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#### **INTRODUCTION**

The Pulp and Paper Industry has made rapid strides in India during the last two decades. Most of the mills which were initially installed with capacities of 10-20 tonnes per day have expanded themselves to 150-200 tonnes and in a few years time an economic factory scale would well become 300-500 tonnes per day.

It has been estimated that the requirement of newsprint, writing and printing paper, rayon etc., would be nearly 4 million tonnes in 1985. It can safety be assumed that through the crash programme of expansion of capacities of existing pulp and paper mills, their annual production would soon be raised to 1 million tonnes. There would thus be a gap of 3 million tonnes between the productive capacity and the projections for 1985.

For bridging the gap it would be necessary to set up a large number of new units. Seth<sup>1</sup> has pointed out

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# Integrated Planning And Financing of Man-Made Forests For The Pulp And Paper industry

The pulp and paper industry in India will have to grow rapidly in order to meet the projected demand of 4 million tonnes in 1985. To overcome the sharply rising costs of production, the industry will have to become more competitive.

In this connection the forestry sector has the responsibility of organizing raw material supply at a cost that does not impair the competitive effectiveness of industries. This could be ensured by an integrated planning and financing of man-made forests for the pulp and paper industry. It would be necessary to have a coherent national plan for the setting up of new units and expansion of existing ones and to tie up the plantation programmes with it.

The creation of man-made forests for supply of raw materials to the pulp and paper industries could result in significant savings. It has been estimated that a net saving of Rs. 50/---per tonne of finished product could he made which, when applied to the projected production target of 4 million tonnes in 1985, would mean on annual saving of Rs. 200 million. This should spur the forestry and industrial sectors to step up the plantation activities.

If future raw material supplies are to be made from plantations, then it would be necessary to dedicate 1 million hectares for bamboo plantations and 1 million hectares for pulpwood plantations (including softwoods and hardwoods). Funds to the tune of Rs. 2500 million will have to be set apart for this purpose. Some new suggestions have been given in the paper for financing man-made forestry, such as creation of a national fund, attracting institutional finance, participation by industry and channeling of foreign assistance.

that, taking the capacity of a single mill to be 300 tonnes per day, it would be necessary to plan for 30-36 new mills. The investment required for this purpose would be nearly Rs. 14,000 million.

Kothari<sup>2</sup> has pointed out that notwithstanding the progress maintained by the industry in the last two decades, it is in doldrums and a paper famine is looming over the country. To rectify the situation it would be necessary to introduce drastic changes both in the forestry and industrial sectors with regard to the management of forests for production of pulpwood, stepping up the programme of raising man-made pulpwood forests, utilization of existing raw material resources in the industry and developing technology to

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suit the available raw material resources.

For this purpose both the sectors will have to shed their isolation and jointly and unitedly formulate integrated plans for the future. A coherent national plan for the setting up of new units and the expansion of existing ones would be the first requirement. An important and necessary part of such a national plan would be a thorough appraisal of existing wood resources, delineation of distinct industrial catchments for the different selected units, and an integrated programme for raising concentrated plantations of fastgrowing pulpwood species to provide raw material for the units.

To benefit to the highest possible degree from the economics of integration it would be desirable to have available for the industrial plant both long-fibred and short-fibred pulping material. This is an important point to keep in mind when plantation plans are drawn up.

# Cost-Price Squeeze Makes Economies Necessary

The pulp and paper industry faces a future in which a rapidly rising and changing pattern of demand for its products can be forecast with confidence. However, it is generally conceded that, to benefit from this, it will need to remain or even become more competitive. But at the same time, it faces sharply rising costs of production. The resulting rise in the cost of production of paper in India has been quite striking. According to the Economic and Scientific Research Foundation', the total cost of production rose by 28% from Rs. 910 per tonne in 1955 to Rs. 1164 in 1964. Raw material cost went up by 22%, but sizeable increases were reported also by other elements of cost such as chemicals (22%), fuel and electricity (46.8%)and wages (28%).

The average present cost of production of paper in round figures according to the Indian Pulp and Paper Technical Association<sup>4</sup> is Rs. 1500 per tonne. The break-up by broad items is—raw material, Rs. 250; labour, Rs. 160; depreciation, Rs. 240; chemicals, Rs. 320; power, Rs. 190; miscellaneous, Rs. 70; repairs, Rs. 120; interest, Rs. 50; and freight and packing, Rs. 100.

The cost-price squeeze is not a new situation for forest industries. They have had to adjust continually to a long-term squeeze. As far as the forestry sector is concerned the changing structure and technology that will be brought about by the demand for their products, plus the sheer magnitude of the supply and organizational problems associated with the escalating demand for industrial wood over the next fifteen years that will accompany this change, raises some critical questions. A test for the sector for the future would be how the supply of the enormous quantity of industrial wood is organized at a cost that does not impair the competitive effectiveness of the industries. It is in this context that an integrated planning and financing of man-made forests for the pulp and paper industry would assume increasing importance. Perhaps it is time to have another look at the ways in which forestry is organized in relation to large-scale industrial wood supplies.

For a production target of 4 million

tonnes in 1985 (assuming that costs remain constant), the total annual cost of manufacture would be Rs. 6000 million. Out of this amount the annual cost of raw material would be Rs. 1000 million. There would be a good deal of scope for economizing on the cost item of raw material if the recent technological trends are taken into consideration and recourse is taken to the idea of producing raw material (be it bamboo, hardwoods or softwoods) from man-made forests.

By referring to Figure I, it would be seen that by shrinking the industrial catchment by adopting plantation forestry the transportation lead would be appreciably reduced. The saving under the item "transportation" alone would be about Rs. 5/per tonne of raw material. By adding the savings on management, supervision, road-building costs etc., the saving could well be in the range of Rs. 10/-per tonne of raw material supply or Rs. 25/- per tonne of finished product. There would also be significant economies in the mills too in the form of less wastage, better yields of pulp and less requirement of power and chemicals for cooking and bleaching. It is time that industry carried out comprehensive studies to quantity these economies. For the present, however, it may not be unrealistic to assume an economy of Rs. 25/- per tonne of finished product. In that case the total economy would be in the range of Rs. 50/per tonne of finished product, and the annual economy through the item of raw material for a production target of 4 million tonnes would be Rs. 200 million. This is quite a sizeable item of economy (3% of

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total cost of manufacture and 20% of cost of raw material) and should spur the forestry and industry sectors to launch a stepped-up and concerted drive for raising manmade forests with the object of providing raw material for pulping.

## Man-Made Forests As Ideal Source of Raw Material Supply

The most heartening feature of the pulp and paper industry in the country today is that hardwoods as a source of raw material have come to stay. Though they cannot produce as wide a range of pulps and papers as softwoods, modern technology has narrowed this difference. Furthermore, for certain grades of paper, pulps from hardwoods are superior to pulps from softwoods.

At present mixed hardwoods are being used as a major portion of the furnish by several paper mills in the country, and their use is increasing steadily. The total consumption of hardwoods in 1968 was over 200,000 tonnes.

The pulping of hardwoods is an outstanding contribution of the Australian paper technologists and is a great step forward in modern technology. According to Bamber<sup>5</sup> in the year 1962 ninety percent of the pulpwood used in Australia was obtained from Eucalyptus. It has been stated by Rydholm and Gedda<sup>6</sup> that the pulp of the future for fine papers will be Eucalyptus kraft. Principally because of the ease of establishment and rapid growth Eucalyptus have become one of the most important genera for afforestation. They are considered to have some advantages over the traditional long-fibred pulps, such as-

- i) they yield more paper per unit weight of wood;
- ii) cheaper pulping processes can be used;
- iii) the shorter fibres have lower flow resistance; and
- iv) they are more suitable for strongly hydrating pulps with transparency and high fibre to fibre bond strength.

Westoby<sup>7</sup> has stated that plantation forestry has made spectacular advances in recent decades and plantations of fast-growing pulpwood species would constitute important sources of raw material for the pulp and paper industry. Forestry genetics can assure high quality breeding material. With the use of selected seedlings, by tilling and fertilizing the soil, plantations can produce as much as ten times the growth of the natural forest. The shift to what are essentially agro-technical methods presents many advantages, viz., convenient selection of species and rotation periods, a more homogeneous crop lending itself to mass production, removal and processing techniques; co-use of the land with agricultural crops in the first few years after establishment; reduction of supervision and transportation costs by concentration; and freedom to plan the sequence of age groups for orderly harvesting. An adaptation of plantation forestry-now commonly called linear forestryhas evolved in a number of countries and India is no exception. The plantation targets aimed at till the end of the Fourth Plan period are 560, 500 hectares of fast-growing species and 906, 500 hectares of economic species.

The demand of the pulp and paper industry of raw material for a projected production target of 4 million tonnes would be nearly 10 million tonnes. Presuming that the maximum bamboo potential of the country is tapped to yield annually 4 million tonnes, this would still leave a gap of 6 million tonnes to be made up by hardwoods. Thus it is evident that to overcome supply bottlenecks in the coming years plantation activity in the country will have to be stepped up appreciably.

For the planting programme in the forestry sector for raw material supply to the pulp and paper industry to be effective and meaningful, it would be necessary to tie it up with the location of new units taking into consideration markets, infrastructure, river flows, and location of chemical and mineral deposits such as coal, lime etc. The two major determining factors for the location of a pulp and paper mill are railway communications and adequate water supply. The requirement of water per tonne of paper manufactured is nearly 140,000 gallons, and a good deal more water is required in the stream flow to take care of the effluent problems.

At present the management of forests for pulpwood supply is not separate from the conventional practices of long rotation management for timber supply. This, in the first place, results in lower returns to the forestry sector per unit area and secondly it creates problems for the pulp and paper industry for the pulping of unsuitable raw material and sizes. Industry, however, prefers young wood of uniform size for

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pulping, which could be produced if low rotations are adopted and if the pulpwood production function from the forest is separated from the production timber conventional management. In this connection it may be of interest to point out that Scaramuzzi<sup>s</sup> has found that 5 year old Euclyptus viminalis has a lower wall thickness/lumen diameter ratio than 15 year old wood, and he has suggested that using the young trees is a direction for improving Eucalyptus utilization for pulping.

Seth and kharbanda<sup>9</sup> have shown that on the basis of the growing stock found in the sal stratum of Bastar forests, the required catchment for raw material supply to a pulp and paper unit of 100,000 tonnes per year capacity (using 60% bamboo and 40% hardwoods), would be 3000 sq. km. for a rotation of 120 years and 1300 sq. km. for a rotation of 70 years. If on the other hand, the source of raw material is to be Eucalyptus wood of plantation origin, the catchment would be only 150 sq.

Figure I



I — Industrial Catchment for Rotation 120 years.

II — Industrial Catchment for Rotation 70 years.

III -- Industrial Catchment for Eucalyptus Plantations. (10 years cutting cycle).

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km. The following figure illustrates

the situation of industrial catch-

ments vis-a-vis a paper mill. These

have been made bigger to allow for

an a lmixture of some poor, unsui-

As against a yield of 60 m<sup>3</sup> per

hectare of pulpwood of assorted

grades from Case I the yield of the

best grade of pulpwood from Case

III would be (depending upon the

site quality or inputs) in the range

In an integrated planning of man-

table or under stocked areas :

of 100 m<sup>3</sup> per hectare.

made forests for the pulp and paper industry the ideal arrangement would be when the mill is in the centre of the plantation area. But this would rarely be possible and plantation activity would have to be confined to forest areas. This could transform the raw material situation speedily, and open up entirely new perspectives for the development of the industry even in regions which have little or no forests of economic value.

### Choice of Specics, Management Aspect and Yields

The choice of species for planting for the pulp and paper industries for Indian conditions could be quite wide, as different climatic and soil conditions are found in different regions. In fact any species which is fastgrowing and can give annual increments in the range of 10-15 m<sup>3</sup> per hectare could be cultivated on a large scale for pulpwood supply. It would, however, be best if the country is divided into regions on the basis of climate and productivity and a specific set of species is prescribed for each region. Seth<sup>10</sup> has suggested the division of the country into ten regions on the above basis.

Considerable experience has been gathered in India during the past decade on the cultivation of Eucalyptus and bamboos. Some work has also been done in recent years on trials with tropical pines and the results obtained are quite encouraging. There would be considerable scope for raising tropical pines in the coastal regions as well as in the cooler regions of northern India.

Bamboo plantations have also been carried out by some paper mills and State Forest Departments. The West

Coast Paper Mills have obtained annual yields at Dandeli of 3 tonnes\_ per hectare of *Dendrocalamus strictus* and 6 tonnes per hectare of *Bambusa arundinacea*. With higher inputs in the form of irrigation, fertiliizer treatment and soil working, these yields could be further increased.

The *Casuarina* plantations in the coastal regions of South India and Eastern India are quite well know and they give fairly high annual increments. With irrigation and fertilizing it should be possible to obtain 100 m<sup>3</sup> or more of yield per hectare over a ten year cutting cycle.

Mention could also be made of the *Acacia* plantations in Bengal, *Albi-zzia* plantations in Assam and *Wattle* plantations in Nilgiris. All these are known to give high increment rates. This list is given only by way of illustration, and it should suffice to emphasize that there would be a wide range of species which suit different soil and climatic conditions in different regions.

It may be pertinent to refer to recent trials conducted by the West Coast Paper Mills on Sesbania species at Dandeli and Rajahmundry. With assured irrigation and fertilizer treatment this species gives an annual increment in the range of 50 tonnes per hectare and the crop could be harvested over a cycle ranging from one to three years. The intercropping of Sesbania for the first few years of a plantation cycle of pulpwood species would make for high economic returns and also for a considerable augmentation of pulpwood production. Similarly Kenaf could be cultivated for pulpwood supply on the same lines as Seshania.

Perhaps the widest experience is available with regard to the planting of Eucalyptus in India. The Eucalyp us hybrid plantations of Uttar Pradesh and Mysore and the Eucalyptus grandis plantations of Kerala are too well-known to need any introduction. The average annual increments of these plantations could be put at 5-8 m<sup>3</sup>, 10-15 m<sup>3</sup> and 25-30 m<sup>3</sup> respectively. These plantations could be harvested on cutting cycles ranging from 10 to 20 years.

Deshmukh11 has estimated that 60% or more of the area of the country falls in the arid zone receiving annual rainfall of less than 750 mm. This vast area is capable of producing a considerable quantity of raw material for the pulp and paper industry if planted with suitable species. The trend of growth of diameter with age for the Mysore plantations of Eucalyptus hybrid has been found by Deshmukh to be as shown below. The dotted line shows the growth conditions of Encalyptus hybrid plantations of Haldwani in Uttar Pradesh as determined by Seth et al<sup>12</sup>.

A compact area of 150 sq. km. under intensive plantation forestry which could be the catchment for a mill could be divided into 10 annual planting blocks in conformity with a ten year cutting cycle that has been presumed in this case. Thus the annual planting area could This block of be 1500 hectares. annual planting area could be further divided into twelve monthly blocks and each monthly block could have thirty sub-divisions of nearly 5 hectares each to conform to daily cuts.

Industry favours the use of green

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### **Figure II**

wood because the penetration of cooking liquor in it is better. Besides, the debarking of green wood is more convenient and economical. With this sort of an intensive management model as indicated above it should be possible to arrange the cutting blocks contiguously and to provide freshly cut and green wood to the mills on a daily planning basis. This arrangement could be possible if the plantation areas are served by all-weather roads and this will obviate the need for stock piling raw material Moreover, considerable supply. economy could be effected in the handling and washing of raw material before it is fed into the chippers.

With such an intensive type of management for pulpwood supply it should also be necessary to have complete information on items such as bark content and loss of weight due to driage from air-dry to ovendry stages. Work done in Andhra Pradesh gives an indication that the bark content for 8 to 10 years old *Eucalyptus hybrid* wood is 23% of green weight and loss of weight due to driage is 30% and 45% for air dry and oven dry weights respectively. These factors would vary according to the age of wood and also to the locality.

#### Financing of Man-Made Forests

Plantation forestry of fast-growing species could be a profitable activity if the pulp and paper industry could pay a satisfactory royalty for pulpwood supplies. The same argument would apply to plantations of bamboos and tropical pines which could provide the much-needed long fibred raw material. This is important from the national point of view in that the country's dependence on imports of long fibred pulp could be ended, thereby saving a tremendous amount of foreign exchange. There would be ample justification, therefore, for investing this saving on the raising of man-made forests of bamboo, tropical pines and even hardwoods for raw material supply to the pulp and paper industry.

The economics of man-made forests could further improve considerably if agri-silvicultural techniques are adoped. Such practices are already in vogue in West Bengal, Uttar Pradesh and Kerala. Returns from *taungyas* in Kerala sometimes are much more than the cost of formation of such plantations.

The raising of forest plantations costs a good deal of money and inspite of the rising allocations made in succeeding Five Year Development Plans, budgetary constraints and bottlenecks have restricted the planting activity to limited targets whereas the demand projections would warrant a manifold increase in it. The only way to get over this difficulty would be to convince governments, planners, bankers and industrialists that man-made forests for the pulp and paper industry could pay handsome returns and that it would be worthwhile to invest money on this activity. The pulp and paper industry has a responsibility in this connection and looking to its stake in assured supplies of raw material at economic costs, there is no reason why it should not join hands with the forestry sector in raising the resources and providing finances for this.

Seth<sup>13</sup> has shown that several developed countries have set up national forestry funds for this purpose and has also given instances of banks and industries which finance such activities. Similar ideas could also be applied to the Indian situation

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and it should be possible for world bodies liks F. A. O., U. N. D. P., SIDA etc. to lend a helping hand in this activity of top national importance, which, apart from providing raw material to the pulp and paper industry, would make for balanced regional development and the creation of employment opportunities for the backward sections of society. It should also be possible to attract institutional finance from bodies like I.D.B.I., A.F.C., L.I.C. etc.

Perhaps another good idea would be to have an integrated scheme of industrial development and regional productivity studies on the lines done in U.S.A.<sup>14</sup> These regional productivity studies have as their objective the evaluation of alternatives for achieving different levels of supply in the different regions. Results are expressed in terms of internal rate of return on investment and they are used to determine a regional allocation of funds for improving wood yields based on opportunities for a prospective return of 6% or greater. Areas are classified into type-site classes for major forestry regions.

If all future supplies of raw material to the pulp and paper industry in the country are to be met from man-made forests, then it would be necessary to dedicate 1 million hectares for bamboo plantations and 1 millon hectares for pulpwood plantations, and to set apart Rs. 2500 million for their formation, supervision and maintenance. In addition to providing suitable raw material for industry, this activity could generate an employment potential for 4 million persons.

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