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# REACTIVATION OF THE JUTE BAG FACTORY

SI/SIL/88/801

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Technical report: Economic Viability of a Bagging Factory*

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

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* This document has not been edited.

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## INTRODUCTION

Jute bags are primarily used for the storing, transporting and exporting of produce such as coffee, cocoa, palm kernels, rice, ginger and groundnuts, which are traditionally packed in 'B' twill sacks. All sacks were imported at a cost of $0.55 per bag and sold at $0.80, before devaluation of the local currency. The current market price per bag is approximately $1.17. (The exchange rate, w.e.f. 15th January 1990, is $1 = 120 leones). It is estimated that a turnover of over 2 million bags per annum will be required.

A bagging factory, Jute Products Co. Ltd., was in operation for one year in 1977/78, which imported sacking 'B' twill cloth to make into bags. The factory had to close down due to various reasons, including foreign exchange problems for importation of raw material and machinery.

It is now proposed, with the purchasing of additional machinery, to produce sacking bags by processing fibre into fabric and fabric into bags using, initially, imported jute from Bangladesh or India and gradually reducing this once locally grown fibre, called Urena Lobata, became available. This would not only create a new cash crop but offer much-needed employment and, in the long term, effect a large saving in foreign exchange.

All Government officials (see Annex 3) with whom I had discussions were very keen on the project and stressed the urgent need for bags, especially in the rural areas. The owner of the old factory, Jute Products Co. Ltd., is an influential businessman,who has a sound knowledge of the bagging market in Sierra Leone and appears to have assets and connections to raise a portion of the capital for the expansion of the factory. The two leading companies in the private sector, which are the largest purchasers of sacking bags, also appear to have adequate assets and funds and may be interested to invest in the project.

# I. SUMMARY

## Reactivation of Jute Bag Factory

The old factory buildings at Freetown are not large enough to accommodate the required number of machines for manufacturing fibre into bags. Other sites were inspected which were in close proximity to the production area of the urena lobata.

The present availability of the fibre, however, is insufficient to sustain a bagging factory, and the extra capital cost required to develop a new site with an already low return on capital investment for machinery alone would be an unwise move, unless additional funds could be raised.

It is suggested, therefore, that extension and development of the present site in Freetown should be taken in hand.

## II. URENA LOBATA

### A. Background

This fibre plant, which grows in a wild state in Sierra Leone, is widely used by the local people for making into hammocks, bags, ropes and fish nets. No attempt has been made to cultivate the plant. In 1974/75 the Ministry of Agriculture and Natural Resources showed interest in this plant and commenced production on a commercial scale, with the help of a small number of farmers, at their Newton Agricultural Centre. Unfortunately, the market demand was not there and it was therefore phased out. On my visit to the Newton Station I found only a few samples of the following:-

The Swamp-growing type

This can be cultivated and has a duration of 1-6 months from planting to harvesting, and can attain a height ranging from 6'-12'.

The Upland-growing variety

This plant has stronger fibre and can attain a height of up to 15'. It also grows to maturity in 6 months. Seemingly, this was the variety that was used for the urena lobata pilot project of the Ministry of Agriculture and Natural Resources in 1974/75.
Retting time of both varieties is 14 days under ideal conditions.

### B. Fibre Availability

In 1983 the Commonwealth Fund for Technical Co-operation submitted a detailed report on all aspects of this fibre and mention was made of areas most likely to succeed in the growing of this crop. Mambolo, in the north west, and Binkolo, further east, were favoured, and my visit to these areas was to ascertain the presence, in the wild or cultivated state, of urena lobata and to determine its agricultural and commercial viability.

Binkolo District

There are a number of areas here that are suitable for growing the urena fibre on a commercial scale. However, according to the Agricultural Officer, only a wild variety is growing at present.

Mambolo District

I was advised by the Paramount Chief of Mambolo that a scheme to produce urena lobata was started by the late Chief but because of a lack of demand was soon phased out, and the plant now grows in the wild state only. On inspection I found this to be correct and observed large areas of land which would be suitable for commercial cultivation.

At the Area Seed Multiplication Farm I visited I was shown samples of rope made from urena lobata (local name - fen fen) for their own requirements. Another fibre which they also produced, on a trial basis only, was Dashin (technical name not known) which I feel would also be suitable for weaving and manufacturing of bags.

Remarks

It is apparent that there is not enough urena lobata growing on a commercial scale in either of these districts to be able to give a constant supply to a bagging mill.

RECOMMENDATIONS

Implementation of a urena lobata fibre production project similar to the system being used by Aureol Tobacco Company to improve the qualtiy and yield of the tobacco leaf in Sierra Leone. The system has worked so well that the Company has not only ceased to import leaf but, in fact, exports its own local grown product.

The Aureol Tobacco Company financed and managed its own affairs, to begin with but, later, formed a subsidiary company called Rokel Tobacco Company, which is managed and operated at Makeni, as follows:-

1. Farmers who wish to join the scheme are registered.

2. The farmer is encouraged to start off in a small way, say, with 1/10 acre, gradually increasing to, say, .5 or 1 acre.

3. The company, through its instructors, supplies all inputs to the farmer and a debit note is held on his account.

4. The instructor advises, supervises and generally assists the farmer in the sowing and planting, etc. He also organises the harvesting to enable the farmer to present the crop correctly to the market. The company provides transport and purchases all produce.

5. The produce is then weighed and the cost worked out. Cost of inputs, such as seed, fertiliser, equipment, etc. is then deducted, after which the farmer is paid.

At present, alongside the tobacco, the farmer is allowed to grow rice, groundnuts, or whatever, which is bought by the company, or could be purchased by the farmer at cost price. If, for instance, one bushel of rice seeds was supplied, then one bushel of rice is returned to the company, the balance being retained by the farmer.

The following is the company's management structure:-

i) A General Manager in overall charge.
ii) 1 Divisional Manager per 4860 acres.
iii) 1 Area Manager per 1620 acres.
iv) 1 Chief Instructor per 540 acres.
v) 1 Senior Instructor per 180 acres.
vi) 1 Instructor per 60 acres.

Since the farmer is permitted to grow a subsidiary crop alongside the tobacco, Rokel Tobacco Company could be requested to grow a small quantity of urena lobata for trial purposes which would enable us to assess and highlight problems, if any.

## C. Production Cost for Cultivating 3 acres of Urena Lobata

**Assumptions**

| | | |
|---|---|---|
| 1 month | = | 26 working days |
| Yield per acre | = | 800 lbs |
| Acreage required to produce 1 ton | = | $\frac{2240}{800} = 2.8 = 3$ acres |
| Daily wage | = | Le 50 per manday |
| Production period | = | 5 months |

**Labour Cost**

| | | |
|---|---|---|
| Production cost | = | 1 man x 5 months x Le 50 = Le 6,500 |
| Retting, washing | = | 2 helpers x Le 50 x 21 days = Le2,100 |
| Drying and bundling | = | 3 men x 3 days x Le 50 = Le 450 |

**Additional Input**

| | | |
|---|---|---|
| 2 bags fertiliser (50 kg/acre) at Le 1,000 per bag for 3 acres | = | Le 6,000 |

**Seed Production Cost**

| | | |
|---|---|---|
| Spacing during field planting | = | 6' x 6' or 1210 seedlings per acre |
| Assuming even 50% germination | | |
| Total amount of seed required | = | 1210 x 2 x 3 (acres) = 7260/3 acres |
| Seed collection cost | = | 2 mandays |
| Processing cost | = | 3 mandays |
| Cost in Leones at Le 50 per day | = | Le 250/3 acres |

**Summary of cost**

| | | |
|---|---|---|
| Cost of growing crop | = | Le 6,500 |
| Harvesting, retting, washing | = | Le 2,100 |
| Drying and bundling | = | Le 450 |
| Fertiliser | = | Le 6,000 |
| Seed production | = | Le 250 |
| TOTAL | = | Le15,300 |

## III. MARKET SUPPLY AND DEMAND

The major importer is the Sierra Leone Produce Marketing Board (SLPMB), and the following are the total bags imported by them over the past three years:-

| Year | Qty. of Bales | Total No. of Sacks |
|---|---|---|
| 1987 | 2,600 | 780,000 |
| 1988 | 2,000 | 600,000 |
| 1989 | 2,127 | 638,100 |

Private companies, however, are now allowed to import bags and, in the latter part of 1989, Lewis & Peat Produce Ltd. imported 668 bales, or 200,400 sacks/bags, bringing the total for 1989 to 838,500 bags.

At present Sierra Leone is importing rice which comes in bags, except for shipments from the USA which are bulk supplied, along with empty new sacks which are then filled in by local contract labour here. It must be assumed, therefore, that a large percentage of these bags will eventually land in the open market; this also applies to sugar bags which are being imported privately for the sugar factory at Magbass.

There is, however, a possibility that, with the high cost of rice, more rice will be produced locally and therefore the number of these imported bags will correspondingly reduce. Enquiries are in hand to find out whether the sugar company would acccept indigenously manufactured bags.

The following information was obtained from the Director, Projects Evaluation and Monitoring Service Unit in connection with the movement and storing of produce throughout Sierra Leone (coffee and cocoa excluded):-

| Produce | Annual Production | Year | Bags Required |
|---|---|---|---|
| Maize | 11,000 tons | 1987/88 | 200,000 |
| Millet | 20,000 " | " | 400,000 |
| Rice (husk) | 480,000 " | " | 9,600,000 |
| Cocoa yams | 22,000 " | 1988/89 | 440,000 |
| Fish | 75,000 " | " | 1,500,000 |
| Cassava | 115,000 " | 1987/88 | 2,300,000 |
| Potatoes | 14,000 " | 1988/89 | 280,000 |
| Groundnuts | 19,000 " | " | 380,000 |
| Sugar | 6,000 " | " | 120,000 |
| Ginger | 1,200 " | " | 24,000 |
| Palm kernel | 37,000 " | " | 740,000 |
| | 800,200 tons | | 16,004,000 bags |

If the above figures are correct, we could take the grand total of 16 million bags and divide it by three (years), which would give us 5.3 million or, say, 5 million bags per year, and if we are to take a replacement ratio of, say, 30% - which is considered reasonable for wear and tear - this would give a market requirement of 1.5 million bags per year. This figure, therefore, along with the present export figures (on page 8) means that Sierra Leone itself has a market potential for over 2 million bags per annum.

Discussions were held with the representatives of the Mano River Union to establish their bag requirements but up to the time of this report there has been no further response.

There is certainly a market for 2 million bags per annum in Sierra Leone, which will increase considerably once the agricultural yield of produce improves.

## IV. PROJECT LOCATION

At present there is a policy for decentralising industrial development away from Freetown, and it has been suggested that a factory which was sited where the urena lobata grew in abundance would have its advantages, such as the areas of Binkolo and Mambolo.

It must, however, be taken into account that the factory will require, initially, to import raw material over quite a considerable period and therefore the availability of a deep water port is essential. The length of time this facility will be required will largely depend on the successful growing of the urena fibre and ultimately its market price per ton, in comparison to imported fibre.

### A. Binkolo District

This area is situated northeast of Freetown, a distance of approximately 121 miles of reasonably surfaced roads. The nearest provincial town is Makeni - only 10 miles before Binkolo - which has the necessary facilities such as water, drainage and electric power supply. The power supply, however, is irregular owing to overloading and therefore a bagging factory would only aggravate this problem.

The facilities at Binkolo are very poor at present; there is no mainline water supply, no power, nor any drainage system. However, a water line is being laid from Makeni and a project is in hand to build a power station which is expected to be completed in about two years' time.

#### Transport/Communication

The nearest deep water port for thisarea is at Pepel which has only a small gauge railway, carrying iron ore from Port Loko (not a seaport) to Port Pepel, a distance of 25 miles. There is no road link with Pepel and therefore to import jute bales by this way could be just as costly as by Freetown owing to the extra unloading and loading costs, plus railway charges which would be incurred at Port Loko.

If, however, it is decided to build a factory in this area, the following will be the land and building requirements:-

| | |
|---|---|
| Main factory | $3000m^2$ |
| Office/Store | $400m^2$ |
| Raw material warehouse | $945m^2$ |
| | $4345m^2$ |
| Land | 4 to 5 acres |

There would seem to be a sufficient number of people in the area who could be recruited.

B. Mambolo District

This area is situated northwest of Freetown, a distance of approximately 120 miles on a reasonably surfaced road as far as Port Loko, after which it slowly deteriorates until it is only a rough track which apparently becomes unusable during the rainy season.

The facilities at Mambolo are very poor indeed, with only a few hand-pump wells for water, no drainage nor electric power, and there is no likelihood of any in the near future. It was observed, however, that there is a boat service from Mambolo to Freetown, 4 or 5 hours away, depending on the tides. Therefore it can be assumed that material could quite easily be conveyed to Freetown at a relatively low cost.

To build a factory at Mambolo would not be suitable.

C. Port Loko

Port Loko has all the necessary facilities, such as water, drainage and electric power though, because of heavy demand, a constant supply of electricity is not available and this situation is likely to continue for a considerable period. Port Loko has the added advantage

of being in close proximity to Port Pepel and is well situated with the main roads to Makeni and Binkolo.

If it is decided to build a factory in this area, similar land and building requirements will be applicable as for the Binkolo district.

## D. Freetown

The old factory site is situated in the industrial area of Freetown and consists of the following:-

| Buildings | Construction | Floor | Size |
|---|---|---|---|
| 2 Warehouses | Brick | Concrete | 47m x 22m x 8m each |
| 1 Office/quarters | Brick | Concrete | 26.12 x 15.46 x 2 (Top and bottom) |

Facilities Power and water connections.

Communications The major road connecting Freetown with other up-country towns, via Waterlook, passes this site. Freetown harbour is only a few miles away.

Total ground area - 2.5 acres.

Building requirements

| | |
|---|---|
| Main factory building | 100m x 30m |
| Warehouse for raw material | 31.5m x 20m |

Remarks

1. The existing two warehouses would require to be joined and extended to acccommodate the extra processing machinery. The present floor area will require to be levelled.

2. A part of the office building could be converted into a store.

3. As there are quite a number of small workshops in the vicinity which could be utilised by the factory, the immediate requirement for a full workshop will not be necessary.

4. An area of approximately 1 to 1.5 acres which is lying vacant beside the existing property could be purchased if required.

## V. FACTORY DETAILS

### A. Present Machinery Position

It is well over ten years that the factory has ceased to operate, and the only machine left installed from that period is the John Shaw Baling Press. The remaining machines were stored when the factory was converted into a warehouse. All the machines have been located and will require to be checked and repaired where necessary; the availability of spare parts is being looked into.

Below is a list of existing machinery and equipment:-

1 Printing Machine
1 Hydraulic Press
17 Heavy Duty Sewing Machines
1 Air Compressor
1 Cutting Machine
1 Forklift Truck (medium size - unserviceable)

## B. Machinery requirements for the Production of 2 million 'B' Twill Sacks per annum

Factory to operate 3 shifts per day, each shift of 7½ hours, 300 days per annum.

### 'B' Twill Sacks Specification

| | | |
|---|---|---|
| Length of sack | = 44" | (111.76 cm) |
| Width of sack | = 26½" | ( 67.3 cm) |
| Weight of sack | = 2.25 lbs | (1.02 kgs ) |
| Weight of weft (light yarn) | = 12 lbs | (410 tex ) |
| Weight of warp (heavy yarn) | = 32 lbs | (1,100 tex) |
| Cloth cut length per sack | = 91" | (231.14 cm) |

### Production Requirements

### Working Hours

3 shifts x 7½ hours x 300 days = 6,750 hours per year

### Sack Requirements

'B' Twill sack contains 60% heavy yarn and 40% light yarn.

2,000,000 sacks x 1.02 kgs per sack = 2,040,00 kgs/annum

$\frac{2,040,000 \text{ kgs per annum}}{6,750 \text{ hours per annum}}$ = 302.22 kgs/hour

60% of 302.22 kgs = 181.33 kgs/hour heavy yarn

40% of 302.22 kgs = 120.89 kgs/hour light yarn

An allowance of 10% must be made for waste and maintenance on heavy yarn.

Therefore: 181.33 kgs + 10% = 199.46 say, 200 kgs/hour heavy yarn.

An allowance of 7½% must be made for waste and maintenance on light yarn.

Therefore, 120.89 kgs + 7½% = 129.95 say, 130 kgs/hour light yarn.

Total heavy yarn required per hour = 200 kgs

Total light yarn required per hour = 130 kgs

330 kgs

Sacks required per hour

2,000,000 sacks per annum
6,750 hours per annum = 296.29 sacks/hour

Machinery requirements

1 - O.D. Automatic Batch Mixer for mixing and supplying of batching emulsion to fibre softener.

1 - 64 Pair Roller Softener to process jute or kenaf fibre.

Carding: Heavy and light yarn = 330 kgs per hour

As local fibre will become available a Three Card System is required.

First Passage Card can produce 330 kgs per hour.

Therefore $\frac{330}{330}$ kgs required / kgs per machine = 1.00 machines

Require therefore: 1 - First Passage Card - hand feed.

Inter. Passage Card can produce 200 kgs per hour.

Therefore $\frac{330}{200}$ kgs required / kgs per machine = 1.65 machines

Require therefore: 2 - Inter. Passage Cards.

Finisher Card can produce 200 kgs per hour.

Therefore $\frac{330}{200}$ kgs required / kgs per machine = 1.65 machines

Require therefore: 2 - Finisher Cards.

Drawing — 130 kgs per hour

Light yarn

First Passage Drawing Frame can produce 165 kgs/hour

Therefore $\frac{130}{165}$ kgs required per machine = 0.78 machines

Require therefore: 1 - First Passage Drawing Frame

Second Passage Drawing Frame can produce 165 kgs/hour

Therefore $\frac{130}{165}$ kgs required per machine = 0.78 machines

Require therefore: 1 - Second Passage Drawing Frame

Finisher Drawing Frame can produce 165 kgs per hour.

Therefore $\frac{130}{165}$ kgs required per machine = 0.78 machines

Require therefore: 1 - Finisher Drawing Frame

Heavy Yarn = 200 kgs per hour

First Passage Drawing Frame can produce 165 kgs/hour

Therefore $\frac{200}{165}$ kgs required per machine = 1.21 machines

Require therefore: 2 - First Passage Drawing Frames

Finisher Drawing Frame can produce 165 kgs per hour

Therefore $\frac{200}{166}$ kgs required per machine = 1.21 machines

Require therefore: 2 - Finisher Drawing Frames.

Spinning - Light Yarn — 130 kgs per hour.

12 lbs light yarn (410 Tex) on 4.3/4" Apron Draft Spinning Frame

$\frac{950 \times 60 \times 85 \times 12}{36 \times 100 \times 14400 \times 2}$ = 0.56 kgs/spdl/hr.

Therefore $\frac{130}{0.56}$ kgs required per spindle = 232.14 spindles

$\frac{232.14}{96}$ spindles required / spindles per machine = 2.42 machines

Require therefore: 3 - 4.3/4" Apron Draft Spinning Frames

Heavy Yarn — 200 kgs per hour

32 lbs heavy yarn (1100 tex) on 5½" Sliver Spg. Frame

$\frac{850 \times 60 \times 85 \times 32}{36 \times 100 \times 14,400 \times 2.2}$ = 1.21 kgs/spdl/hr.

Therefore $\frac{200}{1.21}$ kgs required per spindle = 165.28 spindles

$\frac{165.28}{80}$ spindles required / spindles per machine = 2.06

Require therefore: 2 - 5½" Sliver Spinning Frames.

Winding: Light Yarn — 130 kgs per hour.

12 lbs light yarn (410 tex)

$\frac{450 \times 60 \times 60 \times 12}{100 \times 14,400 \times 2.2}$ = 6.13 kgs/spdl/hr

Therefore $\frac{130}{6.13}$ kgs required per spindle = 21.20 spindles

$\frac{21.20}{32}$ spindles required / spindles per machine = 0.66 machines

Require therefore: 1 - 32 Spindle Mackroll Winder

Heavy Yarn = 200 kgs per hour

32 lbs heavy yarn (1,100 tex)

$\frac{200 \times 60 \times 60 \times 32}{100 \times 14{,}400 \times 2.2}$ = 7.27 kgs/spl/hr

Therefore $\frac{200 \text{ kgs required}}{7.27 \text{ kgs per spindle}}$ = 27.51 spindles

$\frac{27.51 \text{ spindles}}{32 \text{ spindles per m/c}}$ = 0.85 machine

Require therefore: 1 - 32 spindle Mackroll Winder

Cloth yardage

Sacks per hour required = 296.29

$\frac{246.29 \times 91"}{36}$ cut length/sack = 748.95 yards/hr (684.83 meters) per hour

$\frac{748.95}{60}$ (684.83 meters) per hour required = 12.48 yards/minute (11.41 meters) per hour

Beaming

933A Dry Beamer can produce 1,600 yards (1463 meters) per hour

Therefore $\frac{719.07 \text{ meters including 5\% Corrugation required}}{1{,}463 \text{ meters per machine}}$ = 0.50 machine

Require therefore: 1 - 933A Dry Beamer

1 - 280 End Floor Creel

MLS 840 Loom on 'B' twill cloth

$\frac{210 \times 60 \times 75 \times 2}{8 \times 36 \times 100}$ = 65.62 yards/loom/hr
(60.00 mts)/loom/hr

Therefore $\frac{684.83}{60}$ meters required = 11.41 machines
meters per machine

To allow for down time, etc., the following is proposed:

12 - MLS 840 Looms
1 - Faking & Measuring Machine
24 - Long Cloth Roll up Units.

Damping

Damping machine can produce at 110 yards (100.58m) per min.

Therefore $\frac{11.41}{100.58}$ meters required = 0.11 machines
meters per machine

Require therefore: 1 - 66" Damping Machine

Calendering

Calender can operate at 24 yards (21.94 meters) per minute on single width cloth, but by passing two widths through simultaneously, machine can give 48 yards (43.88 meters) per minute.

Therefore $\frac{11.41}{43.88}$ meters required = 0.26 machines
meters per machine

Require therefore: 1 - Cloth Calendering Machine.

Cloth cutting

Machine can produce 7.9 cuts or sack lengths per minute on single cloth, but by passing through two widths of cloth simultaneously, machine will give 15.8 cuts or sack lengths per minute.

Total sacks required per minute = $\frac{296.29}{60}$ = 4.93 sacks

Therefore $\frac{4.93}{15.8}$ cuts (sacks) required = 0.31 machines
cuts (sacks) per m/c

Require therefore: 1 - Cloth Cutting Machine

Hemming

'B' twill sacks are hemmed at the mouth.

Hemming machine can hem 150 sacks per hour.

Therefore $\frac{296.29 \text{ sacks required}}{120 \text{ sacks per machine}}$ = 2.46 machines

To allow for Special Maintenance System on hemming m/c.

Propose: 4 - Hemming Machines + Tables

Overseaming

'B' twill sacks are overseamed at sides.

Overseaming machine can seam 80 sacks per hour.

Therefore $\frac{296.29 \text{ sacks required}}{80}$ = 3.70 machines

To allow for Special Maintenance System on overseaming m/c

Propose: 5 - Overseaming Machines + Tables

Printing

Two-Colour Sack Printing machine can brand 900 sacks per hour

Therefore $\frac{296.29 \text{ sacks required}}{900 \text{ sacks per machine}}$ = 0.32 machines

Require therefore: 1 - Two Colour Sack Printing m/c.

With the spinning production averaging 80% and weaving 75%, the finished bag production will be approximately:-

296.29 bags per hour x 22.5 hrs. = 6666.525 per day

Therefore 6666.525 bags per day x 25 days = 166663.12 per month

Therefore 166663.12 bags per month x 12 months = 1999957.4 bags/year

## C. List of Machinery

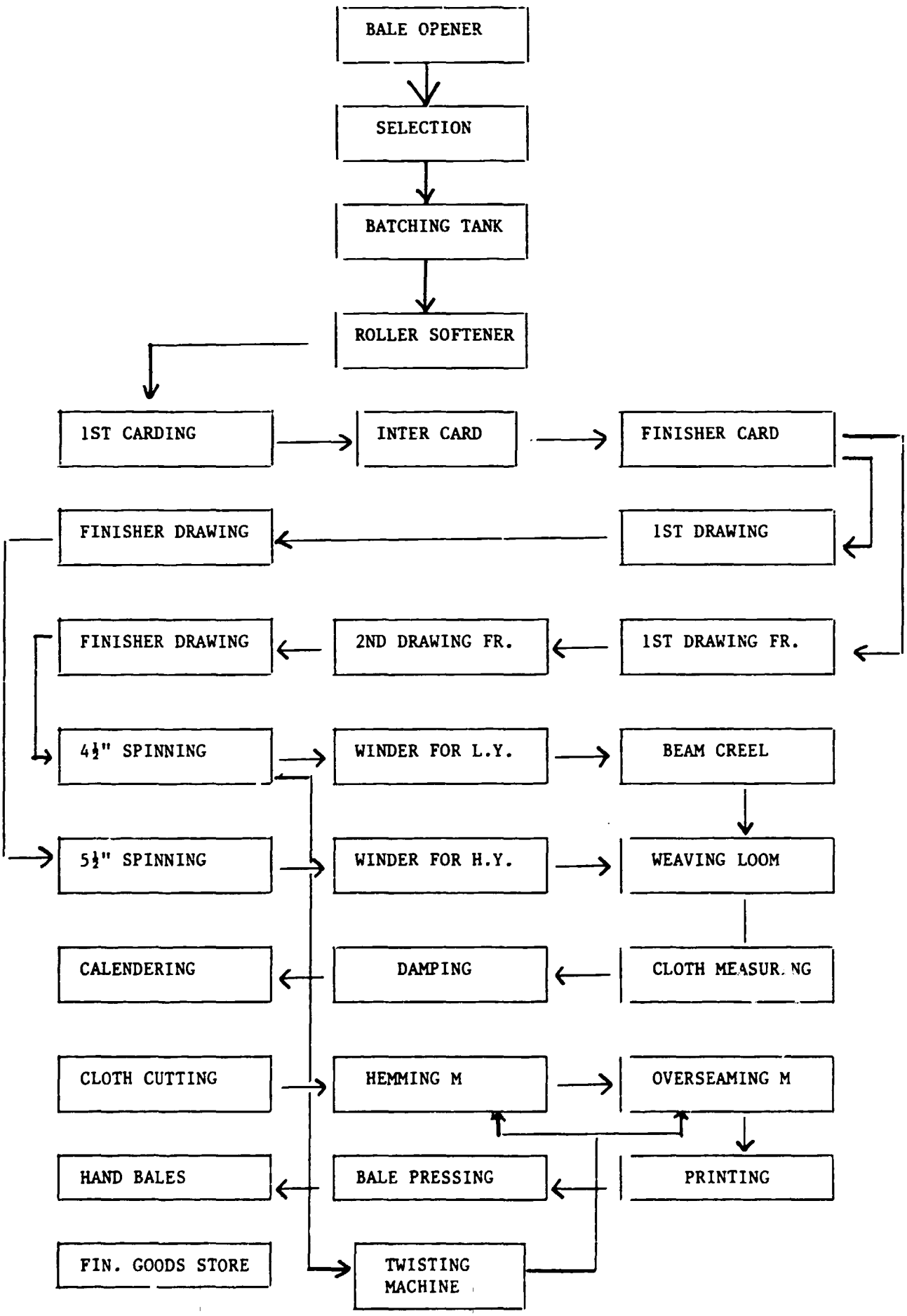
| Machinery | Quantity |
|---|---|
| O D Batch Mixer | 1 |
| 64 Pair Roller Softener | 1 |
| First Passage Card | 1 |
| Inter. Cards | 2 |
| Finisher Cards | 2 |
| First Drawing Frame L.Y. | 1 |
| Second Drawing Frame L.Y. | 1 |
| Finisher Drawing Frame L.Y. | 1 |
| First Drawing Frame H.Y. | 2 |
| Finisher Drawing Frame H.Y. | 2 |
| 4 3/4" Apron Draft Spinning Frames | 3 |
| 5½" Slip Draft Spinning Frames | 2 |
| 32 Spindle Mackroll Winder L.Y. | 1 |
| 32 Spindle Mackroll Winder H.Y. | 1 |
| 933 Dry Beamer | 1 |
| 280 End Floor Creel | 1 |
| MLS Looms | 12 |
| Long Cloth Roll Ups | 24 |
| Faking and Measuring Machine | 1 |
| Damping Machine | 1 |
| Calender | 1 |
| Cutting Machine | 1 |
| Hemming Machines (in hand) | 4 |
| Overseaming Machines | 5 |
| Printing Machine (in hand) | 1 |
| 5½" x 80 T.D. Flyer Twister | 1 |
| Baling Press (in hand) | 1 |
| S.S. Power Reel | 1 |
| Friction Disc Washing Machine | 1 |
| 100 cu.ft. Air Compressors (1 in hand) | 2 |

## D. Production Process

The production process of bag making is divided into six main processes, namely, batching, carding, drawing, spinning, weaving and finishing. The fibre is received in a form of a compressed bale weighing 400 lbs. It is passed through a softener for initial treatment using emulsion oils for reducing abrasive properties of the fibre and then a carding breaking process to standardise fibre length.

After the above processes,the usual operation of spinning of the warps and weft for weaving on modern automated flat/round looms resulting in woven jute cloth. This would then be passed through damping, cutting, hemming and printing machines where bags would be printed according to end use requirements.

PROCESS PRODUCTION CHART



## VII. PRODUCTION MACHINERY POWER REQUIREMENTS

| | MACHINERY | H.P. EACH | TOTAL CONNECTED H.P. |
|---|---|---|---|
| 1 | O.D. Batch Mixer | 2.50 | 2.50 |
| 1 | Softener | 20.00 | 20.00 |
| 1 | First Passage | 20.00 | 20.00 |
| 2 | Inter Cards | 15.00 | 30.00 |
| 2 | Finisher Cards | 10.00 | 20.00 |
| 1 | 1st Drawing L.Y. | 5.50 | 5.50 |
| 1 | 2nd Drawing L.Y. | 5.50 | 5.50 |
| 1 | Finisher Drawing L.Y. | 5.50 | 5.50 |
| 2 | 1st Drawing H.Y. | 5.50 | 11.00 |
| 2 | Finisher Drawing H.Y. | 5.50 | 11.00 |
| 3 | 4 3/4"Apron Draft Spinning | 25.00 | 75.00 |
| 2 | 5½" Slip Draft Spinning | 20.00 | 40.00 |
| 2 | 32 Spindle Roll Winders | 5.50 | 11.00 |
| 1 | Dry Beamer | 13.00 | 13.00 |
| 1 | Creel | 0.33 | 0.33 |
| 12 | MLS Looms | 5.50 | 66.00 |
| 24 | Long Cloth Roll-ups | 0.50 | 12.00 |
| 1 | Faking and Measuring Machine | 1.50 | 1.50 |
| 1 | Damping Machine | 2.00 | 2.00 |
| 1 | Calender | 12.00 | 12.00 |
| 1 | Cutting Machine | 3.00 | 3.00 |
| 4 | Hemming Machines | 0.50 | 2.00 |
| 5 | Overseaming Machines | 0.50 | 2.50 |
| 1 | Printing Machine | 3.00 | 3.00 |
| 1 | Baling Press | 20.00 | 20.00 |
| 1 | 5½" x 30 Flyer Twister | 20.00 | 20.00 |
| 1 | S.S. Power Reel | 1.00 | 1.00 |
| 2 | Air Compressors | 30.00 | 60.00 |
| 20 | Humidifiers | 0.75 | 15.00 |
| | | Total connected H.P. = | 490.33 |
| | Plus 15% for Lighting and Services | = | 73.55 |
| | Grand Total | = | 563.88 |

| | | |
|---|---|---|
| B.F. Grand Total | = | 563.88 |
| 563.88 H.P. x .746 | = | 420.65 kw |
| Taking a diversity factor of 0.75, the actual loads | = | 315.49 kw. |
| Therefore Total K.W. required | = | 315.49 |

The manufacturers and suppliers of the above machinery are James Mackie & Sons Ltd., P.O.Box 149, Belfast BT12 7ED, Northern Ireland, U.K.

## VIII. WATER REQUIREMENTS

### O.D. Batch Mixer

| | | |
|---|---|---|
| Factory production | = | 330 kgs |
| Batching emulsion | = | 30% |
| 30% of 330 kgs | = | 99 kgs |
| 79% of emulsion is water | = | 78.21 kgs |
| 78.21 kgs | = | 78.21 litres/hour |
| 78.21 litres/hour x 22.5 | = | 1,759.72 lts/day |

### Damping Machine

| | | |
|---|---|---|
| Water is applied to cloth at 4% | | |
| 4% of 330 | = | 13.2 kgs |
| 13.2 kgs | = | 13.2 litres/hour |
| 13.2 litres x 22.5 | = | 297 litres/day |

### Domestic

Allow 69 litres per day per person employed.

## IX. CAPITAL COSTS

### A. Land Purchase and Developments

and

### B. Buildings

Quotations not received to date but estimated at $2,000,000.

### C. Factory

| | Cost | Total |
|---|---|---|
| | $ | $ |
| Processing machinery | 6,171,206 | |
| Laboratory equipment | 24,000 | |
| Weighing scales | 38,400 | |
| Air compressors | 38,400 | |
| Workshop equipment | 40,000 | |
| Forklift truck | 40,000 | 6,352,000 |

### D. Pre-operating Expenses

| | | |
|---|---|---|
| Installation costs | 48,000 | 6,400,000 |

## X. RAW MATERIAL AND COSTS

The following types and quantities of jute fibre shall be required:-

Sack construction 'B' Twill.

Light Yarn 12 lbs = 40% of sack
Heavy Yarn 32 lbs = 60% of sack
Fibre Blend Light Yarn 12 lbs
50% long fibre-jute - medium grade type BWD
50% cuttings or low grade fibre type BWCB
Fibre Blend Heavy Yarn 32 lbs
15% long fibre-jute - medium grade type BWD
85% cuttings, ropes - low grade long type BWCB

Details of calculations are shown in Annex 3.

Quantity of fibre required:

| | | |
|---|---|---|
| Type BWD | - | 603.2 tons |
| Type BWCB | - | 1476.8 tons |
| Total requirements | - | 2080.0 tons. |

This includes an allowance of 4% process loss.

Costing

| | | |
|---|---|---|
| Type BWD at US$ 410 FOB per ton | | |
| Therefore 603.2 x 410 | = | $ 247,312 |
| Type BWCB at $ 230 per ton | | |
| Therefore 1476.8 x 230 | = | $ 339,664 |
| Total FOB Freetown | = | $ 586,976 |
| Freight and Insurance 5% | = | $ 29,348 |
| CIF cost | = | $ 616,324 |

## XI. WORKING CAPITAL

The working capital requirements have been estimated on the basis of the following:-

Finished Goods Stock

This has been set at one month's production.

Raw Material Stocks

Stocks of six months have been used.

Consumables Stock

A stock level of one month at replacement rate has been used.

## XII OPERATION OF FACTORY

### Labour

The working hours of the factory will be as follows:-

| | |
|---|---|
| Working hours per shift | 7½ |
| Total number of shifts per day | 3 |
| Total number of hours per day | 22.5 |
| Annual working days | 300 |
| Working hours per year | 6750 |
| Total number of employees: | 419 |

Placement of workers is as follows:-

| No. | Placement | Person | Total | Cost per person | Total Le |
|---|---|---|---|---|---|
| 1 | General Manager | 1 | 1 | 25,000 | 25,000 |
| 2 | Technical Manager | 1 | 1 | 15,000 | 15,000 |
| 3 | Engineer | 1 | 1 | 10,000 | 10,000 |
| 4 | Accountant | 1 | 1 | 8,000 | 8,000 |
| 5 | General Office | 14 | 14 | 4,000 | 56,000 |
| 6 | Supervisors | 10 | 10 | 4,100 | 41,000 |
| 7 | Skilled labour | 115 | 115 | 3,500 | 402,500 |
| 8 | Unskilled labour | 225 | 225 | 2,700 | 607,500 |
| 9 | Miscellaneous skilled | 26 | 26 | 3,350 | 87,100 |
| 10 | Miscellaneous unskilled | 25 | 25 | 2,700 | 67,500 |
| | | 419 | 419 | - | 1,319,600 |

Monthly salary bill = $\frac{\text{Le } 1,319,600}{120}$ = $ 10,996

Annual salary bill = $\frac{\text{Le } 15,835,200}{120}$ = $ 131,960

Details on Labour Loading see Annex 2

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Labour wages obtained from the Ministry of Labour

Direct Labour Costs

The direct labour costs extracted from the data above amounts to
Le 13,976,160 per annum = $ 116,468

Indirect Labour Costs

These amount to Le 1,859,040 per annum = $ 15,492

Overheads

These amount to Le 3,000,960 per annum = $ 25,008

Insurance

This amounts to Le 3,839,040 per annum = $ 31,992

Electric Power

Power will be available from National Power Authority.

| | | | |
|---|---|---|---|
| Consumption per hour | | 315 kw/hr | |
| Hours per shift | | 7½ hours | |
| Number of shifts | | 3 | |
| Consumption per day | | 7087.5 | |
| Cost per unit | | 14 | |
| Cost for 3 shifts | | 99,225 | |
| Working days per month | | x 25 | |
| Total cost per month | = | Le 2,480,625 | or $20,671 |
| Months per year | | x 12 | |
| Annual cost | = | Le 29,767,500 | or $248,062.5 |

Water

Water will be available from the Guma Valley Water Company (GVWC).

Le 160 per 1000 gallons

| | | |
|---|---|---|
| Therefore consumption for processing per day | = | 452.02 galls. |
| Domestic per day | = | 2762.63 galls. |
| | | 3214.65 galls. |
| Therefore $\frac{3214.65}{1000}$ | = | 3.21 x 160 rate |
| Cost per day | = | Le 513.6 |
| Working days per month | | x 25 |
| Cost per month | = | Le 12840 or $107 |
| Months per year | | x 12 |
| Annual cost | = | Le154080 or $1284 |

Consumables

This is largely the cost of grease, batch oil, emulsifier and lubricating oil andhas been estimated at $64,572 per annum. Details are as follows:-

| | | |
|---|---|---|
| Batch oil | = | $ 45600 |
| Emulsifier | = | $ 6480 |
| Lubricating oil and grease | | $ 12492 |
| | | $ 64572 |
| Repairs and Maintenance | = | $ 41340 |

With new machines and a good preventive maintenance programme, cost should be minimum. However, this figure will increase considerably after the first twelve months.

Depreciation

A depreciation rate of 1%, instead of 10%, has been used for machinery only.

Packing Cost

An allowance has been made to cover this.

Marketing Cost

An allowance has been made to cover this cost. The Company should sell direct to the market to obtain maximum profit.

Transport Cost

An allowance has been made to cover this. It is suggested that all movement of goods should be undertaken by contractors.

## XIII. INTEREST ON LOAN (MACHINERY)

A very low market rate of 10% interest has been taken into account. Sierra Leone, being a member of the Commonwealth, could possibly be eligible for a concessionary loan from the United Kingdom if the machinery was purchased from Belfast.

## XIV. ANALYSIS OF MONTHLY RUNNING COSTS

(A)

| Variable Cost | Amount | Per Ton | % |
|---|---|---|---|
| Raw jute | $ 51,348 | $ 296.30 | 30.8 |
| J B O | 3,800 | 21.92 | 2.23 |
| Nonidet | 540 | 3.11 | 0.31 |
| Workers wages | 9,705 | 56.00 | 5.70 |
| Workers Provident Fund | 486 | 2.80 | 0.28 |
| Stores consumption | 3,125 | 18.03 | 1.83 |
| Lubricants | 1,040 | 6.00 | 0.61 |
| Repairing charges | 320 | 1.84 | 0.18 |
| Power consumption | 20,671 | 119,27 | 12.15 |
| Water consumption | 107 | 0.61 | 0.06 |
| Packing cost | 1,500 | 8.65 | 0.88 |
| Marketing cost | 500 | 2.88 | 0.29 |
| Transport cost | 2,083 | 12.01 | 1.22 |
| Interest on working capital | 10,086 | 58.24 | 5.94 |
| Factory/Admin. overheads | 2,084 | 12.01 | 1.22 |
| TOTAL (A) | $ 107,405 | $ 619.67 | 63.08% |

(B)

Fixed Cost

| | | | |
|---|---|---|---|
| Salaries | $ 1,291 | $ 7.44 | 0.75 |
| Provident Fund | 68 | 0.39 | 0.03 |
| Depreciation at 1% | 5,333 | 30.77 | 3.13 |
| Insurance | 2,666 | 15.38 | 1.56 |
| Interest on loan at 10% | 53,333 | 307.74 | 31.35 |
| TOTAL (B) | $ 62,691 | $ 361.72 | 36.82% |
| Total cost (A + B) | $ 170,096 | $ 981.39 | 99.9% |

Total bag production per ton = 995

Present cost per ton = $ 981.39

Therefore $ $\frac{981.39}{995}$ = $ 0.98 per bag, say, $1

Total bag production per month = 166,663.12

Therefore 166,663.12 x Le 140 sale price per bag = Le 23,332,836

Therefore Le $\frac{23,332,836}{120}$ ($ rate) = $ 194,440.3 sale value

Therefore $ 194,440.3 - $ 170,096 mfg cost= $ 24,344.3 profit per month

## XV. CONCLUSION

It is clear from the running cost analysis that the return on capital investment will be negative. Normally, raw material usually represents 45 to 50% of the cost of manufacture but this balance has been altered, mainly due to high interest repayment for machinery and, therefore, unless this figure can be reduced it would not be a commercially feasible operation.

There is a possibility, however, of reducing this cost by applying for concessionary loan terms from the EEC, the United Kingdom or the Commonwealth Fund For Technical Co-operation. Another possibility is to purchase reconditioned or second-hand machinery if available.

However, taking a long term view, and with the possibility of reduced interest rates, a bagging factory would become a viable unit once the local fibre became readily available at a competitive price.

ANNEX 1

## Details of Raw Jute Requirements

2,000,000 sacks x 1 kg per sack = 2000 tons of fibre per annum + 4% process loss

Sack construction: 'B' Twill

Light Yarn - 12 lbs - 410 TEX = 40% of sack
Heavy Yarn - 32 lbs -1100 TEX = 60% of sack

Fibre Blend - Light Yarn - 410 TEX/12 lbs

50% Long fibre Jute/Kenaf - medium grade - Type BWD
50% Cuttings or low grade fibre - Type BWCB

Fibre Blend - Heavy Yarn - 1100 TEX/32 lbs

15% Long Fibre - Jute Kenaf - medium grade - Type BWD
85% Cuttings, ropes or low grade long fibre - Type BWCB

Quantity of Fibre

2080 tons x 40% = 832 tons - Light Yarn - 410 TEX
2000 tons x 60% = 1248 tons - Heavy Yarn - 1100 TEX

Light Yarn - 12 lb/410 TEX = 832 tons
832 tons x 50% = 416 tons of fibre - Type BWD
832 tons x 50% = 416 tons of fibre - Type BWCB

Heavy Yarn

32 lbs/1100 TEX - 1248 tons
1248 tons x 15% = 187.2 tons of fibre - Type BWD
1248 tons x 85% = 1060.8 tons of fibre - Type BWCB

Total Fibre required

Type BWD = 416 tons plus 187.2 tons = 603.2 tons
Type BWCB = 416 tons plus 1060.8 tons = 1476.8 tons
Total 2080.0 tons

Prices used are average prices for the period January to March from R.E.B. Willcox Ltd., London, U.K. dated 15.2.1990.

ANNEX 2

## Labour Loading

1st, 2nd, 3rd = shifts per Day

| Department | Unskilled | | | | Skilled | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total |
| Raw material stores | 3 | 3 | 3 | 9 | - | - | - | - |
| Transporting raw material from stores to mill | 2 | 2 | 2 | 6 | - | - | - | - |
| Fibre sorting and stricting | 3 | 3 | 3 | 9 | - | - | - | - |
| O D Batch Mixer | Operation of machine can be checked periodically by supervision. Emulsion drum can be changed by oiler and fork lift driver. | | | | | | | |
| Softener | 3 | 3 | 3 | 9 | - | - | - | - |
| Transporting to maturing area and card dollop weighing | 3 | 3 | 3 | 9 | - | - | - | - |
| Cards | 5 | 5 | 5 | 15 | - | - | - | - |
| Drawing | 3 | 3 | 3 | 9 | - | - | - | - |
| Spinning | 6 | 6 | 6 | 18 | - | - | - | - |
| Winding | 9 | 9 | 9 | 27 | - | - | - | - |
| Twisting/Reeling | 1 | 1 | 1 | 3 | - | - | - | - |
| Roll transport/ storage | 2 | 2 | 2 | 6 | - | - | - | - |
| Beaming | 3 | 3 | 3 | 9 | - | - | - | - |
| Beam transport | 2 | 2 | 2 | 6 | - | - | - | - |
| Weaving | - | - | - | - | 6 | 6 | 6 | 18 |
| Beam Tiers | - | - | - | - | 2 | 2 | 2 | 6 |
| Cloth transport | 2 | 2 | 2 | 6 | - | - | - | - |
| Measuring, damping and calendering | 5 | 5 | 5 | 15 | - | - | - | - |
| Cloth cutting | 2 | 2 | 2 | 6 | - | - | - | - |
| Cloth transport | 2 | 2 | 2 | 6 | - | - | - | - |

ANNEX 2 (continued)

## Labour Loading

### 1st, 2nd, 3rd = shifts per day

| Department | Unskilled | | | | Skilled | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total |
| Sewing and hemming | - | - | - | - | 12 | 12 | 12 | 36 |
| Printing | 2 | 2 | 2 | 6 | - | - | - | - |
| Baling | 3 | 3 | 3 | 9 | - | - | - | - |
| Finished goods store | 3 | 3 | 3 | 9 | - | - | - | - |
| Factory cleaners | 4 | 4 | 4 | 12 | - | - | - | - |
| Oilers | 6 | - | 6 | 12 | - | - | - | - |
| Can and bobbin transportation | 3 | 3 | 3 | 9 | - | - | - | - |
| Engineering: Mechanics | | | | | | | | |
| Batching & carding | - | - | - | - | 2 | 2 | 2 | 6 |
| Preparing | - | - | - | - | 2 | 2 | 2 | 6 |
| Spinning & twisting | - | - | - | - | 1 | 1 | 1 | 3 |
| Winding & Beaming | - | - | - | - | 3 | 3 | 3 | 9 |
| Weaving | - | - | - | - | 3 | 3 | 3 | 9 |
| Finishing | - | - | - | - | 6 | 4 | 2 | 12 |
| Workshop | - | - | - | - | 6 | 4 | 2 | 12 |
| Electrical | - | - | - | - | 1 | 1 | 1 | 3 |
| Carpenter | - | - | - | - | 1 | - | - | 1 |
| Supervisors | | | | | | | | |
| Selecting fibre, batching & carding | - | - | - | - | 1 | 1 | 1 | 3 |
| Preparing, spinning, winding, reeling and twisting | - | - | - | - | 1 | 1 | 1 | 3 |

ANNEX 2 (continued)

## Labour Loading

1st, 2nd, 3rd = shifts per day

| Department | Unskilled | | | | Skilled | | | |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | Total | 1st | 2nd | 3rd | Total |
| Weaving & Finishing | - | - | - | - | 1 | 1 | 1 | 3 |
| Mechanical and Electrical | - | - | - | - | 1 | - | - | 1 |
| **Miscellaneous** | | | | | | | | |
| Gateman | 2 | 2 | 2 | 6 | - | - | - | - |
| Watchman(Security) | 4 | 4 | 4 | 12 | - | - | - | - |
| Stores Keeper | - | - | - | - | 4 | 4 | 4 | 12 |
| Weighing Clerks | - | - | - | - | 4 | 4 | 4 | 12 |
| Test House | - | - | - | - | 1 | - | 1 | 2 |
| Drivers (cars,etc) | 3 | 3 | 1 | 7 | - | - | - | - |
| Drivers (fork lift trucks) | - | - | - | - | 2 | 2 | 2 | 6 |

**Staff**

| | |
|---|---|
| General Manager | 1 |
| Technical Manager | 1 |
| Engineer | 1 |
| Accountant | 1 |
| General Office | 14 |

**Summary**

| | |
|---|---|
| Unskilled labour | 225 |
| Skilled labour | 115 |
| Supervisors | 10 |
| Staff | 18 |
| Miscellaneous: Skilled | 26 |
| Unskilled | 25 |
| Total | 419 |

ANNEX 3

## List of Persons Contacted

### GOVERNMENT

| | | |
|---|---|---|
| 1. | The Honourable Ben Kanu | Minister of Industry & State Enterprises |
| 2. | Mr A T Morgan | Director of Industries |
| 3. | Mr A J Jalloh | Actg. Deputy Director of Operations and Service Division |
| 4. | Mr M Bendu | Market Research Officer, Export Promotion Council |
| 5. | Dr S M B Kano | Director of Social Affairs |
| 6. | Dr Isaac Marve | Director of Economic Affairs, Mano River Division |
| 7. | Dr Kargbo | Director of PEMSU/Man R & F |
| 8. | Mr J B Mahoi | Commissioner, Ministry of Labour |
| 9. | Mr T Gaujah | Principal Inspector of Produce |
| 10. | Mr S Conteh | Manager, National Development Bank |
| 11. | Mr A Sanor | Manager, Accounts, SLPMB |
| 12. | Mr A E Turay | Manager, SLPMB |
| 13. | Mr A R Wurie | General Manager, SLPMB |
| 14. | Mr A Carew | Project Officer of National Authorising Office |
| 15. | Mr N Cole | Customs & Excise Controller |
| 16. | Mr Musa | Agriculturist, Newton Research Station |
| 17. | Mr B Johnstone | Agro-Economist |

### PRIVATE

| | | |
|---|---|---|
| 1. | Mr A Jalloh | Managing Director, Jute Products Co. Ltd. |
| 2. | Mr F C Jones | General Manager, James International |
| 3. | Mr M Taylor | Manager, Penguia Development & Finance |
| 4. | Mr M Dodge | Managing Director, Lewis & Peat |
| 5. | Mr M McNally | Manager, Finance, Aureol Tobacco Company |
| 6. | Mr C R Thorpe. | Senior Communications Officer, Magbass Sugar Company |
| 7. | Mr R Prasad | General Manager, Rokel Tobacco Company |
| 8. | Paramount Chief of Mambolo | |

ANNEX 3 (Continued)

AGENCIES

| | | |
|---|---|---|
| 1. | Mr K C Hall | FAO Chief TechnicalOfficer |
| 2. | Mr J Turay | FAO National Tree Planting Officer (Forestry) |
| 3. | Dr P Schroden | Manager, Seed Multiplication Project |
| 4. | Mr T Walters | VJO, Agricultural Project, Mambolo |
| 5. | Mr S Pattoo | Chief Technical Adviser, UNIDO |