

# **HAND- AND ANIMAL - DRIVEN CARTS**

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## I. SUMMARY

This profile envisages the establishment of a plant for the production of Hand-and Animal-Driven carts with a capacity of 1820 pieces per annum.

The present demand for the proposed product is estimated at 1,535 pieces per annum. The demand is expected to reach at 1,969 pieces by the year 2010.

The plant will create employment opportunities for 20 persons.

The total investment requirement is estimated at Birr 2.2 million, out of which Birr 0.7 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 31.1% and a net present value (NPV) of Birr 3.2 million, discounted at 8.5 %.

## II. PRODUCTION DESCRIPTION AND APPLICATION

Hand-driven carts are wheel barrows having metallic bucket fitted to single wheel and two handles. They are used for transporting loads of smaller size. Their main application is in agriculture, construction and sanitary works.

Animal-driven carts are two or more wheeled vehicles drawn by animals, used for moving relatively higher loads. Their main area of application is in construction, farm and commercial sectors.

Due to the availability of cheap animal power, the demand for animal-driven carts is considered to be high. Input materials required for the production of carts are wooden parts which are locally available, steel sheets, metallic profiles and wheels. Most of these materials can be procured locally.

General features of these carts are:

### **Animal drawn cart is**

- adjustable to be drawn by a pair of oxen, a single donkey, mule or a horse;
- fitted with metallic or pneumatic type; and
- easily repaired or manufactured at local level.

### **Hand driven cart**

- can easily be handled by human being;
- can be fitted with metallic or pneumatic tyre; and
- easily repaired or manufactured at local level.

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

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

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

The demand for animal-driven carts in the country is mainly met by local production in small workshops in different parts of the country. On the other hand, demand for wheel barrows is largely met through import. Domestically, wheel barrows are assembled in a small quantity by one private industry in Addis Ababa and the Ethiopian Roads Authority fabricates some wheel barrows from used metal components for its own-use. Although the general situation is as stated above, there is no data on the quantity of local production and import of carts and wheel barrows.

In order to estimate the present demand for carts and wheel barrows in BGRS, the uses of the products in the urban and rural areas, current transportation situation in the region and studies made in other developing countries with respect to carts and wheel barrows has been reviewed and analyzed.

Carts and wheel barrows are used as a means of transport of goods and persons in rural and most urban centers of the country. Horse and donkey carts operate in a relative well developed areas (Dire Dowa, Mekelle, Jimma, Bahir Dar, etc) in restricted zones, but they operate in all zones in all other urban areas. If carts are widely used in rural and semi urban areas, they can help the population in saving time and cost.

Wheel barrow, its major applications being in civil construction, does appear to be widely used for rural goods movement in many developing countries including Ethiopia. Their use is highly preferred to human portage.

For many poorer developing countries such as Ethiopia the accessibility of motor transport is likely to remain constrained by:

- Shortage of finance for their purchase of vehicles and fuel, spare parts. According to World Bank study, the position in this respect is so serious in Ethiopia.
- Few regular transport services operate away from all weather road networks. However, many people live in remote from such networks and hence lack access to transport services
- In areas with all-weather road access, motor vehicles are beyond the financial means of the majority of the people.
- Low standard of road construction makes these roads less suitable for motorized transport.

The way in which the local population use the transportation system is a function of a variety of factors including level of access, cropping pattern, means of transport ownership and the state of the network. The transport needs of the bulk of the rural population and work trips related to paid employment in urban areas is largely for the movement of small loads over relatively short distances. Hence, upgrading of traditional transportation technology and provision of alternative means of non-motorized and cost effective means of transport should be given due attention to improve the livelihood of underdeveloped areas.

In determining the demand for carts and wheel barrows in BGRS, the following categories of trips and services are found to be direct relevance

- Trips to acquire farm inputs ( fertilizers, seedlings, farming implements etc);
- Trips to the farm (farming, sawing, visiting, transporting manures etc);
- Trips to meet domestic needs ( to obtain fire wood, construction materials, etc);
- Trips to market place to sell crops and livestock products (poultry, dairy products, vegetables & fruit, etc);
- Recreation and social trips (to participate in customary festivals, marriages, etc);
- Work trips related to paid employment;
- Movement of goods for short distances using wheel barrows;
- Use of wheel barrows for garbage collection by municipalities; and
- Use of wheel barrows for movement of construction material.

In the absence of a compiled data on the past and present demand for the products, studies undertaken in other developing countries has been used as a starting base. Accordingly, studies undertaken in some villages & semi-urban areas of India indicate that about 17% of total number of households owned animal carts and used by about 48%.

A study made in Kenya also reveals that about 26% to 36% of total households own /use donkey and ox cart. On the other hand, wheel barrows are owned and used by about 13% of the total households.

Taking the above facts, it can be safely assumed that of the total households in BGRS at least 0.5% (which is 50 times less than that of Kenya) can purchase a cart in each year for the coming 10 years. According to CSA, the total population of BGRS in July 2003 was 580,000 with an average household size of 4.5 persons. This gives a total household size of about 128,888. By applying an annual average growth rate of 4% (which is equal to the population growth) and 0.5% potential buyers /users, demand for a cart is estimated at 670 for the year 2004.

As wheel barrows are also demanded by the municipality and the construction sector, in addition to the general public, the demand is estimated to be higher by 82% than carts. Accordingly, the present demand for wheel barrows is estimated at 838.

## **2. Projected Demand**

The method used to estimate the present demand is applied to project the future demand. Hence, it is assumed that 0.5% of the total households will buy a cart each year with an annual growth rate of 4% due to population increase.

Demand for wheel barrows is expected to grow with the growth of population, establishment of municipalities and the development of the construction sector. Considering the combined effect of the above factors, demand for wheel barrows is estimated to grow by 6%. The projected demand for carts and wheel barrows in BGRS is shown in Table 3.1

**Table 3.1****PROJECTED DEMAND FOR CARTS & WHEEL BARROWS IN BGRS**

<b>Year</b>	<b>Carts (No.)</b>	<b>Wheel barrows (No.)</b>
2005	697	838
2006	724	888
2007	753	941
2008	784	998
2009	815	1058
2010	848	1121
2011	882	1188
2012	917	1260
2013	954	1336
2014	992	1415
2015	1031	1500

**3. Pricing and Distribution**

The price of horse-driven cart and wheel barrow ranges from Birr 8,200 to 4,500 and from Birr 350 to 482, respectively. For the purpose of sales revenue projection an average price of Birr 3,500 for a cart and Birr 375 for a wheel barrow is adopted.

**B. PLANT CAPACITY AND PRODUCTION PROGRAMME****1. Plant Capacity**

Based on the market study, the demand of hand driven carts (also called wheel barrows) and animal-driven carts for the year 2005 is 838 and 697, respectively. These figures will grow to 1121 and 848 by the year 2010, respectively. The envisaged plant will, therefore, have full production capacity of 700 hand-driven carts and 550 animal- driven carts per annum, working single shift of 8 hours a day and for 300 days a year.

**2. Production Programme**

In order to provide time for market penetration and develop engineering skill of metal fabrication, it would be advisable to start production at a relatively lower output. The plant will, therefore, start production at 60% of full capacity during the first year and then raise production capacity to 75%, 85% in the 2<sup>nd</sup> and 3<sup>rd</sup> year and then to 100% during the 4<sup>th</sup> year, respectively.

#### IV. MATERIALS AND INPUTS

##### A. RAW MATERIALS

The major raw materials required for the production of hand-and animal-driven carts are wheels for carts, rubber wheels for wheel barrows, angle iron, steel tube, mild steel sheet, bushes, tyres and tubes for carts, leaf spring and shackles, mild steel bar, wooden bars and slates.

Annual cost of these materials at full production capacity of the plant is estimated at Birr 1.0 million. Table 4.1 below shows the details of major raw materials and related costs.

**Table 4.1**  
**RAW MATERIAL REQUIREMENTS AND COST**

Sr. No.	Description	Qty.	Cost, [ 000 Birr]		
			LC	FC	TC
1	Wheels for carts	550 pairs	182	-	182
2	Rubber wheels for wheel barrows	700 pcs	120	-	120
3	Angle iron	12 tonne	-	26.4	26.4
4	Steel tube	22 tonne	-	48.4	48.4
5	Mild steel sheet	85 tonne	-	195.5	195.5
6	Bushes	550 pairs	-	7.5	7.5
7	Tyres and tubes for carts	550 pairs	300	-	300
8	Leaf spring and shackles	1100 set	-	50	50
9	Mild steel bar	10 tonne	-	40	40
10	Wooden bars	15000 m	75	-	75
11	Wooden slates	8000 m	24	-	24
	<b>Grand Total</b>		<b>644</b>	<b>367.8</b>	<b>1011.8</b>

##### B. AUXILIARY MATERIALS

Auxiliary materials requirement include: bushes, paints, bolts and nuts, washers and welding electrodes. Annual requirement of auxiliary materials & related cost at full production capacity is shown in Table 4.2 below.

**Table 4.2**  
**AUXILIARY MATERIALS REQUIREMENT AND COST ('000 BIRR)**

Sr. No.	Description	Qty.	Cost
1	Nails and fasteners	3 tonne	20
2	Welding electrodes	4 tonne	32
3	Paint	2.5 tonne	62.5
4	Bolts & nuts, washers	reqd.	10.0
5	Bushes	reqd.	6.0
	<b>Total</b>		<b>130.50</b>

## C. UTILITIES

Electricity and water are inputs required for the plant. Installed electric power of about 50 kWh with three phase of four wire system at 380v/220 V supply voltage will be required. Daily water consumption of about 1500 litres or 450 m<sup>3</sup> per annum will also be required. Total expenditure on electricity is Birr 56,880, and for water it is Birr 675.

## V. TECHNOLOGY AND ENGINEERING

### A. TECHNOLOGY

#### 1. Production Process

##### Wheel barrows:-

Wheel barrows consist of buckets, two legs, axle-wheel, handles and brackets. The fabrication of these parts is as follows:-

- Buckets - Mild steel sheet cut to size, deep drawn or for small scale welded to shape, grinding and hammering.
- Legs - Tubes cut to size, bent and welded to frame.
- Wheel - Flat iron cut to size, rolled, welded, connected to the hubs by welding. Note that if rubber wheel is to be used, it will be brought out.
- Handles - Tubes are cut to size and bent.
- Brackets - Are cut to size, bent and welded.
- Axle - The mild steel rod is cut to size and machined.

Having thus fabricated the parts, assembly is done and then finally painted.

##### Carts:-

A cart mainly consists of the body, axle and wheel.

The body is made from structures cut to size, welded and /or bolted together, and covered with sheet metal flooring and sides, forming the compartment.

Round mild steel bar is cut and machined to size to form the axle.

The wheel can be either steel or air inflated rubber tyres. Rubber tyres will be bought out while steel wheels will be manufactured from flat iron cut to size and welded to make the run and then connected with spokes to the hub.

#### 2. Source of Technology

The technology of Hand-and Animal-driven Carts is simple metal fabrication technique that is well - developed in many engineering workshops in Ethiopia. Conventional metal-working equipment can be used to manufacture and assemble both types of carts. In the past the Rural Technology Promotion Department in the Federal Ministry of Agriculture has rich experience



in the manufacture of both types of carts. Rural Technology Promotion Centres at Assela, Bako, Bahir Dar, Kombolcha, Harrar, Jimma, Sodo and Tigray have been engaged in the design and fabrication of these mechanical equipment. Address of the Addis Ababa Centre is as follows:

Rural Technology Promotion Department,  
Ministry of Agriculture and Rural Development,  
Tel: 51-23-45,  
Addis Ababa.

## **B. ENGINEERING**

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

The machinery required for the manufacture of Hand-and Animal-driven carts are conventional metal-working machines. The required machinery and equipment and related investment cost is given in Table 5.1 below.

**Table 5.1**  
**MACHINERY AND EQUIPMENT REQUIREMENT AND COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Qty. (No.)</b>	<b>Price (Birr)</b>
1	Deep drawing press, 150 tonnes capacity	1	90,000
2	Lathe machine, center to center distance, 2m	1	120,000
3	Surface grinder	1	50,000
4	Pillar type drilling machine	1	45,000
5	Double ended pedestal grinder	1	8,500
6	Pipe bending machine	1	7,500
7	Power shearing machine	1	40,000
8	Power hack saw	1	32,500
9	Hand angle shear	1	3,500
10	Portable drilling machine	2	4,500
11	Portable drilling machine	2	4,500
12	Compressor	1	12,000
13	Spraying unit (set)	1	2,500
14	Arc welding machine	3	45,500
15	Gas welding unit (set)	1	8,500
16	Wood working machine (set)	1	112,500
	<b>Total FOB price</b>		<b>587,000</b>
	Freight, Insurance, Bank charges, handling cost		117,000
	<b>Total Machinery &amp; Equipment Cost</b>		<b>704,000</b>

## 2. Land, Building and Civil works

The total land requirement including provision for open spaces is 800 m<sup>2</sup>, of which 500m<sup>2</sup> will be covered by buildings. Estimating unit building construction cost of Birr 1000 per m<sup>2</sup>, the total cost of building will be Birr 500,000. The cost of land leasing is Birr 2.0 per m<sup>2</sup>, and for 70 years of land holding, the total land lease value will be Birr 112,000. Thus, the total investment cost of land, building and civil works assuming that the total land lease cost will be paid in advance will be Birr 612,000.

## 3. Proposed Location

The engineering products will be widely used in urban areas although they also find application in rural areas. It would, therefore, be advisable to locate the plant in Assosa, which is the major town of the regional state. Locating the plant in Assosa will create a better market for the products.

## VI. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

The envisaged project's manpower requirement is 20 persons. The list of required manpower & annual labour cost including fringe benefits is shown in Table 6.1

**Table 6.1**  
**MANPOWER REQUIREMENT & ANNUAL LABOUR COST**

Sr. No.	Description	Req. No.	Salary, Birr	
			Monthly	Annual
1	General manager	1	1800	21600
2	Production head	1	800	9600
3	Welders	2	650	15600
4	Fitters	2	450	10800
5	Helpers	4	820	12000
6	Machinists	2	700	16,800
7	Secretary	1	700	8400
8	Store-keeper	1	600	7200
9	Cashier	1	450	5400
10	Clerk	1	350	4200
11	General services (inc. Guards)	4	820	12000
	<b>Sub-total</b>	<b>20</b>		<b>123600</b>
	82% Benefit			30900
	<b>Total</b>			<b>154500</b>

### B. TRAINING REQUIREMENT

On -the-job-training is required for production workers. The training could be arranged with local instructors. The training cost is estimated at Birr 12,000.

## VII. FINANCIAL ANALYSIS

The financial analysis of the Hand-and Animal-Driven Carts project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 years
Source of finance	30 % equity 70 % loan
Tax holidays	3 years
Bank interest	7.5 %
Discounted cashflow	8.5 %
Repair and maintenance	3 % of the total plant and machinery
Accounts receivable	30 days
Raw material, local	30 days
Raw materials, import	90 days
Work in progress	5 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

### A. TOTAL INITIAL INVESTMENT COST

The total initial investment cost of the project including working capital is estimated at 2.2 million, of which 32.5 per cent will be required in foreign currency.

The major breakdown of the total initial investment cost is shown in Table 7.1

**Table 7.1**  
**INITIAL INVESTMENT COST**

Sr. No.	Cost Items	Total ('000 BIRR)
1	Land lease value	112
2.	Building and Civil Work	500
3.	Plant Machinery and Equipment	704
4.	Office Furniture and Equipment	35
5.	Vehicle	-
6.	Pre-production Expenditure*	133.2
7	Working Capital	706.2
	<b>Total Investment cost</b>	<b>2,191.1</b>
	<b>Foreign share</b>	<b>32.5%</b>

\* N.B Pre-production expenditure includes interest during construction (Birr 116.2 thousand), training (Birr 12 thousand), and ( Birr 5 thousand) costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.

## B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 1.62 million (see Table 7.2). The material and utility cost accounts for 74.1, per cent, while depreciation and financial cost take 13 per cent of the production cost.

**Table 7.2**  
**ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)**

Items	Cost	%
Raw Material and Inputs	1,142.3	70.5
Utilities	57.6	3.6
Maintenance and repair	45.0	2.8
Labour direct	64.8	4.0
Factory overheads	6.0	0.4
Administration Cost	94.2	5.8
<b>Total Operating Costs</b>	<b>1,409.9</b>	<b>87.0</b>
Depreciation	107.9	6.7
Cost of Finance	102.0	6.3
<b>Total Production Cost</b>	<b>1,620</b>	<b>100</b>

## C. FINANCIAL EVALUATION

### 1. Profitability

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the life time of the project.

The income statement and the other indicators of profitability show that the project is viable.

### 2. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operates at full capacity ( year 4) is estimated by using income statement projection.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 35.8 \%$$

### **3. Pay-Back Period**

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 4 years.

### **4. Internal Rate of Return and Net Present Value**

Based on the cash flow statement, the calculated IRR of the project is 31.1 % and the net present value at 8.5% discount rate is Birr 3.2 million.

## **D. ECONOMIC BENEFITS**

The project can create employment for 20 persons. In addition to supply of the domestic needs, the project will generate Birr 0.2 million per annum in terms of tax revenue when it starts to operate at full capacity. Moreover, the Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. Besides, it has an advantage of mitigating the shortage of transpiration service in the region and facilitates the delivery of goods & services.