

A Sectoral Study of the Paper Industry

SUMMARY

1. STRUCTURE AND GROWTH OF THE INDUSTRY

The installed capacity of the paper industry increased from a mere 1.37 lac tpa in 1950-51 to 7.7 lac tpa by 1970-71 and further to 33 0 lac tpa by 1990-91 as shown below:

Table No. 1

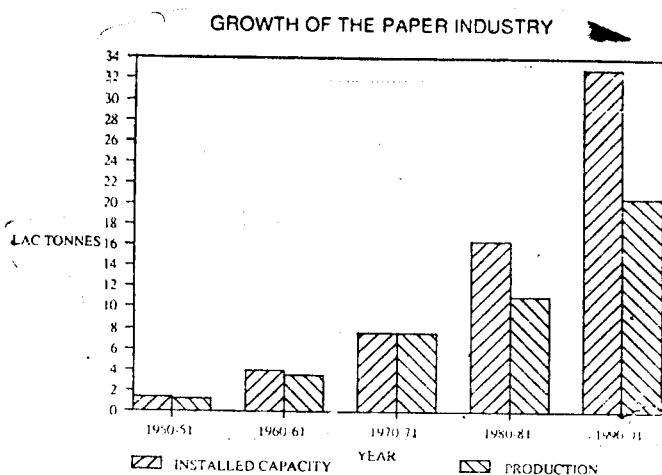
Growth of the Paper Industry

(lac tonnes)

Year	No. of Units	Installed Capacity	Production	Capacity Utilisation (%)
1950-51	17	1.37	1.16	85
1960-61	25	4.00	3.45	86
1970-71	57	7.68	7.58	99
1980-81	135	16.50	11.12	67
1989-90	317	32.31	18.75	58
1990-91*	325	33.04	20.60	62
Growth Rate (%)	9.4	7.0	6.6	-

*: Capacity at the beginning of the year.

*: Capacity at the beginning of the year.



The average capacity utilization of the industry declined from a peak of 99% of installed capacity in 1970-71 to around 57 to 58% during the period 1984-85 to 1989-90. This was because of a greater increase in installed capacity vis-a-vis demand. With demand picking up, capacity utilisation in 1990-91 improved to 62%.

The rapid increase in capacity was due to structural changes in the paper industry in the seventies when the Government encouraged the setting up of small paper mills using nonconventional raw materials. Till

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1970 the industry was dominated by integrated large paper mills based on forest based raw materials and a few small mills using waste paper & imported pulp. As a result of the policy change, a large number of agro-based as well as waste paper based small paper mills were set up in the country. Gradually, most of the small agro based mills started expanding their capacities and a few large mills were also set up based on agro residues. Hence, it is more appropriate to classify paper mills on the basis of raw material usage instead of size, into :

- (i) Wood based
- (ii) Agro residue based
- (iii) Waste Paper based

Zonewise installed capacities of different categories of mills indicate a rapid proliferation of agro and waste paper based paper mills in the North and West while South and East are dominated by wood based paper mills, as can be seen from the following table :

The number of agro residue and waste paper based mills have increased in the North and West due to two factors :

- (1) Shortage of forest based raw materials.
- (2) Sizeable availability of agro residues.
- (3) Deliberate policy of the Government to create additional capacity quickly.

Agro residue and waste paper based mills presently constitute about 56% of the total installed capacity.

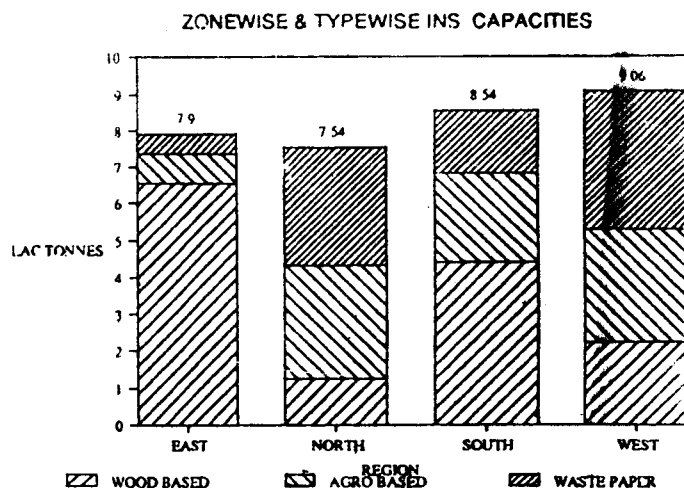


Table No. 2

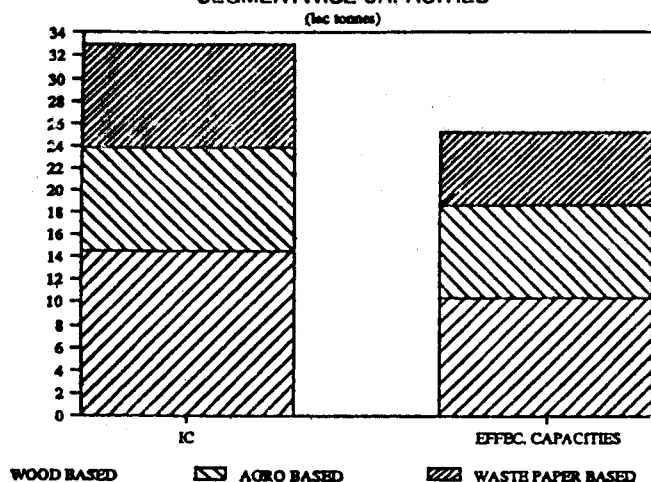
**Zone-wise Installed Capacity to Manufacture Paper
(As at March 31, 1991)**

(lac tonnes)

Zone	Wood Based		Agro Based		Waste Paper Based		Total	
	No. of Units	I.C.	No. of Units	I.C.	No. of Units	I.C.	No. of Units	I.C.
East	14	6.56	7	0.82	19	0.52	40	7.90
North	3	1.24	37	3.08	83	3.22	123	7.54
South	7	4.38	18	2.46	31	1.70	56	8.54
West	4	2.26	25	3.06	77	3.74	106	9.06
Total	28	14.44	87	9.42	210	9.18	325	33.04

I.C: Installed capacity.

SEGMENTWISE CAPACITIES



In addition, there are 400 handmade paper units producing paper using cotton rags, jute waste, cotton linters etc. These units are under the overall control of Khadi and Village Industries Commission (KVIC). The estimated production of these units was about 4000 tpa valued at Rs. 750 lacs and employing more than 700 persons in 1989-90.

Effective Capacity

On account of closure of a number of paper mills in all the 3 categories, the effective capacity of the industry is only 25.19 lac tpa as given below :

Production & Capacity utilisation

The production of paper & paper boards increased from 11.12 lac tonnes in 1980-81 to 20.6 lac tonnes in 1990-91 indicating a compound growth of 6.4% p.a. Overall, the average capacity utilisation declined to 62% by 1990-91 from a peak of 98.7% in 1970-71 due to faster growth in capacity (7.0% p.a.) vis-a-vis demand and also problems of raw material availability. Excess capacity and technological problems unremunerative selling price of paper led to sickness in the industry. This resulted in closure of some integrated large paper mills and a large number of units, especially those based on waste paper. If the closed capacities are excluded the effective capacity utilisation in 1990-91 was 82% (Based on capacity at the end of year).

Of the operative capacity of the average capacity utilization the wood based mills was 95% of the capacity at the end of the year and that of agroresidue based mills was 80%. Based on the above utilisation levels and the estimated overall production of paper, the capacity utilisation of the waste paper mills would have been 63% in 1990-91.

The performance of agro and waste paper based mills has fallen short of expectation despite various facilities extended to them. Various factors contributed to their poor performance, the major ones being: Cost and time over run of projects, deficient management, technical problems, lack of chemical recovery

Table No. 3

Effective Installed Capacity for Paper & Paper Boards (As on March 31, 1991)

Category of the Mill	Total Installed Capacity	Closed Capacity	Effective Capacity	% Share
1. Wood Based	14.44	4.00	10.44	41
2. Agro Residue Based	9.42	1.29	8.13	32
3. Waste Paper Based	9.18	2.56	6.62	27
Total	33.04	7.85	25.19	100

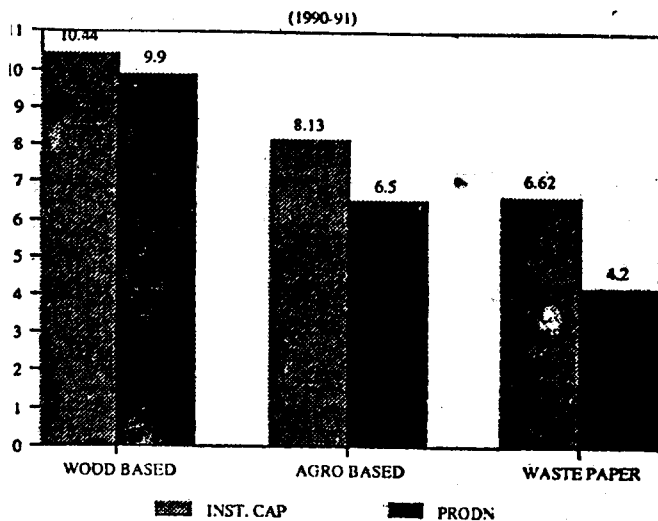
Table No. 4

Segmentwise Capacity Utilisation in 1990-91

(Lac Tonnes)

Category of the Mill	Installed Capacity	Effective Capacity	Production	Effective Capacity Utilisation(%)
1) Wood Based	14.44	10.44	9.90	95
2) Agro Residue Based	9.42	8.13	6.50	80
3) Waste Paper Based	9.18	6.62	4.20	63
Total	33.04	25.19	20.60	82

SEGMENTWISE CAPACITIES & PRODUCTION



system and marketing problems. Increasing rise in international price of wood pulp and waste paper coupled with unremunerative selling price (till 1989) rendered many waste paper based mills unprofitable. Consequently a number of agro based and waste paper based mills were closed. Further several wood based paper mills were closed down on account of outdated technology, increasing costs and financial problems.

The balance of payment problems during 1990-91 and the imposition of heavy cash margins also increas-

ed the raw material costs for waste paper based mills significantly. This eroded their profitability which was otherwise improving due to substantial increase in selling prices. The effect of devaluation in July 1991, on the import of waste paper was however, neutralised by corresponding lowering of import duty.

Apparent Consumption

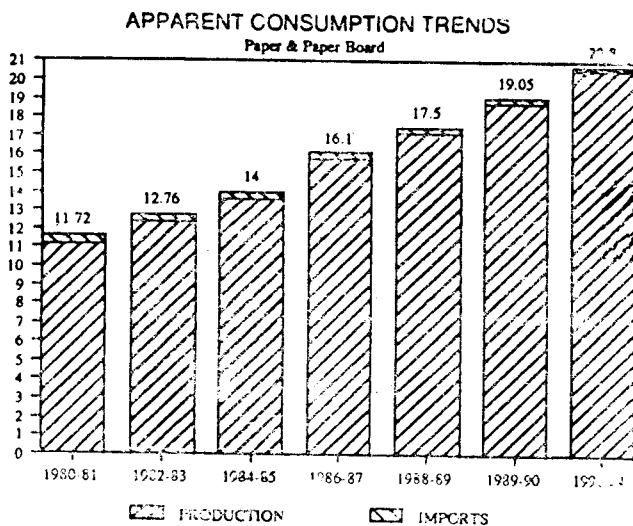
Apparent consumption of paper and paper board increased from 11.94 lac tonnes in 1980-81 to 20.80 lac tonnes in 1990-91 indicating a growth of 5.7% per annum as shown below:

The type-wise consumption of paper and paper board (cultural/industrial) indicated that the consumption of cultural paper increased from 6.16 lac tonnes in 1980-81 to 10.00 lac tonnes in 1990-91 indicating an annual growth rate of 5.0%, while the consumption of industrial paper increased from 5.78 lac tonnes in 1980-81 to 10.80 lac tonnes in 1990-91 registering a growth rate of 6.5% per annum. The consumption of cultural & industrial paper increased at a rate of 6.2% & 7.5% p.a respectively during the period 1984-85 to 1990-91. As a result, the share of industrial paper has increased from about 48% in 1980-81 to 52% in 1990-91. This is in conformity with the international trends wherein the consumption of industrial paper accounts

Table No. 5
Apparent Consumption of Paper and Paper Board

(Lac tonnes)

Year	Production	Imports	Consumption
1980-81	11.12	0.84	11.94
1984-85	13.60	0.40	14.00
1985-86	15.05	0.30	15.35
1988-89	17.20	0.30	17.50
1989-90	18.75	0.30	19.05
1990-91	20.60	0.20	20.80
Growth rate (% p.a.)			
1980-81 to 1990-91	6.4%		5.9%
1984-85 to 1990-91	7.2%		6.8%



2. Projected Demand/Supply

Demand Estimates: The demand for paper and board has been fluctuating and the growth in demand has not been consistent with the parameters like increase in literacy, growth in population, national income and industrial production. This is because of inherent shift in usage and substitution trends. As such an econometric analysis considering parameters such as national income, literate population, index of paper did not reveal a significant correlation.

Hence, the demand for Cultural and Industrial paper was projected on the basis of past rates of growth till 1995-96 and at a slightly lower growth thereafter. Based on the above, the demand for different types of paper was estimated as shown below;

During 1991-92, as there is likely to be a slow-down in the overall rate of growth in industrial production, the growth would be lower for cultural and industrial papers at about 5.0% and 6.5% respectively. Thereafter, demand may increase as shown below:

for a major share due to greater industrialisation. Within the above categories also, there is a considerable qualitative shift towards better quality paper, such as computer stationary higher g.m bond paper, copier papers, fax paper, MICR cheque papers. High speed offset machines require high strength paper to prevent machine stoppages on account of paper breakages. Faster speed packaging machinery also requires high strength industrial paper.

Table No. 6
Expected Rate of Growth in Demand for
Paper & Paper Board

Period	(% p a.)	
	Cultural Paper	Industrial Paper
1991-1992	5.0	6.5
1992-93 to 1995-96	6.0	7.5
1996-97 onwards	5.0	6.5

With the expected increase in base demand from 1996-97 onwards the rate of growth may slow down.

Based on the above, the demand for different types of paper can be estimated as follows.

Table No. 7
Demand for Paper & Paper Board
(lac tonnes)

Year	Cultural	Industrial	Total
1990-91	10.00	10.80	20.80
1995-96	13.20	15.40	28.60
2000-01	16.80	21.10	37.90

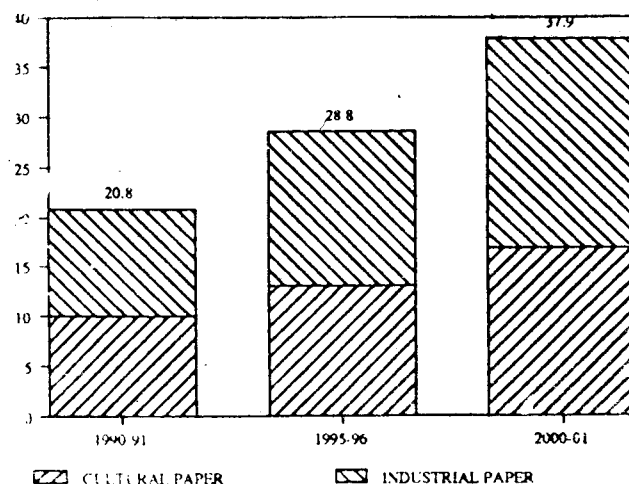
Future Capacity

The future effective capacity has been estimated by considering a) the existing effective installed capacity, b) capacity of closed mills likely to be revived and c) additional capacity likely to materialise.

Revival of closed Units

Considering the large number of closed units (1.C-7.85 lac tpa), it would be obvious to give priority for revival of closed units as primary means of increasing supply. At the prevailing price of paper, some of the units may be economically viable and could be revived. However, in case of a large number of units, it would be extremely difficult to revive them due to a variety of reasons including obsolete plant and machinery and phenomenal losses. Similarly, it may not be possible to revive most of the waste paper based units on account of poor economic viability and lack of raw material availability (waste paper).

DEMAND ESTIMATES FOR PAPER



Hence, only a few agro based mills could be possibly revived by 1995-96, depending on the following factors;

- (i) Status of the plant and machinery
- (ii) Economic viability of the unit and
- (iii) Adequate availability of raw materials

However, large wood based mills could be interested in taking over some of the agro residue based sick/closed units due to the following factors:

- i Lack of opportunities to expand their capacity due to shortages of wood based raw materials
- ii Technical & Marketing strengths.
- iii High investment reqts. for a new plant.
- iv Excise duty benefits.

It is then possible that a large wood based plant may be able to manufacture high quality writing & printing paper from wood pulp and kraft & board paper & regular writing & printing paper from agro residues, enabling it to manufacture a complete range of paper & paper boards.

Tables below give the expected aggregate effective installed capacities by 1995-96 and 2000-01.

Table No. 8
Total Effective Capacity with Paper Mills by 1995-96

(lac tonnes)

Type of Mill*	Effective Installed Capacity (1991)	Additional Capacity (incl.revival)	Total Capacity
1. Wood based Mills	10.44	2.53	12.97
2. Agro Based Mills	8.13	2.70	10.83
3. Waste Paper based Mills	6.62	1.78	8.40
Total	25.19	7.01	32.20

Table No. 9
Total Effective Capacity with Paper Mills by 2000-01
Total Likely Capacity

(tonnes)

Category of the Mill	Effective Installed Capacity (1991)	Additional Capacity (incl.revival)	Total Capacity
1. Wood based	10.44	2.53	12.97
2. Agro Residue Based	8.13	3.70	11.83
3. Waste Paper Based	6.62	1.78	8.40
Total	25.19	8.01	33.20

say 33.20

Thus the aggregate capacity to produce paper and paper board would be 32.20 lac tpa by 1995-96 and 33.20 lac tpa by 2000-01. The above capacities are based on likely capacity addition that have been finalised. In addition, many of the wood and agro based mills are in the process of finalising their plans for modernisation and expansion of their capacities and since

the gestation periods for partial expansions are not long, the actual capacity materialising may be higher.

Based on anticipated capacity utilisation levels for the different categories of paper mills, the production of paper and paper board can be estimated as shown below:

Table No. 10
Estimated Production - Segment-wise

	(Lac tonnes)				
	Effective Installed Capacity		Assumed C.U (%)	Expected Production	
	1995-96	2000-2001		1995-96	2000-2001
1) Wood Based :					
a) Working Units*	10.81	10.81	95	10.25)	12.30
b) Revived Capacity	2.16	2.16	80**	1.70)	
Sub-total	12.97	12.97		11.95	12.30
2) Agro Residue based	10.83	11.83	80	8.70	9.50
3) Waste Paper based	8.40	8.40	70	5.90	5.90
Total	32.20	33.20		26.55	27.70

*: Including additional capacity likely to materialise of 0.37 lac tonnes.

** : A lower capacity utilisation has been assumed for 1995-96 considering the age of plant and machinery and the time that would be required for stabilisation of the operations of the units.

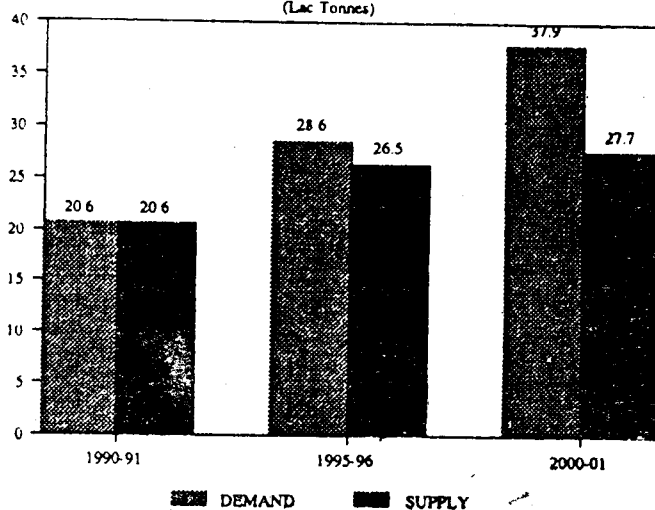
Demand/Supply

The projected demand/supply situation for paper and paper board in 1995-96 and 2000-2001 will be as follows:

Table No. 11
Demand/Supply Balance in 1995-96 and 2000-2001.
(Lac Tonnes)

Year	Estimated Demand	Production	Deficit
1995-96	28.60	26.50	(-) 2.10
2000-01	37.90	27.70	(-) 10.20

DEMAND SUPPLY BALANCE FOR PAPER
(Lac Tonnes)



Thus there would be a deficit of paper by 1995-96 to the extent of 2.1 lac tonnes by 1995-96 increasing to 10.20 lac tonnes by 2000-01. The actual deficit by 1995-96, however, could be even higher if the following factors are taken into account.

- Diversion of 40 gsm creamwove paper to news-print. (Expected about 1.0 lac tpa by 1995-96).
- Lower capacity utilisation of mills due to raw material problems: With wood based mills likely to face raw material availability problems, the

pressure to maintain capacity utilisation would force them to make increasing use of waste paper to augment production. This may affect the operation, of small waste paper mills, especially the ones dependant on domestic waste paper.

Hence, the actual c.u. of the waste paper based units may fall short of 70% envisaged. If the c.u. comes down to 60%, the additional deficit would be 85,000 tonnes.

The additional deficit on these counts is summarised below:

Table No. 12
Additional Deficit Likely

	Lac Tonnes
a. Diversion to Newsprint	1.00
b. Lower Capacity Utilisation of waste paper based units (60%)	0.85
Total	1.85

Hence, the actual deficit may range between 2.1 and 3.95 lac tonnes by 1995-96.

It is therefore, necessary in the short term to

- (1) encourage expansion of paper mills with assured agro and/or non wood raw material supplies.
- (2) Concentrate on developing a suitable technology for chemical recovery system for small paper mills.
- (3) encourage modernisation of old mills on a priority basis and in the long run to
 - (1) permit wood based mills to develop their captive plantation or encourage farm forestry in a big way to generate the raw materials required.
 - (2) Manage and run State forests in a more scientific manner.

- (3) Encourage sugar mills to modernise and put up energy efficient boilers so as to release greater quantity of bagasse.
- (4) Provide fiscal incentives to sugar units switching over to coal fired boilers and supplying their entire bagasse to paper mills.
- (5) Undertake research in use agro. based materials and recycle of used paper.
- (6) Identify new agrobased products for use as raw material.

Considering

- a) that a major portion of the demand for the superior varieties of paper would have to be met by the wood based mills and
- b) the critical raw material scenerio for the wood based mills.

the modernised wood based paper mills would need to concentrate on manufacturing superior quality premium papers, while the agro and waste paper based mills would meet the balance requirements. Some of the agro based mills, with substantial modernisation, can also manufacture premium quality papers. But given the status of the plant & equipment of many of the existing manufacturers, these may be very few.

3. NEWSPRINT

Presently there are five units with an aggregate installed capacity of 3.0 lac tpa for the manufacture of newsprint.

Apparent consumption of newsprint stagnated during the period 1980-81 to 1983-84 due to lack of availability. Since then, the apparent consumption has increased as shown in the following table.

Table No. 13

Apparent Consumption of Newsprint

Year	Production	Imports	Apparent Consumption	Imports as % of A.C
1983-84	1.76	1.94	3.70	52
1985-86	2.70	1.95	4.65	42
1986-87	2.85	1.89	4.74	40
1987-88	2.92	2.00	4.92	40
1988-89	3.20	2.50	5.70	44
1989-90	3.10	2.50	5.60	45
1990-91	3.00	2.50	5.50	45

The growth in production could not keep pace with the growth in demand for newsprint leading to continued reliance on imports to meet a large portion of the requirements. As such, there continues to be a shortfall in supply. The shortfall in 1990-91 is estimated at about 1.0 lac tonnes. The growth in actual demand during the period 1985-86 to 1990-91 was about 5.4% p.a. Projecting the same growth for over the next five years and a growth of 5.0% p.a. thereafter, the demand for newsprint would be as follows :

Table No. 14
Demand for Newsprint

Year	demand (lac tonnes)
1995-96	8.50
1996-97	8.90
2000-01	10.80

Future Supply

The current installed capacity for newsprint is 3.0 lac tpa. While a number of licences were sanctioned to units based on waste paper and bagasse, only the following capacities are likely to materialise :

Considering the supply from the existing units at 3.2 lac tonnes highest productivity achieved and 80% C,U for new units by 1995-96 & 100% C.U by 2000-01, the demand/supply balance is likely to be as shown below:

Setting up a grass root newsprint project based on forest resources has not been feasible due to shortage of raw materials as also high cost of project. New projects for the manufacture of newsprint could be based on either bagasse or recycled waste paper.

Table No.15

Additional capacities likely to materialise for Newsprint

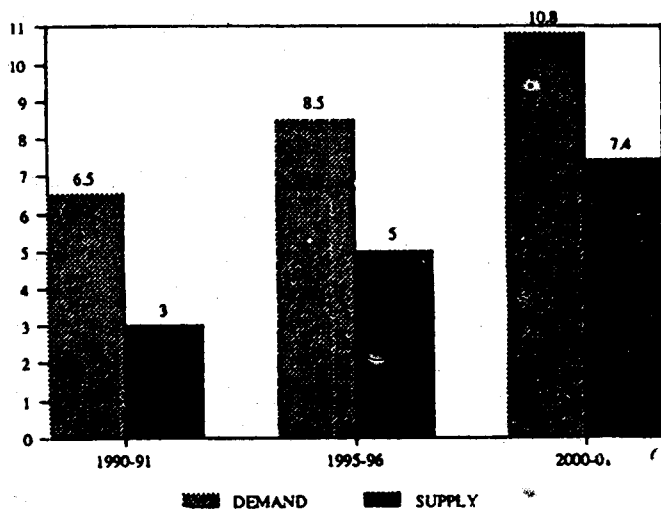
	(Lac Tonnes)	
	1995-96	2000-01
Expansions		
1. TNPL	0.50	-
New Units		
1. Nepa Mills, U.P	1.00	-
2. Punjab Agro Corpn, Punjab	0.66	-
3. TNPL, TN	-	1.00
4. Rashtriya Chemicals & Fertilisers Maharashtra	-	1.00
Total	2.16	2.00

Table No. 16

Demand/Supply Balance of Newsprint

Year	Demand	Likely Production	Shortfall
1995-96	8.50	5.00	3.50
1999-01	10.80	7.40	3.40

DEMAND SUPPLY BALANCE FOR NEWSRRINT



It would be necessary to identify certain locations where bagasse is available for setting up bagasse based newsprint projects. A short -fall of about 3.5 lac tonnes of newsprint every year is envisaged.

About three years back, when the paper industry was experiencing demand recession, the Government allowed paper mills to supply their creamwove paper to newspaper printers as newsprint with excise duty concession, provided they obtain RNI allocation (from 1-4-1988). The Government further stipulated a condition that a paper mill proposing to supply its writing and printing paper as newsprint should supply at least 20,000 tpa on a regular basis. This would enable RNI to allocate newsprint/paper from domestic source. As this policy involved revenue loss to the Government, the Ministry of Finance had not approved the scheme. Mills were also not fully prepared to commit to RNI the supply of 20,000 tpa paper on regular basis as newsprint. As the market for writing and printing paper improved considerably, resulting in higher price realisation, mills did not pursue the matter. However, with increase in the newsprint prices, some of the agro based mills have started supplying lower gsm writing and printing paper as newsprint without excise duty concession.

As in the case of paper, the endusers of newsprint also have installed high speed presses requiring high strength newsprint. The proposed bagasse based newsprint would also need to use substantial quantities of wood as in the case of TNPL to impart the required strength.

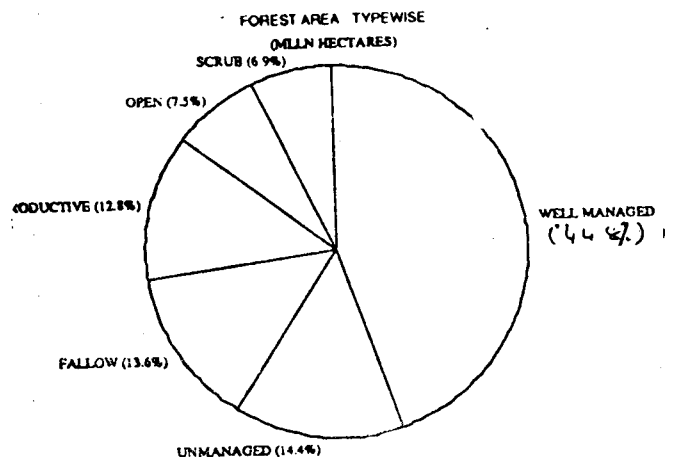
Thus, the total deficit for paper & newsprint would be 5.6 lac tonnes by 1995-96 increasing to 13.6 lac tonnes by 2000-01,

4. Raw Material-Forest And Agro-Based

i) Forest-based

The major raw material for integrated wood based mills is bamboo, hardwoods including eucalyptus. Hardwoods is also used by newsprint manufacturers, as they use chemical pulp made up of wood upto 30% of the furnish : while they can use other raw materials for making 70% mechanical pulp. Severe depletion of bamboo forced wood based paper units to shift to hard wood extracted from natural forests. Even here, acute scarcity of raw materials is being experienced by paper mills in states like West Bengal, Karnataka, Andhra Pradesh, Kerala and Tamil Nadu. In fact, most of the mills are increasingly buying hardwoods from the open market. According to F.A O. statistics of 1981, out of a total forest area of 75.0 million hectares hardly 45 million hectares (60%) are productive and rest 30 million hectares (40%) are unproductive, being fallow, open or scrub type. A subsequent assessment by the National Remote Sensing Agency revealed that dense forest cover was only 10.88% of the total land area. Further, problems relating to royalties, duration of agreement with the State Governments and weighment methods come in the way of getting the required quantity of wood at economic price.

National Fosest Policy of 1988 laid down the following points towards the forest based industries.



- a) As far as possible, a forest based industry should raise material needed for meeting its own requirement by establishing direct contact with the individual growers.
- b) Farmers, particularly small and marginal, would be encouraged to grow wood species.
- c) The practice of supplying forest produce to industry at concessional price should cease.
- d) Industry should be encouraged to use alternative raw materials.

The guidelines provided in the National Forest Policy created uncertainty in obtaining the required quantity of wood by the paper mills, as a farmer can change his crop to a more attractive one, besides keeping the price fluctuating every season.

Captive Plantations : One of the proposals being mooted by the industry is to allow captive plantations by the industry. Plantation activity is a highly scientific, exacting and expensive proposal. Heavy investments are required to make this venture an economically viable proposition. One can expect the crop only after 8-10 years of captive plantation.

It is, therefore, necessary to reconsider and change policy on industrial plantation with the help of State Governments and allow the industry to raise captive plantation to meet the present and future needs of raw material.

Rubber wood is found in a big way in Kerala. Many experiments have been conducted about the commercial use of this material. The presence of latex at cooking stage as well as at paper drawing stage creates problems. If proper technology is found out for the removal of latex this will be a good source of raw material for making paper and paper boards in Kerala.

ii) Agro-based

Agro based paper mills use either rice/wheat straw or bagasse as major raw material. Bagasse pulp to the extent of 75% is used in the furnish to avail of excise duty concessions. In the case of rice and wheat straws, only about 50-60% of straw is used in the furnish and

the balance furnish is made up of waste paper, cotton and jute linters and rags and imported pulp. The consumption norm of bagasse/straws is about 5 to 6 tonnes/per tonne of pulp.

As the production of rice and wheat straw is distributed all over the country, small paper mills, geographically spread out use them. However, straw being a seasonal product, collection, handling, transportation & storage (due to bulkiness) pose difficulties. Sometimes, collection would lead to unhealthy price competition. Under drought situation, the price of straw (which is mainly used as cattlefeed) becomes uneconomical for commercial applications.

Sabai grass, elephant grass, kenaf (mesta) jute & cotton linters are also used to a small extent as raw materials in different ratios. Price of jute and jute cuttings fluctuate widely on the basis of seasonal price variations. Therefore, very few units use these as their basic raw material.

Waste paper has always been used as one of the principal raw materials by small paper mills. Waste paper based paper mills rely on imported pulp and waste paper for making pulp using a hydra-pulper. There are a large number of small paper mills (5 tpd or 10 tpd) which exclusively use waste paper. Wood based mills also use waste paper upto 5 to 10% in their furnish. Board mills use considerably greater proportion of waste paper. Recycling of waste paper contributes to the reduction in the consumption of chemicals as well as environmental pollution. It is estimated that hardly 15% of the total paper produced in India is available for recycling, as bulk of it is used for packaging. With organised collection efforts, if this ratio is increased to 30% (which is the international standard), the quantity of waste paper available for making paper would be substantially greater.

Bagasse has been used successfully as a major raw material for the manufacture of wide range of paper and paper board. The availability of surplus bagasse is restricted to about 5% of total crushing where no coal fired boilers are installed: against the normal release of bagasse of 28% to 30% of sugarcane crushed. Traditionally sugar mills consume their bagasse for firing their boilers. If sugar mills change over to coal fired boilers, a sizeable quantity of substitution bagasse

can be made available to the paper mills. Tamil Nadu Newsprint entered into agreement with 6 sugar mills for supplying the entire bagasse after installing coal fired boilers and operating them with their coal and personnel. However, due to cost considerations and a number of other factors, substitution bagasse may not be a viable alternative except in locations close to the coal belt. However, surplus bagasse generation could be increased by the sugar mills by (1) predrying the bagasse before use in the boilers, (ii) Use of more efficient boilers and (iii) Economy in use of steam.

Of late many sugar mills have also set up their captive paper mills, based mainly on surplus bagasse.

Raw Materials (Requirement and Availability-1995-96)

And Location of Additional Paper Capacity.

The total demand for forest based raw materials by 1995-96 and 2000-01 is expected to be as follows :

Table No. 17

Requirements of Wood for paper & Newsprint

	(Lac ADT)	
	1995-96	2000-01
1. Wood based paper mills	26.30	27.10
2. Newsprint Units	4.10	4.10
3. Bagasse based large mills	1.85	3.10
Total	32.25	34.30
	i.e. say 32.00	34.00

Based on an expected average ratio of 60% for bamboo and 40% for hardwoods, the demand for bamboo & hardwoods would be :

Table No. 18
Demand for Bamboo & Hardwoods

(Lac ADT)

	Share	Demand	
		1995-96	2000-01
1. Bamboo	60	19.20	20.40
2. Hardwoods	40	12.80	13.60
Total	100	32.00	34.00

There are varying estimates on the availability of wood. The Raw Material Committee of the Development Council for Paper, Pulp and Allied Industry had estimated the availability of wood at 32.1 lac ADT, on the basis of 16% forest coverage in the country. It is stated that forest coverage is actually less than 11% of the total land area.

Wood is also required for making cellulosic fibres such as Viscose Filament Yarn, staple fibre etc. The estimated demand for wood from this sector is about 13.0 lac tonnes of ADT wood in 1995-96. Thus, increasing deficit of pulpable wood is foreseen in the near future.

Some of the wood based units could consider the use of bagasse to supplement wood resources.

For possible conversion to bagasse, three factors need to be considered;

The entire pulping section needs to be fully modernised to use bagasse. Partial modernisation of digestors and some sections alone would not suffice.

The unit has to be located within a radius of 75 to 100 kms from at least a couple of sugar mills so as to be assured of raw material supplies.

Care needs to be taken so as not to deprive an existing bagasse based mill nearby of raw material supplies. Considering the locations of various wood based paper mills, not many mills may be able to easily convert to bagasse.

Surplus vs Substitution Bagasse

Various factors favour setting up of paper units based on surplus bagasse vis-a-vis substitution bagasse.

- (i) Surplus bagasse is cheaper than substitution bagasse.
- (ii) Sugar mills are reluctant to use extraneous fuel such as coal in view of lack of continuous assured supplies.
- (iii) Most paper mills do not favour entering into long term agreements with sugar mills, since many of them are in the cooperative sector.

However, while the above parameters may widely influence paper units to prefer surplus bagasse, there are

a number of factors which would favour consideration of substitution bagasse as a major option; viz.

- (i) One drought year could reduce surplus bagasse availability substantially and push up prices significantly.
- (ii) Emergence of a number of bagasse based paper units could also push up the prices, thus narrowing down the cost between surplus and substitution bagasse.
- (iii) Developments in other application areas of bagasse such as cogeneration of power and the possible emergence of bagasse as a source of power for rural electrification (though presently insignificant) cannot be ignored. These could also affect bagasse availability for paper units.

Hence, a combination of substitution bagasse needs to be looked into. Paper units while being set up on the basis of surplus bagasse may do well to simultaneously tie up with at least one sugar mill for supply of substitution bagasse in the event of shortage. The investment in the coal fired boiler should be considered as part of the project cost.

If technology for effective chemical recovery for smaller sized plants at a reasonable cost is developed, smaller paper mills with surplus bagasse can also be set up.

Location for new Agro-based Paper Mills

As mentioned earlier, the supply of paper & paper board indicates a deficit of 2.1 lac tonnes in 1995-96. By 2000-01, there would be a deficit of 10.2 lac tonnes. This deficit is after considering production from the existing paper mills, proposed expansions and likely revival of some of the closed units. However on account of a number of factors such as likely diversion of paper to newsprint, problems of raw material supplies for the waste paper based mills leading to a lower production, etc. the actual deficit by 1995-96 would range between 2.10 lac tonnes and 3.95 lac tonnes. The deficit in case of newsprint is expected to range between 2.5 lac tonnes and 3.5 lac tonnes by 1995-96.

As many large forest based paper mills may be unable to either expand their capacities or set up new projects for the manufacture of paper and paper boards mainly for want of forest-based raw material (due to depleting wood base and lack of captive plantations),

increased availability of bagasse through proper energy conservation measures with the sugar mills as also substitution bagasse, it would be desirable to increase the production of paper in the short run through a combination of ;

- i. Creation of fresh capacities based on agro based raw materials.
- ii. Expansion of existing capacities where raw material supply is assured, and
- iii. Revival of viable closed units directly or through takeover by wood based paper mills.

However bridging a further envisaged gap of over 10.2 lac tonnes by 2000-01 would call for the setting up of a number of agro based units as also expansion of existing agro based units.

As mentioned earlier, paper units can be based on either substitution bagasse or surplus bagasse. In certain locations where coal can be conveniently made available to sugar plants, they should be encouraged to set up coal fired boilers and supply the bagasse to paper mills. In some locations 2-3 sugar mills can pool their surplus bagasse for a paper mill of 33,000 tpa. The actual surplus bagasse availability is 5% in case of many sugar mills. The surplus bagasse availability

could be increased to about 8 to 10% of the cane crushed by use of more fuel efficient boilers, adoption of moist dipithing and recycling of the pith and the use of dryers to reduce moisture content of the bagasse.

Considering the cluster of sugar mills existing and likely to be set up, sugar mill clusters for setting up a 100 tpd paper mill based on bagasse have been identified. For details please refer the enclosed map. The landed cost of coal would be the lowest in the Eastern U. P , North West Bihar and Andhra Pradesh (Rs. 700/- to 800/- per tonne. Hence some large sugar mills in these regions may be appropriate for providing substitution bagasse. The ex-factory cost of bagasse would be about Rs. 420/- toane. The landed price of coal in most other places will be Rs. 950/- to Rs. 1200/- tonne. In such locations, substitution bagasse may not be economical and hence surplus bagasse needs to be considered for setting up paper mills.

Total scope for locating Paper plants is given in the following Table.

This scope is based on a 5% surplus bagasse and in a few cases based on substitution bagasse. If as indicated earlier, the sugar mills are encouraged to modernise their boilers, the extent of surplus bagasse released could be increased. Surplus bagasse generation

Table No. 19

Suggested Locations for new agro-based Paper Mills

Clusters	Type	Units	Capacity (tonnes)
1. N.W. Bihar & Eastern U.P.	Substitution and Surplus	3	99,000
2. Central U.P.	Surplus	1	33,000
3. Nainital & Western U.P.	-do-	-	
4. South Gujarat	-do-	-	
5. South & West Maharashtra & North Karnataka	-do-	3	99,000
6. North Andhra Pradesh	Substitution	4	132,000
Total		11	363,000

could also be increased through the utilisation of pith generated by the paper mill, in the sugar mill boiler so as to release more bagasse. This is however, possible only if the paper mill is set up by the sugar mill or both are located in the same area. The above surpluses are based on existing sugar mills. It is likely that the government may allow the setting up of a number of new sugar mills. If this is coupled with diversion of cane from Gur and Khandsari to sugar mills, then the availability of bagasse would be greater. If on the other hand, additional sugarcane is not diverted to sugar mills, then, the new sugar mills would compete for the same quantity of cane resulting in an overall lower capacity utilisation and even lower surplus bagasse generation.

Further, in considering areas to locate paper units, one has to consider a radius of less than 100 kms from the raw material source to enable transport economies and also ensure that it does not affect the raw material supplies to existing paper units dependent on bagasse or agro residues. Adequate provisions would also have to be made for enabling existing units to expand their capacities to at least minimum economic size so as to be able to set up a chemical recovery system.

5. TECHNOLOGY

A. Process : Paper manufacturing involves :

- i. Debarking & Chipping
- ii. Pulping
- iii. Paper making

Bamboo, hardwoods and other raw materials are debarked and chipped into small pieces to facilitate cooking. The cooking process eliminates lignin & other impurities from the wood & separates the wood fibres from other ingredients. The fibres are then washed & bleached. The pulp is then passed through a rapidly moving wire mesh to remove the water. It is then transferred to a felt blanket & conveyed through steam heated driers to remove excess moisture.

B. Environmental & Pollution Aspects

Paper industry utilises forest based raw materials, agricultural residues and some varieties of grass. Conversion of such raw materials into pulp and paper involves

the consumption of large amounts of water and energy. This process gives rise to the problems of (a) depletion of natural forests (b) environmental pollution.

Area under forest is believed to have reduced to 11% of the land area. To-day paper mills do not consume wood and bamboo from annual increment in the growing stock, but consume from the existing standing forest. Over exploitation of this source of raw material poses a serious threat to the ecological system. It is therefore necessary to develop secondary source of raw material in a big way, improve forestry operations, scientific felling to maintain higher yield with proper environmental management.

The Paper Industry also contributes to pollution of air, water and land (due to lime sludge). Air pollution can be controlled by installing cyclones, dynamic precipitators, electrostatic precipitators, fume incinerators etc.

Process water discharged from paper mills contain bark, wood debris, fibres, lignin, clay, minerals, resins, phenolics, starch etc. Small paper mills which do not have chemical recovery system have more pollution problems. The common methods employed by the paper industry for water pollution control include:

- i. Pre treatment to remove coarse solids.
- ii. Primary treatment to separate suspended matter through settling ponds
- iii. Secondary treatment employing biological water treatment to dissolve organic matter &
- iv. Tertiary treatment to recycle water through methods such as filtration, chemical oxidation & reverse osmosis.

(This is generally not employed by paper mills in India).

- v. Chemical Recovery Systems: All large mills have chemical recovery system, wherein about 65 to 90% of the black liquor (mainly caustic soda) is recovered. On other hand, most small paper mills do not have a viable chemical recovery system due to uneconomic size and lack of suitable technology. For units using cereal straws, suitable technology has yet to be evolved to remove silica content in the black liquor. For the purpose, the alternate chemical recovery systems under development are

- a. DARS - Ferrite Recovery Process
- b. Wet Cracking System
- c. Organosolv Pulping
- d. Bio pulping and Bio bleaching
- e. Membrane Process

Appropriate R & D efforts in controlling pollution aspects with modernisation of various departments of the paper mill would improve ecological balance and pollution control.

C Energy Conservation

Paper is an energy intensive industry consuming about 1000 kwh to 1600 kwh per tonne of paper produced. Most of the paper mills have been set up during the low cost energy era and sufficient attention was not paid to energy efficiency in the process involved. Thermal energy requirement accounts for 85% of the total energy requirement of a paper mill and practically the entire fuel is consumed in the boilers for generation of steam. The average consumption of steam per tonne of paper is about 8.3 tonnes (i.e. 1.70 tonne of coal; at 4.8 tonne of steam per tonne of coal). The requirement of coal by small paper mills is about 1.0 to 1.2 tonne per tonne of paper produced.

Steam generation, co-generation, chemical recovery system, water conservation and mechanisation at raw material preparation, effluent treatment, plant modernisation would result in energy conservation and consequent saving in the cost of production.

D Research & Development

There is limited R&D at the industry level. Research in the field of pulp and paper was mainly being carried out by the cellulose and paper branch of the Forest Research Institute (FRI) and the Institute of Paper Technology (IPT), Saharanpur. The important issues involved in Research and Development activities relating to the pulp and paper industry were :

- a) Identification of non-conventional raw materials & develop process know-how.
- b) Development of Chemical Recovery System for Small paper mills using bagasse and other agricultural raw-materials.
- c) Improve technology for reducing the cost

- d) Development and updating design engineering
- e) Solutions for effluent disposal.

Central Pulp and Paper Research Institute (CPPRI) has carried out some pilot studies on the above noted aspects. However, so far it has not been possible to design a plant suitable for chemical recovery for agro residue based paper mills.

E Equipment-Requirements and Availability

The manufacture of a new paper plant involves a wide range of equipment from raw material storage to rolling out finished paper. Indigenous equipment suppliers have over the years developed technical skill to manufacture major items. Some critical components accounting for about 30% of the total requirement needed are still imported. Manufacturers like Larsen & Toubro, and Jessop & Co. are capable of supplying paper machine upto 300 tpd capacity. Servalls, Mechano and Eastern Paper Mills have supplied equipment to paper mills upto 60 tpd. At present two 60 tpd capacity units based on bagasse are being set up with indigenous equipment as well as imported components.

There is also ample scope to upgrade the technology of different departments of the existing paper mills, especially in the area of paper machine rebuilding and energy conservation.

The experience of importing second hand equipment has revealed several problems in this regard. A careful review must be made on the techno-economic viability of the second hand paper plants using bagasse, other agricultural residues or waste paper.

F Investment Requirements

Capital costs for setting up a paper plant have increased over the years. Setting up a grass root large paper mills based on forest resource involves a massive investment. In the 80s, only two units of Hindustan Paper Corporation at Assam (Cachar and Nawgang) have been set up. The capital cost of these projects were over Rs. 250 crores for 1.0 lac tonne capacity. The cost of an agro based mill with an installed capacity of 18,500 tpa was Rs. 22,000/tonne in 1990. The current capital cost of TNPL's major expansion is estimated at about Rs. 40,000/tonne. The capital cost for setting up a 33,000 tpa capacity paper mill

based on bagasse would also be in the region of about Rs. 130 cr. For the purpose of bridging the gap between demand and supply in 1995-96 at least 7 paper mills of 33,000 tpa are required. It would involve an investment of upto Rs. 920 cr. TNPL's expansion project is estimated to involve an outlay of Rs. 400 cr. For a new grassroot plant in Tamil Nadu, the envisaged cost is Rs. 1100 cr. (Rs. 55,000/- tonnes).

Further, the two new Newsprint units, viz Nepa Mills & Punjab Agro would invest about Rs. Rs 650cr.

Some agro based paper mills are expanding their capacity. It is estimated the minor expansion would need about Rs. 15,000/- per tonne of output. For expanding about 2.08 lac tonnes of paper, (excl TNPL's expansion) an investment of Rs. 310 crores would be required. Modernisation of wood based paper mills would need at least Rs 12,000/- per tonne. Though a large capacity needs to be modernised, it is reported that about 12 mills have drawn up modernisation plans aggregating about Rs. 1000 cr.

Revival of sick mills would need about Rs. 300 crores.

Thus, the minimum invest requirements during the next 3 years would be Rs 3,800 cr. as shown below :

	Rs. crores.
New Units	1100
Newsprint units	650
TNPL	400
Expansions	310
Revival of sick units	300
Modern's of wood based units	1000
Total	3760

Say Rs. 3800 cr.

In addition to the above, considering a gap of over 2.1 lac. tonnes by 1995-96, additional capacity of at least about 2.3 lac tpa would be required. This,

could be met either, through grass root plants based on bagasse or through expansions of existing units. In the event of grassroot plants, the additional investment required would be about Rs. 920 cr. If the additional capacity is met through expansions, the additional investment requirement would be about Rs 345 cr. The actual additional investment required may range between Rs. 345 and Rs. 920 cr. in view of the fact that part of the additional capacity would be met through expansion and partly through grass root plants.

Further, substantial investments would be required in the even of an appropriate chemical recovery system being developed for small agro paper plants. Considering the fact that most of the agro paper mills with an aggregate installed capacity of over 70 lac tpa do not have a chemical recovery system, sizeable investments would be required in this sector.

Significant investments would also be required if additional capacities are set up for newsprint, the gap for which is expected to be substantial.

6. Prices And Excise Duty

Paper Industry was under statutory price control for a long time. Shortage of paper for a long time compelled the Government to procure paper required for education sector at a concessional rate. This practice was stopped in 1988. During the years 1985 to 1988 the industry experienced demand recession and as such there was no 'substantial' increase in selling prices. Many mills had low profitability at that time. However, after the 2nd half of 1988, mills have been able to pass on the increase in their input costs and realise fairly better returns which is reflected in their over-all performance during the years 1988-89, 1989-90 and 1990-91. The increase in selling price was almost 80% in some varieties of paper. Table below indicates a trends in the selling prices of paper.

Table No. 20
Trends in Selling Prices

	1-1-1988	1-4-1990	1-12-90	1-10-91
Creamwove	11,400	17,950	19,500	21,460
Maplitho	12,637	18,500	20,000	23,950
Duplex Board	10,912	14,200	15,400	16,200
Kraft Paper	9,990	12,800	14,000	15,000

The price of paper from the agro based units is about Rs 1000 to Rs 2000 per tonne lower than those realised by the wood based units.

The domestic selling prices of newsprint ranges from Rs. 15,100/- to Rs. 17,900/- per tonne. The landed cost of imported standard newsprint of 49 gsm is Rs. 17,600/- per tonne while that of glazed newsprint is Rs. 27,000/- tonne.

Excise Duty

Small Paper Mills have excise duty concessions. It is levied slab-wise on the basis of goods cleared during the year. Use of bagasse as raw material upto 75% of its furnish is fully exempt from excise duty. This is to encourage the use of bagasse for making paper and paper board. The excise paid by wood based mills is about Rs. 2500/- per tonne (10% of advalorem + Rs. 5.50).

Prospects For The Paper Industry

- a. In the absence of planned forestry, existing large paper mills would increasingly face problems in obtaining adequate raw materials viz bamboo and hardwoods. The cost of the same is also expected to increase considerably in the coming years.
- b. Most paper mills have started using increasing quantities of waste paper and imported pulp to maintain production levels, a trend, which is likely to continue in future. This would reduce availability of waste paper for small waste paper based mills leading to higher deficit.
- c. To meet the RM requirements of the wood based paper mills, several measures have been suggested by the industry :
 - i) More scientific management of forest by the State Governments and Forest Development Corporations so as to improve yield per hectare as also to enable the use of incremental wood for paper manufacturing as compared to the depletion of standing forests as at present.
 - ii) Development of farm forestry.
 - iii) Development of captive plantations on leased forest waste lands so as to serve a dual purpose of raising forest cover as well as provide raw material to the paper industry.

While implementation of the first option rests with the government, considerable progress has been made by some of the mills in developing farm forestry.

However, considering a time span of 6-7 years involved, it may not be possible to sustain farmers' interest over a period of time and as such this option may not be sustainable as a major source of RM on a long term basis. As to the last option, the government has yet to device a concrete policy to allow captive plantations by wood based paper mills. Also, substantial investment would be called for.

Thus, the paper mills would have to rely on a combination of above sources for their requirement of raw materials. On the other hand, considering the need for paper mills to grow over a period of time, it is likely that some of them may opt for growth by setting up agro based mills, in which case it may be desirable to explore the possibilities of takeover of some of the sick and closed agro paper mills by the wood based units. This would provide the large wood based mills;

- i) An opportunity to grow
- ii) Manufacture superior qualities of writing & printing paper through wood pulp and kraft paper, regular varieties of writing and printing board from agro residues.
- iii) Investment requirements would also be lower.
- d. The expected demand supply balance for paper & paper board is shown below :

(Lac Tonnes)

Year	Estimated Demand	Production	Deficit
1995-96	28.60	26.50	2.10
2000-01	37.90	27.70	10.20

The supply includes supply from existing units, proposed expansions, as also likely revival of some of the closed units. In case of paper, the actual supply may be lower than envisaged due to a number of reasons such as :

- i) Lower production from Waste paper based units due to probable shortage in waste paper availability.
- ii) Diversion of creamwove paper for newsprint.

Thus the deficit for the paper industry is expected to range between 2.1 and 3.95 lac tonnes depending on the actual supply materialising.

The additional capacities required to meet these deficits could be either by way of

- i) Expansion of existing units with assured raw material supplies and coupled with a chemical recovery system.
- ii) Setting up new agro-based units (mainly based on bagasse.)
- iii) Revival of viable closed units.

In the long run, considering the qualitative shifts taking place in the industry forest based raw materials would continue to play an important role in the industry as they would be the major suppliers of superior varieties of paper, which is the largest growth segment in the paper industry. Hence, captive plantations & farm forestry measures have to be necessarily implemented.

e. The expected demand supply balance for newsprint is shown below :

Year	Demand	Likely Production	Shortfall
1995-96	8.50	5.00	3.50
2000-01	10.80	7.40	3.40

The deficit for newsprint is expected to range between 2.5 lac tonnes and 3.50 lac tonnes (after considering diversion of 1 lac tonnes of paper to newsprint) by 1995-96.

Considering the high investment requirements, in the short run to meet this shortfall, it may be desirable to set up additional newsprint capacity based on deinking technology using waste paper. This would reduce the outgo of foreign exchange. However location should be in an area with adequate bagasse availability so as to set up pulping facilities at a later stage. This would enable the investment to be phased and also reduce the gestation period to begin with.

- f. Considerable attention needs to be paid towards locations of agro-based paper mills.
- i) Primarily, agrobased paper units should be located within a radius of 75 to 100 kms. from the raw material source.

- ii) Continuous availability of raw materials needs to be ensured.
- iii) In locating other paper mills close by, disruption of supply of RM to existing mills should be avoided. Secondly, it also needs to be ensured that the existing and the proposed mills would have adequate RM availability to enable them to expand their capacities in future.

g. **Substitution Bagasse** :— While at current raw material prices, it may be more tempting to set up paper mills based on surplus bagasse alone, in the long run, the option of substitution bagasse needs to be considered as a hedge against drought periods and diversion of bagasse for other uses such as cogeneration of power. Ideally, agro based paper mills need to enter into an agreement with at least one sugar mill for substitution bagasse and instal a multifuel boiler, so as to switch to substitution bagasse in the event of difficulty in procuring surplus bagasse. Setting up of paper mills with substitution bagasse near the coal belt areas should also be encouraged as the cost of such substitution would be lower in such areas. Possible locations for a paper plant of 33,000 tpa capacity based on bagasse (surplus + substitution) have been indicated in the study.

- h. Large wood based paper mills shifting partly to bagasse need to modernise their entire pulping sections and not merely the digestors alone.
- i) A viable chemical recovery system needs to be developed for agro based paper mills. There is also need to develop a technically and economically viable chemical recovery system for straw based units.
- j. With improvement in the price realisation, revival of some of the closed agro-based units may be economically viable, especially in cases where plant and machinery is in good condition. Alternatively, the plant and machinery could be sold to another small unit, so as to enable the installation of a chemical recovery system and cut costs. On the other hand, revival of waste paper based units may be more difficult as availability of waste paper would be a major bottleneck unless substantial imports are permitted,