

# Fibrous Raw Material Requirements for the Development of the Paper Industry in Sri Lanka

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## SUMMARY

This paper reviews the fibrous raw material requirements of Sri Lanka by 1980. Use of different fibrous raw materials like, agriculture residues, bagasse, hardwoods, kenaf and sunn hemp has been discussed and their merits with reference to Sri Lanka's requirements have been shown. It has been justified that by using different raw materials Sri Lanka could now be self reliant in its fibrous raw material requirements and there will be no need of importing wood pulp for the two mills now in operation. By using planted wood, Sri Lanka will now be producing newsprint and some speciality papers in the third proposed paper mill.

## INTRODUCTION

The pulp and paper industry is largely dependent on the vegetable kingdom for raw material. In the manufacture of paper, both woody as well as non-woody material are used. World's pulp production is mainly from woody materials and consists of 75% fibrous raw material, the balance 20% is in the form of waste paper and 5% is in the form of non-woody raw materials. The raw material that could be used for the development of the pulp and paper industry in Sri Lanka are :

1. Agricultural residues Straw, Bagasse
2. Hard woods Mixed tropical hard woods, Eucalyptus
3. Long fibre substitutes Kenaf and Sunn hemp
4. Long fibre material Conifers and Bamboo
5. Waste materials-Waste paper and textile waste.

The suitability of these raw material largely depend on the grade of paper, to be produced, the type of pulping process, the production capacity of the mill and the location of the mill. The raw material besides meeting the qualitative and quantitative requirements should be also available to the industry at the most economic price.

The techno-economic values of the raw material that are available for the paper industry and the projected demand to manufacture various grade of paper to achieve a total production of 120,000 tons of paper by 1980 is presented in this paper.

## AGRICULTURAL RESIDUES

### STRAW

Straw is used by countries which are short of

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woody materials for the manufacture of paper. Besides Sri Lanka, countries such as Indonesia, Egypt, Greece, Holland and Italy produce pulp from straw. Although there are advantages in using rice straw for paper making in view of its ready availability, there are various technological disadvantages such as its short fibre length, high transport cost being a bulky material, and high content of silica which gives rise to various difficulties in both pulping and paper making processes. On account of the poor drainage characteristics of the rice straw pulp as well as its poor strength properties, at least 30-35% of long-fibre pulp has to be used in the manufacture of writing and printing grades. Straw pulp is generally not considered suitable for making strong grades of paper such as Kraft paper for multi-wall bags on account of its poor strength properties. Pulp produced from straw could, however, be used for the manufacture of corrugated boxes as it improves crush resistance. It is also possible to use about 70-80% of straw pulp with 20-30% of long fibre pulp in the manufacture of corrugating medium.

The requirements of straw to manufacture 120,000 tons of paper and paper board by 1980 are estimated as follows :

	Requirements with restricted long fibre usage Tons (O.D)	Ideal requirements with maximum long fibre usage Tons (O.D.)
Valaichchenai Mill	19,400	9,000
Embilipitiya Mill	25,700	12,800
Third Mill	52,800	21,000
Total :	97,900	42,800

## BAGASSE

Bagasse is a by-product of the cane sugar industry. There are approximately 35 pulp and paper mills in the world using Bagasse as a basic raw material. Most of these mills are located in Latin America, India, Phillipine, Japan, Taiwan and some African countries. Most of the sugar mills burn bagasse as a boiler fuel for generating steam. Therefore the use of bagasse in pulp mills would depend mainly on the cost and availability of an alternative fuel for the sugar industry. In the case of Sri Lanka the economy of substituting bagasse by an alternative fuel such as liquid fuel or coal cannot be justified as they have to be imported using valuable foreign exchange. Bagasse could probably be considered as a raw material to the paper industry in Sri Lanka in the event we strike oil during exploration presently being carried out in this country. The disadvantages of Bagasse as a raw material in the paper industry are on account of its bulk and the high cost of transport. It is generally observed that transporting Bagasse from outside a distance of 50 miles of the factory is uneconomic. Besides, Bagasse is a seasonal crop and requires high cost of storage. Use of Bagasse as a raw material for the paper industry is well established where distance of transport is relatively short (i.e. 25 miles) from the Mill site and where a long crushing season and alternate fuels such as oil or natural gas to work the sugar mills are available.

## HARDWOODS

### MIXED TROPICAL HARDWOODS

The pulping of tropical hardwoods is complicated in view of the heterogeneous nature of the tropical forests in species and the problem associated with extraction of desired species within economic limits. However, due to the advance made in technology it is now possible to use 50% mixed tropical hardwoods along with long fibre material such as conifers and bamboos for the manufacture of different types of paper. The utilisation of mixed tropical hardwood is of interest to developing countries such as Sri Lanka. Already countries such as India, Columbia are successfully utilizing mixed tropical hardwoods for the manufacture of writings, printings and Kraft grades. Based on this new technology it might be possible to use indigenous mixed tropical hardwoods as a raw material for the paper industry in Sri Lanka.

The estimated requirements of mixed tropical hardwood are as follows :

	Requirements with restricted long fibre usage Tons (O.D.)	Ideal require- ments with maximum long fibre usage Tons (O.D.)
Valaichchenai Mill	—	—
Embilipitiya Mill	—	—
Third Mill	—	20,000
Total :		20,000

## RUBBER WOOD

Rubber wood has not yet established itself as raw material in the pulp and paper industry inspite of its ready availability in countries such as Sri Lanka, Thailand, Malaysia and Indonesia. The problem in the use of rubber wood is due to the difficulty caused by latex during paper manufacture. Intensive laboratory work has been done to solve this problem in Malaysia, Indonesia, India and Sri Lanka. Mill trials have also been made in certain countries after intensive research work on this problem and we in Sri Lanka too have conducted trials at our Valaichchenai Mills. These trials have confirmed the difficulties of using rubber wood on a commercial scale for pulp and paper manufacture. Rubber wood, like some hardwoods has an average fibre length of 1.55 mm. Even if the problem of latex is satisfactorily solved in the future, rubber wood, on account of other competitive uses in Sri Lanka such as in manufacture of furniture, chip board and as fuel for the low income group, would probably be an uneconomic raw material for the paper industry. The other disadvantages of rubber wood would be on account of its short fibre length requiring a high 20-50% of long fibre pulp for blending depending on the quality requirements of the paper.

## EUCALYPTUS

Australia is the pioneer in the use of Eucalyptus for the manufacture of paper. The paper mills in Australia are using this material to manufacture writing and printing using approximately 80 to 100% Eucalyptus pulp. In the case of Kraft grades adequate long fibre pulp is added to obtain the required strength properties and, in the case of newsprint, a higher percentage of long fibre chemical pulp is used to obtain runnability conditions on fast running newsprint machines. The mechanical pulp required for the newsprint is produced using a certain amount of chemical and is slightly different to the traditional method of producing mechanical pulp with pulping process such as the cold soda or chemi-ground process. One of the disadvantages in the use of Eucalyptus as a raw material is its fibre length. Being short fibred, it has to be blended with Conifers to produce different grades of paper. As far as Sri Lanka is concerned, Eucalyptus could be grown in the dry zone and could be, therefore, considered as an important woody material for the manufacture of newsprint and could be blended with chemical pulp produced from Conifers.

The requirements of Eucalyptus to produce 120,000 tons of paper is estimated as follows :

	Requirements with restricted long fibre usage Tons (O.D.)	Ideal require- ments with maximum long fibre usage Tons (O.D.)
Valaichchenai Mill	—	—
Embilipitiya Mill	—	—
Third Mill	30,000	30,000
Total :	30,000	30,000

## LONG FIBRE SUBSTITUTES

### KENAF

Due to the current difficulty in obtaining wood pulp as well as problems connected with foreign exchange, the pulp industry has been actively engaged during the last 2 to 3 years in developing a substitute pulp for imported long fibre wood pulp. The mill trials conducted by Eastern Paper Mills Corporation have indicated that kenaf pulp could partly replace the imported wood pulp. Technologically kenaf is a better raw material than straw for pulp and paper manufacture, but has certain disadvantages compared with long fibred woody materials such as conifers. Kenaf, however, could be considered as a partial substitute for long fibred pulp in developing countries such as Sri Lanka which are short of Conifers for the manufacture of paper. The requirements of Kenaf by 1980 to manufacture 120,000 tons of paper is estimated as follows :

	Requirements with restricted long fibre usage Tons (O.D.)	Ideal require- ments with maximum long fibre usage Tons (O.D.)
Valaichchenai Mill	—	5,800
Embilipitiya Mill	—	6,700
Third Mill	63,300	30,000
Total :	63,300	42,500

### SUNN HEMP

A mill in India known as Tribeni Tissues is using the best fibre of this material successfully to make high grade hard tissues as Cigarette, Carbonising, Air Mail etc. Sunn Hemp (*Crotalaria juncea*) grows to a height of 6 to 7 ft. under good cultivation conditions. It is the practice of the farmers to grow this as a green manure.

In our development programme, we have considered Sunn Hemp for the manufacture of hard tissues. To produce the estimated requirements of 3,000 tons of hard tissues per year the Sunn Hemp requirement is estimated at 18,000 tons per annum as Sunn Hemp straw.

	Requirements with restricted long fibre usage Tons (O.D.)	Ideal require- ments with maximum long fibre usage Tons (O.D.)
Valaichchenai Mill	18,000	18,000
Embilipitiya Mill	—	—
Third Mill	—	—

## LONG FIBRE MATERIALS

### CONIFERS

A study made by local and FAO Forest Officers indicates that certain Conifers could be grown in Sri Lanka to meet the requirements of the paper industry.

The Conifers found suitable are *Pinus Caribaea*, *Pinus Patula* and *Pinus Insularis*. *Pinus Caribaea* grows satisfactorily from almost sea level to about 4,000 feet elevation in the wet, *P. Insularis* thrives well above 5,000 feet elevation.

The advantages of using Conifers as a raw material for the paper industry are as follows :

1. Conifers yield the very much needed long fibre pulp for the paper industry which has to be blended with short fibred materials like straw, tropical hardwoods, Eucalyptus etc.
2. Being a long-fibred material, Conifers have technological advantages over bamboo.
3. Harvesting is easier with Conifers than with bamboos.
4. The yield of pulp in the case of Conifers is higher compared with bamboo, straw and woody material such as tropical hard woods and Eucalyptus.
5. As a raw material for the Paper Industry Conifers can be used with the flexibility in the manufacture of various grades of paper. For example, ground wood pulp used for the manufacture of newsprint cannot be made from raw materials such as straw, bamboo, kenaf etc.; using the standard mechanical pulping process. Pulp produced from straw, Eucalyptus, bamboo, kenaf do not also have high strength properties that are required for the manufacture of strong grades of paper such as kraft paper required for the manufacture of multi-wall bags. A high percentage pulp produced from Conifers is therefore essential in the manufacture of Kraft grades.

## MAN MADE FORESTS OF CONIFERS

To meet the paper industry's requirements, the required extent of Conifer plantation have to be established. Rotation is normally fixed at 15 years. Man-made forests to support pulp and paper industry have proved successful in countries like New Zealand, Brazil, Chile, Swaziland. To meet the requirements of the paper industry the Forest Department is presently planting Conifers at the rate 2,000-3,000 acres per year.

The coniferous wood requirements for the pulp and paper industry to manufacture 180,000 tons of paper is estimated as follows:

	Requirements with restricted long fibre usage Tons (O.D.)	Ideal require- ments with maximum long fibre usage Tons (O.D.)
Valaichchenai Mills	16,200	18,600
Embilipitiya Mills	13,300	16,700
3rd Mill	27,000	58,400
Total	56,500	93,700

## BAMBOO

Bamboo is not a new raw material for paper making. It is being presently used by most of the mills in India and Taiwan. Besides these countries, there are a few mills operating in Burma, Japan, Pakistan, Philippines and Thailand based on bamboo as raw material. In India, bamboo has been successfully used not only for paper manufacture but also for the manufacture of rayon. Bamboo takes approximately 7 years to attain maturity. The species that are being mostly used for paper manufacture in India are *Dendrocalamus strictus* and *Bambusa arundinacea*. Bamboo pulp being long fibre, could be used in Sri Lanka to manufacture various grades of paper and could substantially replace imported wood pulp.

As a raw material for producing long fibred pulp, bamboo has the following disadvantages compared with Conifers.

1. Extraction of bamboo requires more labour compared with conifers.
2. The death of the bamboo on account of gregarious flowering could result in interruption to production for about 7-8 years in bamboo plantations. For this reason, different species of bamboo has to be grown having different flowering cycles.
3. As a pulping material compared with Conifers, it has a high silica content, but not as high as rice straw.

The advantages of bamboo as a raw material for the paper industry in Sri Lanka are:

1. It could substantially replace the imported long fibre pulp for grades of paper such as writings and printings.
2. It could be grown in the dry zone compared with Conifers which have to be grown either in the hilly region or in the wet zone of Sri Lanka where available land is scarce and has other competitive uses in agriculture and plantation crops.

The entire requirements of long fibre to produce 120,000 tons of paper in 1980 is estimated to be met from conifers, since this is considered the ideal long fibre raw material for the paper industry. However, bamboo plantation should also be developed in the dry zone as a stand-by long fibre source in case there are problems in connection with availability of raw material for growing conifers.

The requirements of bamboo as a stand-by long fibre source is estimated at 1/3 of the total requirements from conifers.

	Requirements with restricted long fibre usage:	Ideal requirements with maximum long fibre usage:
	Tons (OD)	Tons (OD)
Valaichchenai Mills	5,400	6,200
Embilipitiya Mills	4,400	5,600
Third Mill	9,000	19,500
Total ...	18,800	31,300

## WASTE PAPER

The recovery of waste paper is traditional to the paper and paper board industry. The importance of the utilization of the waste paper cannot be underestimated when it is realised that certain countries re-cycle 30/40% of the paper consumed in the form of waste paper. Waste paper is mostly used for manufacture of paper board. With the introduction of new technology involving the process of de-inking it has now become possible to use waste paper for the manufacture of writing and printings and Newsprint.

Collection of waste paper from printers and converters is comparatively simple; they are only too glad to get rid of it, because of its bulky nature and inherent fire hazards. Collection from household is most difficult. In order to collect waste paper from households middlemen acting as waste paper collectors are required. A certain amount of success has been reached in this respect by increasing the prices of waste paper from Cts.-/25 to Cts.-/50 per lb. in 1974. Most of the waste paper presently collected is used for manufacture of paper board at Valaichchenai Mill.

The estimated requirement of waste paper by 1980 would be as follows :—

	Requirements with restricted long fibre usage :	Ideal requirement with maximum long fibre usage :
	Tons (OD)	Tons (OD)
Valaichchenai Mill	19,200	19,200
Embilipitiya Mill	—	—
Third Mill	—	—
Total ...	19,200	19,200

## TEXTILE WASTE AND RAGS

Rags have a long history as a raw material for paper making. Even though wood pulp has replaced rags to a large degree, rags are still used in the manufacture of speciality grades of paper such as ledgers, cartridge paper for certificates, super grade bond for land deeds etc. Rags could also be used to manufacture thin paper such as bible paper, airmail etc. Rags and cotton pulp improve the strength properties of paper made from straw, bagasse, hard woods, since they provide the much needed long fibre pulp. Most of the mills in India and Pakistan use a fair amount of textile waste and rags. Besides rags, it is also possible to use cotton linters for the manufacture of speciality grades. Cotton linters are residual fibres that remain on the cotton seed after the staple long fibre is removed by ginning.

It is possible to make speciality grades of paper on the No.1 Machine at Valaichchenai which is a slow speed machine and has also other design features and facilities more suitable to manufacture this grade

of paper. In the manufacture of speciality grades at Valaichchenai Mills. it is possible to use as much as 5,000 to 6,000 tons per year of textile wastes in the form of cotton linters, rags trimmings from garment manufacturers etc. The collection of this quantity would largely depend on the development of the textile industry.

### CONCLUSION

The study made as presented above indicate the estimated requirements of 1,20,000 tons of different grades of paper by the year 1980 could be produced

from indigenous fibrous raw materials. The study also shows SRI LANKA could be now self reliant in its fibrous materials requirements and there would be no need to import wood pulp for the two mills that are currently in operation and for the proposed third mill due to possibilities of using raw materials such as Kenaf, Eucalyptus, Conifers and Mixed Tropical Hard Woods, etc. The possibilities of using these newly developed woody materials through plantation would now enable SRI LANKA to set up new mills to produce grades such as Newsprint and papers requiring a high degree of strength properties such as Sack Kraft, Bag Kraft and Kraft Liner.