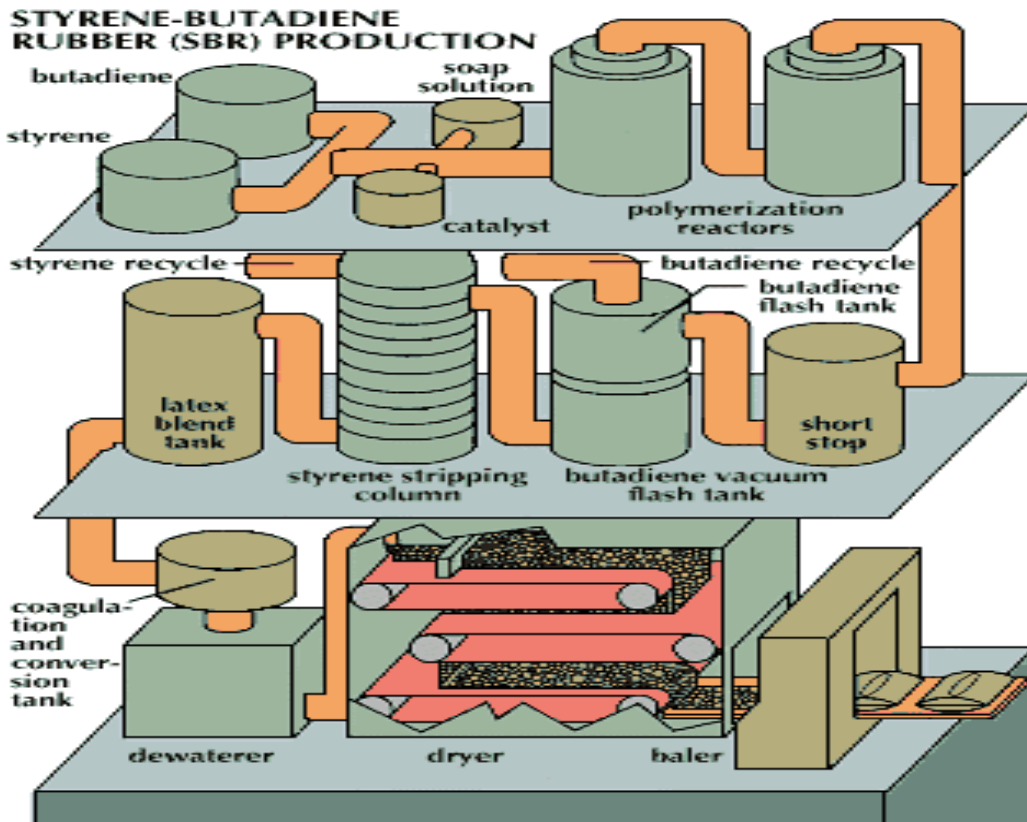
The latex from the reactor train is flashed to evaporate unreacted Butadiene which is compressed, condensed and recycled. Uncondensed vapors are absorbed in a kerosene absorber before venting and the absorbed Butadiene is steam stripped or recovered from the kerosene by some other operation. The latex stream is passed through a steam stripper, operated under vacuum, to remove and recover unreacted styrene. The styrene and water in the condensate are separated by decanting. The styrene phase is recycled to the process. Non-condensibles from the stripping column contain some Butadiene and are directed through the Butadiene recovery operations.

Stripped latex, to which an antioxidant has been added, is pumped to coagulation vessels where dilute sulfuric acid and sodium chloride solution are added. The acid and brine mixture breaks the emulsion, releasing the polymer in the form of crumb. Sometimes carbon black and oil are added during the coagulation step since better dispersion is obtained than by mixing later on.

The crumb and water slurry from the coagulation operation is screened to separate the crumb. The wet crumb is pressed in rotary presses to squeeze out most of the entrained water then dried with hot air on continuous dry belt dryers. The dried product is baled and weighed for shipment.

**Figure 5.1**

**FLOWDIAGRAM FOR THE PRODUCTION OF STYRENE BUTADIENE**



## 2. Environmental Impact Assessment

The adverse impact in relation to the styrene butadiene production process is caused by the exhaust gas to be generated from the reaction of styrene and butadiene. The technology selected encompasses liquid ring vacuum pump to recover uncondensed vapours containing mainly butadiene to recover the butadiene while water from decanter is fully recycled to reaction, greatly reducing the environmental impact of the process.

## B. ENGINEERING

### 1. Machinery and Equipment

The cost of machinery and equipment is estimated to be Birr 92.60 million of which Birr 69.45 million 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	Butadiene storage tank	1
2	Styrene storage tank	1
3	Soap solution tank	1
4	Catalyst storage tank	1
5	Polymerization reactor	1
6	Latex blend tank	1
7	Short stop tank	1
8	Butadiene vacuum flash tank	1
9	Styrene stripping column	1
10	Coagulation and conversion tank	1
11	De-waterer	1
12	Dryer	1
13	Weighing balance	1
14	Baler	1

### 2. Land, Building and Civil Work

The total land required for the plant is 8,000 m<sup>2</sup> out of which the built-up area is 5,000 m<sup>2</sup>. The cost of building is estimated at Birr 25 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

<b>Zone</b>	<b>Level</b>	<b>Floor Price/m<sup>2</sup></b>
	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 criterions 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 2,128,000 of which 10% or Birr 212,800 will be paid in advance. The remaining Birr 1,915,200 will be paid in equal installments with in 28 years i.e. Birr 68,400 annually.

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

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

The total labor requirement of the envisaged plant is 113. The total annual labour cost is estimated at Birr 2,538,000. The list of human resource and labour cost are indicated in Table 6.1.

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

<b>Sr. No.</b>	<b>Description</b>	<b>Req. No.</b>	<b>Salary, (Birr)</b>	
			<b>Monthly</b>	<b>Annual</b>
1	Plant manager	1	10,000	120,000
2	Secretary	2	4,000	48,000
3	Production and technical manager	1	8,000	96,000
4	Finance and administration manager	1	8,000	96,000
5	Commercial manager	1	8,000	96,000
6	Accountant	3	7,500	90,000
7	Sales person	2	5,000	60,000
8	Purchaser	2	5,000	60,000
9	Clerk	2	1,200	14,400
10	Quality control manager	1	7,000	84,000
11	Chemist	3	6,000	72,000
12	Production supervisor	3	6,000	72,000

Sr. No.	Description	Req. No.	Salary, (Birr)	
			Monthly	Annual
13	Operator	24	36,000	432,000
14	Assistant operator	24	21,600	259,200
15	Mechanic	3	4,500	54,000
16	Electrician	3	4,500	54,000
17	Unskilled labor	9	5,400	64,800
18	Personnel	1	3,000	36,000
19	Time keeper	3	2,700	32,400
20	Store keeper	2	1,800	21,600
21	Driver	4	3,200	38,400
22	Guard	12	7,200	86,400
23	Cleaner	6	3,600	43,200
	<b>Sub - Total</b>	<b>113</b>	<b>169,200</b>	<b>2,030,400</b>
	Employee benefit (25% BS)		42,300	507,600
	<b>Total</b>		<b>211,500</b>	<b>2,538,000</b>

## B. TRAINING REQUIREMENT

Two stage training for the envisaged plant is recommended. Training of key personnel of the plant comprising the quality control manager, production and technical manager and supervisors shall be carried out abroad at the site of machinery supplier for about one month. These trained experts in along with the experts of the machinery suppliers shall trained the remaining workers of the plant during plant erection and commissioning. The total cost of training is estimated at Birr 3,000,000.

## VII. FINANCIAL ANALYSIS

The financial analysis of the synthetic rubber 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 160.90 million (see Table 7.1). From the total investment cost the highest share (Birr 119.81 million or 74.46%) is accounted by fixed investment cost followed by initial working capital (Birr 22.73 million or 14.13%) and pre operation cost (Birr 18.35 million or 11.41%). From the total investment cost Birr 69.45 million or 43.16% is required in foreign currency.

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

Sr. No.	Cost Items	Local	Foreign	Total	%
<b>1</b>	<b>Fixed investment</b>				
1.1	Land Lease	212.80		212.80	0.13
1.2	Building and civil work	25,000.00		25,000.00	15.54
1.3	Machinery and equipment	23,150.00	69,450.00	92,600.00	57.55
1.4	Vehicles	1,500.00		1,500.00	0.93
1.5	Office furniture and equipment	500.00		500.00	0.31
	<b>Sub -total</b>	<b>50,362.80</b>	<b>69,450.00</b>	<b>119,812.80</b>	<b>74.46</b>
<b>2</b>	<b>Pre operating cost *</b>				
2.1	Pre operating cost	7,830.00		7,830.00	4.87
2.2	Interest during construction	10,526.30		10,526.30	6.54
	<b>Sub- total</b>	<b>18,356.30</b>		<b>18,356.30</b>	<b>11.41</b>
<b>3</b>	<b>Working capital</b>	<b>22,732.90</b>		<b>22,732.90</b>	<b>14.13</b>
	<b>Grand Total</b>	<b>91,451.99</b>	<b>69,450.00</b>	<b>160,901.99</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 28.40 million. However, only the initial working capital of Birr 22.73 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 130.69 million (see Table 7.2). The cost of raw material account for 62.60% of the production cost. The other major components of the production cost are depreciation, utility and financial cost which account for 16.400%, 8.03% and 7.75%, respectively. The remaining 5.22 % is the share of 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)**

<b>Items</b>	<b>Cost (in 000 Birr)</b>	<b>%</b>
Raw Material and Inputs	81,817.00	62.60
Utilities	10,498.50	8.03
Maintenance and repair	2,778.00	2.13
Labor direct	2,030.40	1.55
Labor overheads	507.60	0.39
Administration Costs	500.00	0.38
Land lease cost	-	-
Cost of marketing and distribution	1,000.00	0.77
<b>Total Operating Costs</b>	<b>99,131.50</b>	<b>75.85</b>
Depreciation	21,436.00	16.40
Cost of Finance	10,131.56	7.75
<b>Total Production Cost</b>	<b>130,699.06</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 will grow from Birr 1.86 million to Birr 26.42 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 198.94 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 77,659,510$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break -even Sales Value}}{\text{Sales revenue}} \times 100 = 56\%$$

#### **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 65.56 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 113 persons. The project will generate Birr 57.94 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 rubber products 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)**

<b>Item</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>	<b>Year 11</b>
Raw Material and Inputs	65,454	73,635	81,817	81,817	81,817	81,817	81,817	81,817	81,817	81,817
Utilities	8,399	9,449	10,499	10,499	10,499	10,499	10,499	10,499	10,499	10,499
Maintenance and repair	2,222	2,500	2,778	2,778	2,778	2,778	2,778	2,778	2,778	2,778
Labour direct	1,624	1,827	2,030	2,030	2,030	2,030	2,030	2,030	2,030	2,030
Labour overheads	406	457	508	508	508	508	508	508	508	508
Administration Costs	400	450	500	500	500	500	500	500	500	500
Land lease cost	0	0	0	0	68	68	68	68	68	68
Cost of marketing and distribution	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
<b>Total Operating Costs</b>	<b>79,505</b>	<b>89,318</b>	<b>99,132</b>	<b>99,132</b>	<b>99,200</b>	<b>99,200</b>	<b>99,200</b>	<b>99,200</b>	<b>99,200</b>	<b>99,200</b>
Depreciation	21,436	21,436	21,436	21,436	21,436	1,050	1,050	1,050	1,050	1,050
Cost of Finance	0	11,579	10,132	8,684	7,237	5,789	4,342	2,895	1,447	0
<b>Total Production Cost</b>	<b>100,941</b>	<b>122,333</b>	<b>130,699</b>	<b>129,252</b>	<b>127,873</b>	<b>106,039</b>	<b>104,592</b>	<b>103,145</b>	<b>101,697</b>	<b>100,250</b>



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

<b>Item</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>
<b>Sales revenue</b>	110,400	124,200	138,000	138,000	138,000	138,000	138,000	138,000	138,000	138,000
Less variable costs	78,505	88,318	98,132	98,132	98,132	98,132	98,132	98,132	98,132	98,132
<b>VARIABLE MARGIN</b>	<b>31,895</b>	<b>35,882</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>	<b>39,869</b>
in % of sales revenue	28.89	28.89	28.89	28.89	28.89	28.89	28.89	28.89	28.89	28.89
Less fixed costs	22,436	22,436	22,436	22,436	22,504	2,118	2,118	2,118	2,118	2,118
<b>OPERATIONAL MARGIN</b>	<b>9,459</b>	<b>13,446</b>	<b>17,433</b>	<b>17,433</b>	<b>17,364</b>	<b>37,750</b>	<b>37,750</b>	<b>37,750</b>	<b>37,750</b>	<b>37,750</b>
in % of sales revenue	8.57	10.83	12.63	12.63	12.58	27.36	27.36	27.36	27.36	27.36
Financial costs		11,579	10,132	8,684	7,237	5,789	4,342	2,895	1,447	0
<b>GROSS PROFIT</b>	<b>9,459</b>	<b>1,867</b>	<b>7,301</b>	<b>8,748</b>	<b>10,127</b>	<b>31,961</b>	<b>33,408</b>	<b>34,855</b>	<b>36,303</b>	<b>37,750</b>
in % of sales revenue	8.57	1.50	5.29	6.34	7.34	23.16	24.21	25.26	26.31	27.36
Income tax	0	0	0	2,624	3,038	9,588	10,022	10,457	10,891	11,325
<b>NET PROFIT</b>	<b>9,459</b>	<b>1,867</b>	<b>7,301</b>	<b>6,124</b>	<b>7,089</b>	<b>22,372</b>	<b>23,386</b>	<b>24,399</b>	<b>25,412</b>	<b>26,425</b>
in % of sales revenue	8.57	1.50	5.29	4.44	5.14	16.21	16.95	17.68	18.41	19.15

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

<b>Item</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>	<b>Year 11</b>	<b>Scrap</b>
<b>TOTAL CASH INFLOW</b>	<b>127,643</b>	<b>143,980</b>	<b>124,240</b>	<b>138,040</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>54,141</b>
Inflow funds	127,643	33,580	40	40	0	0	0	0	0	0	0	0
Inflow operation	0	110,400	124,200	138,000	138,000	138,000	138,000	138,000	138,000	138,000	138,000	0
Other income	0	0	0	0	0	0	0	0	0	0	0	54,141
<b>TOTAL CASH OUTFLOW</b>	<b>127,643</b>	<b>113,085</b>	<b>118,242</b>	<b>126,608</b>	<b>124,914</b>	<b>123,955</b>	<b>129,051</b>	<b>128,038</b>	<b>127,025</b>	<b>126,012</b>	<b>110,525</b>	<b>0</b>
Increase in fixed assets	127,643	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	23,053	2,871	2,871	0	7	0	0	0	0	0	0
Operating costs	0	78,505	88,318	98,132	98,132	98,200	98,200	98,200	98,200	98,200	98,200	0
Marketing and Distribution cost	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0
Income tax	0	0	0	0	2,624	3,038	9,588	10,022	10,457	10,891	11,325	0
Financial costs	0	10,526	11,579	10,132	8,684	7,237	5,789	4,342	2,895	1,447	0	0
Loan repayment	0	0	14,474	14,474	14,474	14,474	14,474	14,474	14,474	14,474	0	0
<b>SURPLUS (DEFICIT)</b>	<b>0</b>	<b>30,895</b>	<b>5,998</b>	<b>11,432</b>	<b>13,086</b>	<b>14,045</b>	<b>8,949</b>	<b>9,962</b>	<b>10,975</b>	<b>11,988</b>	<b>27,475</b>	<b>54,141</b>
<b>CUMULATIVE CASH BALANCE</b>	<b>0</b>	<b>30,895</b>	<b>36,893</b>	<b>48,325</b>	<b>61,411</b>	<b>75,456</b>	<b>84,404</b>	<b>94,366</b>	<b>105,341</b>	<b>117,330</b>	<b>144,805</b>	<b>198,946</b>

**Appendix 7.A.4**  
**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>110,400</b>	<b>124,200</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>138,000</b>	<b>54,141</b>
Inflow operation	0	110,400	124,200	138,000	138,000	138,000	138,000	138,000	138,000	138,000	138,000	0
Other income	0	0	0	0	0	0	0	0	0	0	0	54,141
<b>TOTAL CASH OUTFLOW</b>	<b>150,376</b>	<b>82,336</b>	<b>92,150</b>	<b>99,132</b>	<b>101,763</b>	<b>102,238</b>	<b>108,788</b>	<b>109,222</b>	<b>109,657</b>	<b>110,091</b>	<b>110,525</b>	<b>0</b>
Increase in fixed assets	127,643	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	22,733	2,831	2,831	0	7	0	0	0	0	0	0	0
Operating costs	0	78,505	88,318	98,132	98,132	98,200	98,200	98,200	98,200	98,200	98,200	0
Marketing and Distribution cost	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0
Income (corporate) tax		0	0	0	2,624	3,038	9,588	10,022	10,457	10,891	11,325	0
<b>NET CASH FLOW</b>	<b>-150,376</b>	<b>28,064</b>	<b>32,050</b>	<b>38,869</b>	<b>36,237</b>	<b>35,762</b>	<b>29,212</b>	<b>28,778</b>	<b>28,343</b>	<b>27,909</b>	<b>27,475</b>	<b>54,141</b>
<b>CUMULATIVE NET CASH FLOW</b>	<b>-150,376</b>	<b>-</b> <b>122,312</b>	<b>-90,262</b>	<b>-51,393</b>	<b>-15,156</b>	<b>20,606</b>	<b>49,818</b>	<b>78,596</b>	<b>106,939</b>	<b>134,849</b>	<b>162,324</b>	<b>216,465</b>
Net present value	-150,376	25,512	26,488	29,202	24,751	22,205	16,489	14,768	13,222	11,836	10,593	20,874
Cumulative net present value	-150,376	-	-98,375	-69,173	-44,422	-22,217	-5,728	9,040	22,262	34,099	44,691	65,565

NET PRESENT VALUE           65,565  
INTERNAL RATE OF RETURN   18.37%  
NORMAL PAYBACK               6 years