

# **CORRUGATED PAPER BOX**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of Corrugated paper box with a capacity of 300 tonnes per annum.

The present demand for the proposed product is estimated at 362 tonnes per annum. The demand is expected to reach at 508 tonnes by the year 2010.

The plant will create employment opportunities for 31 persons.

The total investment requirement is estimated at Birr 3.6 million, out of which Birr 1.83 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 30.4 % and a net present value (NPV) of Birr 4.2, discounted at 8.5 %.

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

Corrugated paper box (also called carton) is widely used for diverse packing applications. Many industrial goods and horticultural products are packed using corrugated paper boxes.

A corrugated board is produced by gluing fluted or corrugated paper (middle layer) with two facing (inner and outer) layers to form a continuous board which is finished into boxes of various dimensions by slotting and creasing operations

Based on the number of layers used, three types of corrugated boards can be produced: single faced (or two ply), double faced (or three ply) and double walled boards. The double -faced corrugated board is most commonly used for different packing applications.

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

### **A. MARKET STUDY**

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

Corrugated paper boxes are made from corrugated paper boards which have a row of air columns. The air acts as a cushion while the paper column makes the material strong. Each box is made to hold something just right, protect it from banging around and keep it from spilling. Moreover, corrugated paper boxes are made with important information about the consignment printed on them. They are eco-friendly, recyclable, light weight products available in variety of shapes and sizes.

Because of its inherent advantages, corrugated packaging is used practically for every purpose. In various industries like food, textile, pharmaceuticals, cigarette, soaps, cosmetics and consumer durables corrugated paper boxes are the most suitable to pack consignments. Recently, diversified application like long-time weather resistant boxes are being manufactured creating a promising future for corrugated paper box packaging.

Corrugated paper box is supplied by both domestic producers like Ethiopian Pulp and Paper Share Company, Burayu Carton Factory and others as well as by foreign companies through import. Data on the domestic production is provided only on aggregate production of paper. Annual average domestic production of paper in the period 1999-2002 was 6,422 tonnes while the six years average imported supply of corrugated paper boxes alone was 276 tonnes. However, a closer investigation of the data set reveals that the imported figure for the year 2004 was exceptionally low. Thus, excluding the year 2004, corrugated paper box annual average import for the five years amounts to 321 tonnes. For the purpose of this study, the imported corrugated paper box is considered as a gap between the domestic supply and the overall demand for corrugated boxes in the country. Therefore, the unsatisfied demand by the local production of corrugated paper boxes is estimated on the basis of the 1999-2003 import data and the annual domestic paper production growth rate of 7 %. Accordingly, the current effective demand for paper box is estimated at 362 tonnes. The domestic production of paper and imported corrugated box are presented in Table 3.1.

**Table 3.1**

**DOMESTIC PRODUCTION OF PAPER AND IMPORTED CORRUGATED  
PAPER BOXES IN TONNES**

<b>Year</b>	<b>Domestic Production of Paper</b>	<b>Imported Corrugated Paper Box</b>	<b>Total</b>
1999	5,143	274	5,417
2000	6,144	257	6,401
2001	7,719	501	8,220
2002	6,683	314	6,997
2003	*	259	
2004	*	52	
<b>Average</b>	<b>6,422</b>	<b>276</b>	
Average excluding 2004		321	

\* Not available.

**Source :** *CSA, Annual Survey of Manufacturing Industries;  
Ethiopian Customs Authority, External Trade Statistics.*

## 2. Projected Demand

The demand for corrugated paper box as an all-purpose product is related with the overall economic development of the country. Manufacturers usage of new boxes rather than using previously used boxes is one of the reasons for the ever increasing demand for corrugated boxes. Growth anticipated in the manufacturing and agro-industries, will result in more demand for suitable packaging. Therefore, the average growth rate of 7 % achieved in the domestic production of paper is adopted to project the demand for corrugate paper box. The projected demand for corrugated paper box is presented in Table 3.2.

**Table 3.2**

### **PROJECTED DEMAND FOR CORRUGATED PAPER BOX**

<b>Year</b>	<b>Demand (Tonnes)</b>
2006	387
2007	415
2008	443
2009	475
2010	508
2011	543
2012	581
2013	622
2014	666
2015	712

## 3. Pricing and Distribution

An ex-factory price of Birr 8.90 per pcs (550 x 550 x 250 mm) is recommended. This piece has a weight of 0.75 kg.

Distribution of corrugated paper box by the new entrants in the market shall be handled through direct delivery to customers. Hence, the new project in BGRS should have a distribution and storage warehouse at least in major cities, most importantly at Addis Ababa.

## B. PLANT CAPACITY AND PRODUCTION PROGRAMME

### 1. Plant Capacity

The market study conducted for the product in the region indicates that the demand for corrugated paper box by the year 2006 will be 387 tonnes, and this figure will grow to 508 tonnes by the year 2010, and then to 712 tonnes by the year 2015.

Based on the demand projection indicated above the proposed plant will have a capacity of 300 tonnes of corrugated paper box per annum having different sizes. The plant will operate single shift, 8 hours a day, and for 300 days a year.

## 2. Production Programme

The plant will initially be operated at 70% of its installed capacity and gradually increase its annual output to 85%, in the 2<sup>nd</sup> year and finally to 100% in the 3<sup>rd</sup> year and thereafter. This gradual development of annual output is very important in order to get used to the technology and penetrate the local and national market. Table 3.3 depicts the proposed production programme.

**Table 3.3**

### **PRODUCTION PROGRAMME**

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3-10</b>
Capacity utilization (%)	70	85	100
Production (Tonne)	210	255	300

## IV. RAW MATERIALS AND INPUTS

### A. RAW MATERIALS

The most important raw materials used in making corrugated paper box are kraft paper of different grades, adhesive or glue and printing inks.

For a double - faced corrugated paper box, which is the proposed type for most packing uses, three grades of kraft paper raw materials are required. These are:-

- Kraft liner - The outermost flat layer with a specific weight of 170-180 g/m<sup>2</sup>;
- Test liner - The innermost flat layer with a specific weight of 160-180 g/ m<sup>2</sup>; and
- Fluting medium - The middle corrugated layer having a specific weight of 112-127 g/m<sup>2</sup> and higher stiffness.

The adhesive material commonly used in the paper packaging industry is either silicate adhesive (water glass) or starch adhesive. All the three types of paper raw materials acquired through import. Adhesive and printing inks are locally available.

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

<b>Sr No.</b>	<b>Description</b>	<b>Qty (Tonnes)</b>	<b>Unit Price (Birr)</b>	<b>Cost ('000 Birr)</b>
1	Kraft liner	100	5,000	500
2	Fluting Medium	110	5,500	605
3	Test liner	92	4,000	368
	<b>Total</b>	<b>-</b>	<b>-</b>	<b>1478</b>

Among potential supplier of kraft paper to the world market, the following can be cited:

- i) Yashi Paper Limited  
Darshan Nagar, Faizabd - 224135, U.P., India
- ii) Sappi Cape Kraft (PTY) Ltd.  
Fax: + 27 21 5522152  
South Africa

**B. AUXILIARY MATERIALS**

Auxiliary raw materials required for the production of corrugated paper box include: adhesives, inks and finishing chemicals. Table 4.2 shows the annual requirement of auxiliary materials for the production of corrugated paper box.

**Table 4.2****AUXILIARY MATERIALS REQUIREMENT AND COSTS**

<b>Sr. No.</b>	<b>Description</b>	<b>Qty (Tonnes)</b>	<b>Unit Price (Birr)</b>	<b>Cost ('000 Birr)</b>
1	Adhesive (starch)	8.0	4000	32.00
2	Inks and other finishing chemicals	1.0	115,000	115.00
	<b>Total</b>	<b>-</b>	<b>-</b>	<b>147.00</b>

**C. UTILITIES**

Electricity, fuel oil and water are inputs required for the envisaged plant. Annual requirement and cost of utilities are shown in Table 4.3 below.

**Table 4.3**  
**UTILITIES REQUIREMENT & COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Annual Consumption</b>	<b>Unit Cost (Birr)</b>	<b>Total Cost (Birr)</b>
1	Electricity (120 kWh)	185,000 kWh	0.474	87,690
2	Water (at the rate of 1.5 liters / min)	50,000 m <sup>3</sup>	1.5	75,000
3	Fuel oil (at the rate of 1.5 litres / min)	50 tonnes	1700	85,000
	<b>Grand Total</b>	-	-	<b>247,690</b>

## V. TECHNOLOGY AND ENGINEERING

### A. TECHNOLOGY

#### 1. Production Process

The conventional technology of corrugated paper box production is a batch process where four major operations are involved, namely:-

- Corrugator,
- Slitter scorer,
- Printer slotter, and
- Folder gluer.

The fluting medium leaves its winding reel, passes over heated rolls and goes through steam showers; and then passes between two corrugated rolls to get "U" shape of a flute. The kraft liner rolls are unwound and continuously drawn over heated drum that comes in contact with the glued flute tips. The adhesive applied at this points with an applicator roll is used to form a bond between the corrugated medium and the single face liner.

The web is then guided to the double facer unit where the test liner is glued to the other face of the flute medium and this completes the process of single -walled corrugated board. The single - walled board (3 - ply) board produced in such a way is directed to the slitter - scorer for sizing and finally to the printer - slotter for specific box (carton) designs and necessary printing patterns.

#### 2. Source of Technology

The technology of corrugated paper box manufacturing can be obtained from the following sources:-



- 1) New long Machine Works, Ltd.  
4 -14 MGASHI UENO - 6 CHOME  
TAITO - KU TOKYO 110 - 0015  
Japan
- 2) DAEWOO CORPORATION  
CPO BOX 2924  
541, 5-Ga, Namdaemun - ro,  
Jung - gu, Seoul, Korea

## B. ENGINEERING

### 1. Machinery and Equipment

The basic machinery and equipment required for the envisage plant are listed in Table 5.1. The total cost estimate is Birr 1.835 million, of which Birr 1.66 million is required in foreign currency and the balance is in local currency.

**Table 5.1**

#### **MACHINERY AND EQUIPMENT REQUIREMENT AND COST**

Sr. No.	Description	Qty (Tonne)	Unit Price (Birr)	Cost ('000 Birr)		
				FC	LC	TC
1	Corrugator	1	350	350	-	
2	Slitter scorer	1	165	165	-	
3	Printer	1	225	225	-	
4	Rotary slitter	1	185	185	-	
5	Folder gluer	1	135	135	-	
6	Boiler	1	350	350	-	
7	Fork lift (5-10 ton)	1	250	250	-	
	<b>Total FOB</b>	-	-	<b>1660</b>	-	<b>1660</b>
	Freight, Insurance, Bank charges, handling charges, etc.	-	-		175	175
	<b>Grand Total</b>	-	-	<b>1660</b>	<b>175</b>	<b>1835</b>

### 2. Land, Building and Civil Works

Built - up area of the plant is comprised of main factory building, warehouses, offices and guard houses. These are considered to cover an area of about 500 m<sup>2</sup>. Taking into account reserve area for future expansion, accommodation of vehicles and trucks, and space for gardening, the total site area is estimated to be 1,000 m<sup>2</sup>. Land acquisition by means of lease, at the rate of Birr 2.0 per m<sup>2</sup> and for 70 years land holding, is estimated at Birr 140,000.

Taking the average building construction cost of Birr 1000 per m<sup>2</sup> into consideration, the total cost of building is estimated at Birr 500,000. The aggregate expenditure on plant building and land lease value will be Birr 640,000. 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 780,000.

### 3. Proposed Location

The basic raw material, which is rolls of kraft paper, is to be imported from foreign country. Thus, proximity to raw materials can not be considered as a factor for selecting location. Assosa, being the major town of the region, will be better equipped with infrastructure and utility supplies in the near future.

Therefore, taking factors such as proximity to end users, availability of infrastructure and utilities, Assosa is preferred to be an appropriate location for the establishment of corrugated paper box plant.

## VI. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

The plant requires technical, production and administrative manpower. A total of 31 persons are required. Table 6.1 indicates the details of manpower requirement, together with annual salary expenditure including fringe benefits.

**Table 6.1**

#### **MANPOWER REQUIREMENT & ANNUAL LABOUR COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Req.No.</b>	<b>Monthly Salary (Birr)</b>	<b>Annual Expenditure</b>
1.	General manager	1	2000	24000
2.	Production supervisor	1	1200	14400
3.	Accountant	1	700	8400
4.	Maintenance head	1	800	9600
5.	Personnel	1	600	7200
6.	Clerk	2	400	9600
7.	Secretary	3	500	18000
8.	Stores head	1	500	6000
9.	Cashier	1	400	4800
10.	General services	3	200	7200
11.	Guard	3	200	7200
12.	Operators	6	600	43200
13.	Assistant operators	3	300	10800
14.	Technicians	4	500	24000
	<b>Sub total</b>	<b>31</b>		<b>194,400</b>
	Employee benefit (25% BS)			48,600
	<b>Grand Total</b>			<b>243,000</b>

## **B. TRAINING REQUIREMENT**

Training is required for technical staff and operators. It is proposed that appropriate training programme will have to be executed at the workshop of the machinery supplier(s). The training programme shall be incorporated in the main contractual agreement of technology supply and procurement. Local component of the training programme is estimated to be Birr 20,000.

## **VII. FINANCIAL ANALYSIS**

The financial analysis of the corrugated paper box 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 3.6 million, of which 46.1 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	140
2.	Building and Civil Work	500
3.	Plant Machinery and Equipment	1,835
4.	Office Furniture and Equipment	65
5.	Vehicle	375
6.	Pre-production Expenditure*	25
7	Working Capital	466.9
	<b>Total Investment cost</b>	<b>3,601</b>
	<b>Foreign share</b>	<b>46.1</b>

\* N.B Pre-production expenditure includes interest during construction (Birr194 thousand), training (Birr20 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 2.6million (see Table 7.2). The material and utility cost accounts for 72.4 per cent while repair and maintenance take 2.5 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	1,620	62.8
Utilities	247.7	9.6
Maintenance and repair	65.0	2.5
Labour direct	87.6	3.4
Factory overheads *	6.6	0.3
Administration Cost **	163.2	6.3
<b>Total Operating Costs</b>	<b>2,190.1</b>	<b>84.9</b>
Depreciation	227	8.8
Cost of Finance	161.2	6.3
<b>Total Production Cost</b>	<b>2,578.3</b>	<b>100</b>

\*Factory overhead cost includes salaries and wages of supervisors, insurance of factory workers, social costs on salaries of direct labour, etc.

\*\* Administrative cost includes salaries and wages, insurance, social costs, materials and services used by administrative staff etc.

## 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 lifetime 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 operate at full capacity ( year 3 ) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 36.7\%$$

### 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 30.4 % and the net present value at 8.5% discount rate is Birr 4.2 million.

## D. ECONOMIC BENEFITS

The project can create employment for 31 persons. In addition to supply of the domestic needs, the project will generate Birr 0.8 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.