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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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ASSISTANCE TO THE MINISTRY OF INDUSTRY

[illegible]

KENYA

Technical report: Development of [illegible] pulp and paper industry in Kenya
Part [illegible]. Report [illegible]
[illegible]*

Prepared for the Government of Kenya
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of [illegible],
consultant [illegible] and paper

United Nations Industrial Development Organization
Vienna

* This document has been prepared without formal editing.

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ABBREVIATIONS

ADT	AIR DRY TON
ADTPY	AIR DRY TON PER YEAR
BDT	BONE DRY TON
BL	BLEACHED
CEH	CHLORINE/CAUSTIC EXTRACTION/HYPO
CEHH	CHLORINE/CAUSTIC EXTRACTION/HYPO/HYPO
D.D.	DOUBLE DISC
FTPY	FINISHED TONS PER YEAR
GCV	GROSS CALORIC VALUE
GSM	GRAMS PER SQ.METER
KW	KILOWATT
KSHS.	KENYA SHILLINGS
M^3	CUBIC METER
MPM	METERS PER MINUTE
MM	MILLIMETER
MWH	MEGA WATT HOUR
NCV	NET CALORIC VALUE
OD	OVEN DRY
T	TON
TPD	TONS PER DAY
TPH	TONS PER HOUR
US$	US DOLLAR
WT	WEIGHT

EXPLANATORY NOTES

Value of the local currency - KENYAN SHILLING (K.Shs.) during the period of the mission in terms of United States Dollars:

1 US$ = 15.00 K.Shs.

ABSTRACT

This Report presents the results of a Study of using straw to produce corrugating medium and INNER Line Board for corrugated board manufacture.

It is concluded about 15,000 TPY of corrugating medium and Inner Liner Board could be produced using the straw from the Lower TANA BASIN Area.

The total capital investment needed would be KShs.183,505,000 (exclusive of working capital). The Return on investment is estimated at 29.4%.

It is recommended that serious consideration is given to implement the project and a further study is recommended in close collaboration with the Lower TANA River Authority.

TABLE OF CONTENTS

RECOMMENDATIONS.

(1) The five mills presently operating in Kenya are not geared to produce semi chemical pulp. To produce corrugating medium economically semi-chemical pulping has to be applied.

(2) The market for packaging grades of paper and in particular corrugating medium and liner board seems to be strong. A high rate of growth is predicted due to the demand from food, beverages, consumer goods and industrial goods, needing corrugated boxes for packing and shipment both for domestic use as well as for export.

(3) Straw has been found as an ideal material to produce corrugated medium (Fluting Paper) for the production of corrugated board, needed for the manufacture of corrugated boxes. The project is proposed for location in the GARSEN area where 16,300 Ha of Rice would be grown 2 times a year and where straw could be collected economically.

(4) Besides straw, GARSEN area is also considered well suited on account of the availability of water, availability of Hydro-electric power availability of facilities such as road net work, schools, hospital etc. with the development of the LOWER TANA IRRIGATION PROJECT. The discharge of effluent also is easier as this could be either piped to the Indian Ocean or used for irrigation on the West bank of RIVER TANA.

(5) The proposed project would give employment to 322 persons. The project would give indirect employment to several hundreds and would provide income to the farmer to the extent of 4,360,000 K.Shs./year through sales of straw.

(6) Based on this study it is recommended the project is implemented both for reasons given above as well as on account of a high ROI of 29.4%.

(7) If this Study is accepted, it is recommended a detailed study of the mill site is made and preliminary offers are received to compile the Capital estimate based on actual quotation for supply of equipment.

1.0 INTRODUCTION

Kenya currently has 5 paper mills operating with a total installed capacity of 85,600 TPY of paper and paper board. The afore-mentioned 5 mills have plans to expand to 125,400 TPY within the next 2 to 3 years.

The indigenous pulping capacity is only 58,000 tons of chemical pulp and 8,000 tons of mechanical pulp per year at PANAFRICAN PAPER MILLS, WEBUYE. Therefore, the other 4 mills depend mostly on waste paper for their fibre requirements. The supply of raw material for the PANAFRICAN PAPER MILLS is based on PINE AND CYPRESS from "Man-made plantations". There will be a further demand on this source of supply when the proposed MADHU PAPER MILLS at THIKA goes into production. This mill at THIKA will require wood to produce about 20,000 TPY of chemical pulp.

It is feared Kenya is heading towards a shortage of wood and in particular for domestic fuel requirements both in the form of firewood and wood charcoal. It is, therefore felt at this stage further planning of pulp and paper mills based on wood does not look promising with only 20% of the land area available in Kenya both for agriculture as well as forestry. On the other hand Kenya needs more paper. The demand for paper during the last 5 years has been growing at the rate of 5%. It is expected the future growth will be around 6 to 7%, with a high demand for cultural grades of paper on account of the growth in school going population.

The Department of Industries in the Ministry of Commerce and Industry, sensing this problem, initated the need for a study to look into the

aspect of using non wood materials for pulp and paper manufacture. To conduct this study a pulp and paper expert was requested from UNIDO. He arrived on 9 November 1984 for a three-month assignment in Kenya.

The following report is Part IV of the investigations and studies related to the use of non-woody raw materials for the production of pulp and paper, made up into five parts:

PART I	-	Development of the Pulp and Paper Industry in Kenya
PART II	-	A Report on the Feasibility of Producing Fine Paper from Bagasse
PART III	-	A Report on the Feasibility of Producing Hard Tissues From Sisal Waste
PART IV	-	A Report on the Feasibility of Producing Corrugating Medium From Straw
PART V	-	A Report on the Feasibility of Producing Hand Made Paper from Cotton Waste.

2.0 BASIS OF STUDY

The basis of this study is to produce CORRUGATING MEDIUM (FLUTING PAPER) from straw. The present requirements of KENYA for corrugating medium is met largely by PANAFRICAN PAPER MILLS (PPM) followed by KENYA PAPER MILLS. Since Pan-African Mills has no semi chemical pulping facility there is difficulty in producing this grade of paper economically. Although Kenya Paper Mills could make this grade of paper economically, because of the use of waste paper; there is difficulty in getting the required quality as no virgin semi-chemical pulp is used in the fibrous furnish.

Pan African Paper Mills for reasons given above is getting away from this line of production and wants to concentrate more on Liner board for which chemical pulp produced from PPM is more suited. Kenya Paper Mills on the other hand has not sufficient capacity available to fully meet the demand of the domestic market if PPM withdraws this grade from its production programmes.

Under these circumstances it is considered a mill to produce corrugating medium and similar packaging grades of paper is needed for Kenya. The preferred raw material for this grade of paper is straw. The corrugating medium made with a high percentage of straw pulp gives better concora values which is indicative of high CRUSH RESISTANCE values. Therefore in the packaging industry converters prefer corrugating medium which give high concora values or CMT values. Another reason for initiating - this project is the market trend indicating a high demand in growth rate for corrugated boxes which are needed for the packaging of food, beverages, pharmaceutical and industrial goods. These boxes are needed both for domestic use as well as for export purposes.

This study therefore relates to the feasibility of producing corrugating medium using Rice Straw from the 16,300 hectares that is planned for cultivation in the LOWER TANA RIVER BASIN.

2.1 LOCATION

Straw is a bulky material. Mills based on straw normally collect their requirements within a radius of 50 Km for economical transport. Some of the other key factors that have to be taken into account for locating a pulp and paper mill are as follows:

- Dependable water supply from river or stream both for quality as well as quantity
- Road, Rail or Water transport linkages
- Proper and acceptable facilities for effluent discharge without harming the environment
- Availability of schools, hospitals, shopping and recreation facilities for emplovees.

Taking the above factors into consideration the site that could be tentatively chosen in the LOWER TANA RIVER BASIN is a location somewhere in the GARSEN area close to the TANA RIVER.

2.2 CAPACITY

The optimum size based on market consideration, the pattern of growth in the packaging industry and the feasibility of collecting the straw in the LOWER TANA BASIN area is 15,000 TPY. This size is considered to be viable for operation in a developing country like Kenya.

2.3 STRAW SUPPLY

As already explained under PART I there is ample availability of straw in Kenya. The difficulty lies in the economical collection and transport of straw to operate a pulp and paper mill. The only place where collection and transport could be easily organised to

collect 22,000 tons of straw per year, for processing would be the LOWER TANA RIVER BASIN. The advantages connected with this area are factors such as:

- 16,300 Ha of Rice Cultivation
- 2 Harvests per year
- One centralized management authority

The above factors facilitate economical collection and transport immediately after harvest within a short span of one to two months. The average hauling distance for straw to the mill in the GARSEN area would be well within 15 to 20 Km which is very attractive for economical transport.

2.4 PLANT SITE

It is not possible to pin point a particular site in the GARSEN area at present. This has to be done at a subsequent stage if this study is accepted as the first step in the implementation of the project.

The mill will require together with the housing colony an area of approximately 100 Ha.

In selecting the plant site, it was also considered during the study that the proposed mill will benefit by the development of the LOWER TANA BASIN as indicated below:-

- Settlement of Colonists and adequate labour
- Establishment of townships
- Electrification and availability of hydro power
- Domestic water supply
- Network of roads for easy transport
- Development of education, health, postal and telecommunication facilities
- Workshop facilities
- Development of other industries

2.5 WATER SUPPLY

The TANA is Kenya's largest river with a catchment area of about 100,000 sq.km.. Flow records close to GARSEN could not yet be obtained. A mill such as envisaged would require some 7,500 m^3/day initially and allowing for future expansions 15,000 m^3/day would be required eventually. The visual inspection the expert made at GARSEN indicate there is ample water available. The completion of the planned resovoirs and the extenstion of irrigation will probably decrease the average discharge of the river somewhat but for purposes of this study sufficient water has been assumed as available and this should not pose a problem to the mill.

2.6 ELECTRIC POWER SUPPLY

The mill would be able to tap cheap hydro-power for operating the mill from the RIVER DEVELOPMENT AUTHORITY hydro electric station net work.

The existing stations currently operating on the UPPER TANA are:-

MISINGA	-	40 MW
KAMBURU	-	92 MW
GITARU	-	145 MW
KINDARUMA	-	44 MW

The proposed stations on the Middle TANA are:-

KIAMBERE	-	140 MW (under construction)
MUTONGA	-	PROPOSED
GRAND FALLS	-	"
LISUENI	-	"
ADAMSON FALLS	-	"
KORA HILLS	-	"

With all the hydro stations in full operation, it is estimated TANA would be able to develop 800 MW.

The initial mill load would be around 1,000 KW with a peak load of about 1,500 KW. Allowing for further

expansion the mills would require say 4,000 KW eventually. It is therefore considered thc mill will be able to obtain its full requirements of electric energy from the TANA hydro network.

2.7 PERSONNEL

The mill will provide employment to 272 daily paid employees and 50 salaried personnel. There will be several hundreds that will be indirectly benefited in straw handling, straw baling and straw transport.

2.8 TRAINING:

No specialized training in overseas mills is necessary to operate and maintain this mill. Experienced personnel who have gained working experience in the existing mills in Kenya will be able to operate this mill. foreign experts in Techno-managerial positions would provide on the job training during commissioning, start-up and commercial production for a period of about 6 to 12 months. This is considered as adequate to operate the mill by Kenyan personnel.

2.9 TRANSPORT

With the development programme envisaged by the LOWER TANA RIVER AUTHORITY there will be a net work of good roads leading to the mill site. The only handicap is the lack of rail facilities. In making the more detailed study, the possibility of using barges up the river TANA from the Indian Ocean ports should be examined. This will considerably reduce the cost of transport of imported waste paper, chemicals etc.

2.10 GRADES OF PAPER

The mill will primarily make corrugating medium and liner board. The liner board envisaged under this programme is not the KRAFT LINER which PAN AFRICAN could make. This is still required as FACING LINER for most of the corrugated boxes. Besides this grade the corrugated board manufacture is also looking for a cheaper inner liner sometimes known as "SHRENZ" in Europe. This is used as inner liner for double lined board or middle line

for Triple lined board.

The proposed mill with semi-chemical pulping facilities is in a position to provide to the consumer, a highly economical packaging material, with a production of 10,000 TPY of corrugating medium and 5,000 tons of inner liner board.

3.0 MILL PROCESSING SYSTEM

The mill would have a capacity of 15,000 TPY of packaging grades of paper (10,000 TPY of corrugating medium + 5,000 TPY of Inner Liner board). The mill will employ simple design features.

3.1 STRAW PREPARATION

The major equipment would consist of 2 straw cutters, one as spare to facilitate change of knives. The cut straw would be cleaned and then pneumatically conveyed to feed the digesters.

3.2 PULPING, WASHING AND SCREENINGS

The semi-chemical process adopted would be the Caustic Soda process using the batch system of cooking on rotary type of digesters.

As an alternat ve to Caustic Soda, the use of MAGADI SODA ASH and SLAKED LIME is suggested. This is recommended as both these chemicals are easy to obtain compared to Caustic Soda and is considerably cheaper in price. The use of MAGADI SODA ASH and SLAKED LIME would need laboratory cooking trials to optimize the cooking parameters. If this report is accepted in principle, it is recommended arrangements are made to conduct laboratory cooking trials using local rice straw with Magadi Soda Ash and slaked lime in a reputed internationally recognized cellulose Institute. Another alternate method for cooking would be"MONO SULPHITE COOKING". In this case Magadi Soda Ash would be converted to "SODIUM SULPHITE" and then buffered with SODA ASH to slightly

alkaline medium. This cooking process is suggested as this would be also cheaper than Caustic Soda.

For purposes of this study however the calculations for the Manufacturing Cost and profitability are based on CAUSTIC SODA which is relatively a high priced chemical compared to MAGADI SODA ASH.

The cooked pulp would be discharged into dump pits and then conveyed to a "TORANODO" type of pulper for mechanical defibration. The defibred pulp would be then washed in "Washing Hollanders". The washed pulp would be screened using JOHNSSON type of Screens. The accepts from the screens would pass through a simple riffler system to Centrifugal Screens for fine screening in 2 stages. The accepts would be deckered and raised to a consistency of 8%. The deckered stock would be then stored in a high density tower.

3.3 STOCK PREPARATION

There will be 2 lines of stock preparation one for corrugated container waste (CCW) and the other for semi chemical straw pulp. The CCW will receive initial treatment in a pulper followed by a DEFLAKER and then refiners. The straw pulp from the HD tower would receive mechanical treatment in D.D. refiners or with wide angled refines to prevent damage to straw pulp fibre. The CCW stock and straw pulp after mechanical treatment will be blended together in the desired proportion. Chemicals if needed would be added to the blended stock. After preparation of the stock both mechanically as well as chemically, the stock would be pumped to the machine chest.

3.4 PAPER MACHINE

The paper machine would be of the FOURDRINIER type capable of producing corrugating medium and similar grades of packaging paper of Basis Weight range from 90 to 270 GSM. The machine will carry features that would be simple to operate and maintain such as the following:

- Open Headbox
- Simple press system with only one suction press
- Open gear system for dryer group
- Line shaft drive
- Open hood

The machine on account of its simplicity will be relatively low priced compared to the more sophisticated design features of today's machine.

To conserve energy, heat and water suitable saving devices would be built into the system.

3.5 PAPER FINISHING

This would mainly consist of a winder and a rewinder to produce paper in reel form to the converter. A core making machine would be provided.

3.6 SERVICE FACILITIES

Steam: would be supplied by 2 oil fired package boilers each with a capacity of 15 T.P.H. The average load would be about 10 to 12 TPH and the peak load would be 15 TPH.

Electric Power: All electric power would be purchased. The mills will therefore have the necessary in coming transformers.

Effluent treatment: The possibilities of delivering the effluent without treatment by pipe line to the Indian Ocean would be further studied once a proper site is chosen in the GARSEN area. In the alternative the effluent after primary treatment to separate the fibres would be used for irrigation to grow Kenaf or other cash crops on the West Bank of the river.

Workshop Facilities: The necessary workshop facilities would be provided to the mill.

Housing and Canteen: Housing for technical personnel, key operators and Chief Administrative personnel will be provided.

The Mill would have canteen facilities for all employees.

4.0 COST ESTIMATES

4.1 THE MANUFACTURING COST ESTIMATES

Details of the manufacturing cost are given under APPENDIX 2. A summary of the estimates is produced here below:

ITEM	AMOUNT/YR. (K.SHILLINGS)
- STRAW	4,360,000
- CCW (CORRUGATED CONTAINER WASTE)	2,400,000
- CHEMICALS	9,912,000
- FUEL OIL	13,920,000
- OTHER MATERIALS	3,000,000
- PURCHASED ELECTRIC POWER	4,500,000
- LABOUR	3,335,000
- ADMINISTRATION AND OVERHEAD	5,185,000
- CONTINGENCIES	600,000
TOTAL	47,212,000

The data employed for calculating the manufacturing cost estimates is given under APPENDIX 1. The staff, labour and overhead expenses are all estimated and the details could be found under various estimates in APPENDIX - 2.

4.2 CAPITAL COST ESTIMATES

Preliminary estimates of Capital Costs for the proposed mill are contained in APPENDIX 3 and are summarized below:

ITEM	AMOUNT IN KSHS.
- STRUCTURES	61,300,000
- EQUIPMENT	86,205,000
- CONSTRUCTION EXPENSES	18,600,000
- ENGINEERING AND CONTINGENCIES	17,400,000
- TOTAL PLANT CAPITAL	183,505,000
- WORKING CAPITAL	10,855,000
- INTEREST DURING CONSTRUCTION	-
- DUTY	21,550,000
- TOTAL INVESTMENT	215,910,000

The Capital Cost estimates contained in this report have been based on data from previous projects of similar nature. They are therefore approximate values as they were not obtained based on tender offers or quotations. For the purpose of this Study they are considered to be sufficiently accurate.

If this Study is accepted in principle a further study has to be conducted to establish the actual capital requirements.

The duty has been assumed for this Study at 25%. It is conceivable that the invester might be able to bring the plant and machinery into the country duty free on the basis that the equipment when operating would save foreign exchange to the country.

STRUCTURES

The cost of structures includes all buildings and civil works.

EQUIPMENT

The cost of equipment is based on simple design suitable for developing countries. It is recommended in order to reduce the high cost of equipment the purchase is made from countries such as INDIA, TAIWAN, POLAND, ITALY, GDR, etc. These countries are also able to give the type of technology well suited for developing countries. On the other hand it is also possible to keep Capital Cost down by purchasing second hand equipment from countries such as FRG, SCANDINAVIAN COUNTRIES, and USA.

The Capital Cost estimates also include the cost of assembly and erection of equipment.

CONSTRUCTION OVERHEAD

An allowance has been made to provide the following:

Job management and supervision, accounting, purchasing, expediting, miscellaneous labour cost such as job clean up, unloading, handling and storing of equipment and

material, establishment and operation of a construction camp, temporary workshop and services and the rental and maintenance of construction equipment.

ENGINEERING AND CONTINGENCIES

The amount included in the estimates are for engineering services including field surveys and investigations, calling of tenders, and recommendations for equipment supply, preparations of contract documents, detailed design, the preparation of detailed drawings and specifications for construction, engineering supervision of contract work and assistance with operation during the start up period.

An allowance has been included for contingencies to provide for items of cost presently unforeseen, the need for which may become apparent only during the detail design, construction or preliminary operating stages of the project. This allowance is not intended to provide for changing currency exchange rates or for inflationary changes in the costs of equipment material and labour.

INTEREST DURING CONSTRUCTION

No provision has been made on the assumption that purchasing would be done on a deferred payment basis.

WORKING CAPITAL

Estimates are shown under APPENDIX 4 and covers all raw materials, chemicals, fuel etc.

DUTY

This has been calculated on the basis of 25%.

CURRENCY RATE

At the time of writing this report 1 US$ = 15 Kenya Shilling and this conversion rate was applied.

4.3 EARNINGS ESTIMATE

Product sales prices have been recorded under APPENDIX 2. From these figures and the estimated annual manufacturing costs, the gross annual profit and the return on investment were determined as given in APPENDIX 5. A summary of this calculation is given below:

- ANNUAL MILL NET SALES	-	107,500,000
- ANNUAL DIRECT MFG. COST	-	47,212,000
- GROSS PROFIT BEFORE DEPRECIATION AND INTEREST	-	60,288,000
- CAPITAL INVESTMENT EXCLUSIVE WORKING CAPITAL	-	205,055,000
- GROSS RETURN ON INVESTMENT	-	29.4%

The gross return has been calculated on the investment excluding working capital, since it has been assumed that the working capital would be obtained as a short term bank loan to be repaid out of initial earnings.

The earnings estimate indicate a gross return of 29.4% on the investment.

ANNEX 1

COST DATA

ITEM	UNIT	AMOUNT
- STRAW	SH/ADT	200
- CCW (WASTE PAPER)	SH/ADT	750
- CAUSTIC SODA	SH/T	4,800
- ALUM	SH/T	3,600
- FUEL OIL	SH/T	2,400
- ELECTRIC ENERGY	SH/MWH	600

ANNEX 2

MANUFACTURE ESTIMATES

15,000 FTPY CORRUGATING MEDIUM

AND INNER LINER BOARD

SUMMARY

STATISTICS

ITEM	UNIT	AMOUNT
- SALES PAPER	FTPY	15,000
- STRAW	ADTPY	21,800
- WASTE PAPER CCW	ADTPY	3,200
CHEMICALS		
- CAUSTIC SODA	TPY	1,900
- ALUM	TPY	220
- SIZE	TPY	500
- FUEL OIL	TPY	5,800
- ELECTRIC ENERGY (TOTAL)	MWH	7,500
- WATER	M^3 x 1,000	2,250
LABOUR		
= DAILY PAID	MEN	272
= SALARIED	MEN	49
= TOTAL	MEN	321
- ANNUAL OPERATING DAYS	DAYS	300

ANNEX 2, cont.

MANUFACTURING COST

	ITEM	RATE	COST/YEAR
-	STRAW	200 Sh/ADT	4,360,000
-	CCW (WASTE PAPER)	750 Sh/ADT	2,400,000
	CHEMICALS		
-	CAUSTIC SODA	4,800 Sh/ T	9,120,000
-	ALUM	3,600 Sh/ T	792,000
-	FUEL OIL	2,400 Sh/ T	13,920,000
-	ELECTRIC ENERGY	600 Sh/MWH	4,500,000
-	OTHER MATERIALS		3,000,000
-	LABOUR		3,335,000
-	ADMINISTRATION AND OVERHEAD		5,185,000
-	CONTINGENCIES		600,000
	TOTAL		47,212,000

ANNEX 2, cont.

ESTIMATE 1

PAPER MACHINE

	ITEM	UNIT	AMOUNT
-	BASIS WT. RANGE	GSM	90 - 270
-	WIRE WIDTH	MM	2,600
-	TRIM AT WINDER	MM	2,250
-	FINISHED PRODUCTION	TPY	15,000
-	FINISHING LOSSES	%	5
-	AVERAGE MACHINE PRODUCTION	TPD	55
-	MOISTURE CONTENT	%	6
-	FIBRE LOSS	%	3
-	ANNUAL OPERATING DAYS	DAYS	300

ANNEX 2, cont.

ESTIMATE 2

LABOUR REQUIRED

SUMMARY

	DEPARTMENT	NO. OF MEN	COST/YR.
-	STRAW SUPPLY	16	11,200 x 12
-	STRAW CUTTER	16	13,200 x 12
-	CHEMICAL HOUSE	8	5,600 x 12
-	DIGESTER HOUSE	8	8,800 x 12
-	WASHING AND SCREENING	4	4,800 x 12
-	STOCK PREPARATION	8	8,800 x 12
-	PAPER MACHINE	24	28,400 x 12
-	WINDER	12	11,600 x 12
-	FINISHING AND DESPATCH	20	15,800 x 12
-	CORE MAKING	4	2,800 x 12
-	QUALITY CONTROL & LABORATARY	4	2,800 x 12
-	BOILER HOUSE	8	10,000 x 12
-	WATER SUPPLY	4	7,600 x 12
-	POWER SUPPLY	4	6,000 x 12
-	ENGINEERING & MAINTENANCE	90	108,600 x 12
-	MILL STORES	5	3,500 x 12
-	TRANSPORT AND YARD	25	20,000 x 12
-	OFFICE	8	5,600 x 12
-	HOUSING AND WELFARE	4	2,800 x 12
	TOTAL	272	277,900 x 12
			3,334,800

ANNEX 2,cont.

ESTIMATE 3

SALARIED PERSONNEL

POSITION	NO. OF EMPLOYEES	K.SHS. MONTHLY RATE	KSHS. COST/YEAR
ADMINISTRATION			
- MILLS MANAGER	1	18,000	
- MILLS ACCOUNTANT	1	12,000	
- SUPPLIES OFFICER	1	5,000	
- STORE KEEPER	1	2,000	
- TRANSPORT FOREMAN	1	2,000	
- OFFICE SECRETARIES	3	1,500	
- CLERKS	6	1,200	
- TELEPHONE CUM RECEPTIONIST	1	1,000	
- FIRST AID NURSE	1	1,200	
	16		634,800
PRODUCTION			
- PRODUCTION MANAGER	1	20,000	
- FOREMEN	10	7,000	
	11		1,080,000

ANNEX 2, cont.

ESTIMATE 3

SALARIED PERSONNEL

QUALITY CONTROL

	No. of Employees	K.SHS. monthly rate	K.SHS. Cost/Year
- Chemist	1	8,000	96,000
- Laboratory Testers	8	2,000	192,000
	9		288,000

ENGINEERING AND MAINTAINING

- Mills Engineer	1	12,000	144,000
- Foremen	4	5,000	240,000
	5		384,000

SALARIED MILL PERSONNEL	41		2,386,000

ANNEX 2, cont.

ESTIMATE 4

SALARIED PERSONNEL

SALARIES HEAD OFFICE PERSONNEL

POSITION	No.of Employees	Monthly Rate	Cost/Year
General Manager	1	20,000	240,000
Chief Accountant	1	16,000	192,000
Supplies and Sales	1	12,000	144,000
Office Secretaries	3	2,600	93,600
Clerks	3	1.200	43,200
	9		712,800

ANNEX 2, cont.

ESTIMATE 5

ADMINISTRATION AND OVERHEAD

SUMMARY

ITEM	No. of Employees	Cost/Year
SALARIED PERSONNEL		
Mill Personnel	41	2,386,800
Head Office	9	712,800
	50	3,099,600
GENERAL OVERHEAD EXPESES		2,085,400
	TOTAL	5,185,000

ANNEX 2, cont.

SALES ANALYSIS

GRADES	QTY.	SALES PRICE (K.SHS.)	SALES VALUE (K.SHS.)
- CORRUGATING MEDIUM	7,000	10,000	70,000,000
- LINER BOARD	7,500	5,000	37,500,000
			107,500,000

CONVERSION RATE 1 US$ = 15 K. SHILLINGS

ANNEX 3

CAPITAL COST ESTIMATES

PART I - STRUCTURES

DESCRIPTION	KSHS. LABOUR	KSHS. MATERIAL	KSHS. TOTAL
SITE	500,000	2,500,000	3,000,000
TRANSPORTATION	250,000	750,000	1,000,000
SEWERS AND EFFLUENT	INCLUDED UNDER EQUIPMENT		
FIRE PROTECTION	50,000	50,000	100,000
TOWN SITE	2,150,000	7,850,000	10,000,000
OFFICES AND LABORATORY	1,000,000	2,000,000	3,000,000
WORKSHOP	700,000	1,450,000	2,150,000
FUEL OIL STORAGE AND HANDLING	50,000	200,000	250,000
WATER SUPPLY & DISTRIBUTION	INCLUDED UNDER EQUIPMENT		
STEAM " " "	750,000	2,250,000	3,000,000
POWER " " "	150,000	450,000	600,000
STRAW HANDLING AND STORAGE	INCLUDED UNDER EQUIPMENT		
STRAW PREPARATION	200,000	800,000	1,000,000
DIGESTER HOUSE	950,000	2,450,000	3,400,000
WASHING AND SCREENING	720,000	2,080,000	2,800,000
CHEMICAL PREPARATION	INCLUDED UNDER DIGESTER HOUSE		
STOCK PREPARATION	INCLUDED UNDER PAPER MACHINE		
PAPER MACHINE	4,800,000	16,200,000	21,000,000
FINISHING HOUSE	2,500,000	7,500,000	10,000,000
WARE HOUSE	INCLUDED UNDER FINISHING HOUSE		
TOTAL	14,770,000	46,530,000	61,300,000

$ 4,086,000

CONVERSION RATE 1 US $ = 15 KENYAN SHILLINGS.

ANNEX 3, cont.

CAPITAL COST ESTIMATES

PART II EQUIPMENT

DESCRIPTION	KSHS. LABOUR	KSHS .MATERIAL	KSH. TOTAL
SITE	-	-	-
TRANSPORTATION	50,000	.700,000	750,000
SEWERS AND EFFLUENT	1,100,000	3,350,000	4,450,000
FIRE PROTECTION	660,000	2,010,000	2,670,000
TOWN SITE	INCLUDED UNDER STRUCTURES		
OFFICE AND LABORATORY	30,000	1,050,000	1,080,000
MILL STORES	-	6,000,000	6,000,000
WORKSHOP	90,000	5,910,000	6,000,000
FUEL OIL STORAGE & HANDLING	100,000	1,700,000	1,800,000
WATER SUPPLY & DISTRIBUTION	650,000	4,350,000	5,000,000
STEAM " " "	750,000	8,000,000	8,750,000
POWER " " "	350,000	3,300,000	3,650,000
STRAW HANDLING & STORAGE	-	850,000	850,000
STRAW PREPARATION	210,000	1,290,000	1,500,000
DIGESTER PLANT	455,000	3,395,000	3,850,000
WASHING AND SCREENING	300,000	2,600,000	2,900,000
CHEMICAL PREPARATION	60,000	440,000	500,000
STOCK PREPARATION	670,000	3,270,000	3,940,000
PAPER MACHINE	1,625,000	28,375.000	30,000,000
FINISHING HOUSE	200,000	2,000,000	2,200,000
WARE HOUSE	15,000	300,000	315,000
TOTAL	7,315,000	78,890,000	86,205,000

$ 5,747,000

CONVERSION RATE 1 US $ = 15 KENYAN SHILLINGS

PART 3 CONSTRUCTION EXPENSES

	K.SHS.
- CONSTRUCTION OVERHEAD	18,600,000
- ENGINFERING & CONTINGENCIES	17,400,000
TOTAL	36,000,000
- Structures	61,300,000
- Equipment	86,205,000
- TOTAL PLANT CAPITAL (EXCLUDING DUTY)	183,505,000
US $	12,233,700

CONVERSION RATE 1 US $ = K.SHS.15/-

ANNEX 4

WORKING CAPITAL AND OPENING UP EXPENSES

ITEM		K.SHS. AMOUNT
STRAW	3 MONTHS	1,090,000
CCW (WASTE PAPER)	4 MONTHS	800,000
CAUSTIC SODA	1 MONTH	760,000
ALUM	3 MONTHS	198,000
FUEL OIL	½ MONTH	580,000
OTHER MATERIALS	3 MONTHS	750,000
FINISHED PRODUCTS	½ MONTH	5,104,000
TOTAL		9,282,000
INSURANCE PREMIUMS AND SUNDRY ADVANCES		300,000
OPENING UP EXPENSES		
- ADMINISTRATIVE SALARIES	- 6 MONTHS	117,000
- OVERHEAD	- 3 MONTHS	600,000
- LABOUR	- 2 MONTHS	556,000
TOTAL		10,855,000

ANNEX 5

EARNINGS ESTIMATE

ITEM	UNIT	AMOUNT
PAPER PRODUCTION	PTPY	15,000
MILL NET SALES	KSHS./YR	107,500,000
DIRECT MANUFACTURING COST	KSHS./YR.	47,212,000
GROSS MANUFACTURING PROFIT		60,288,000
CAPITAL INVESTMENT EXCLUDING WORKING CAPITAL	KSHS./YR.	205,055,000
GROSS RETURN BEFORE DEPRECIATION AND INTEREST	%	29.4