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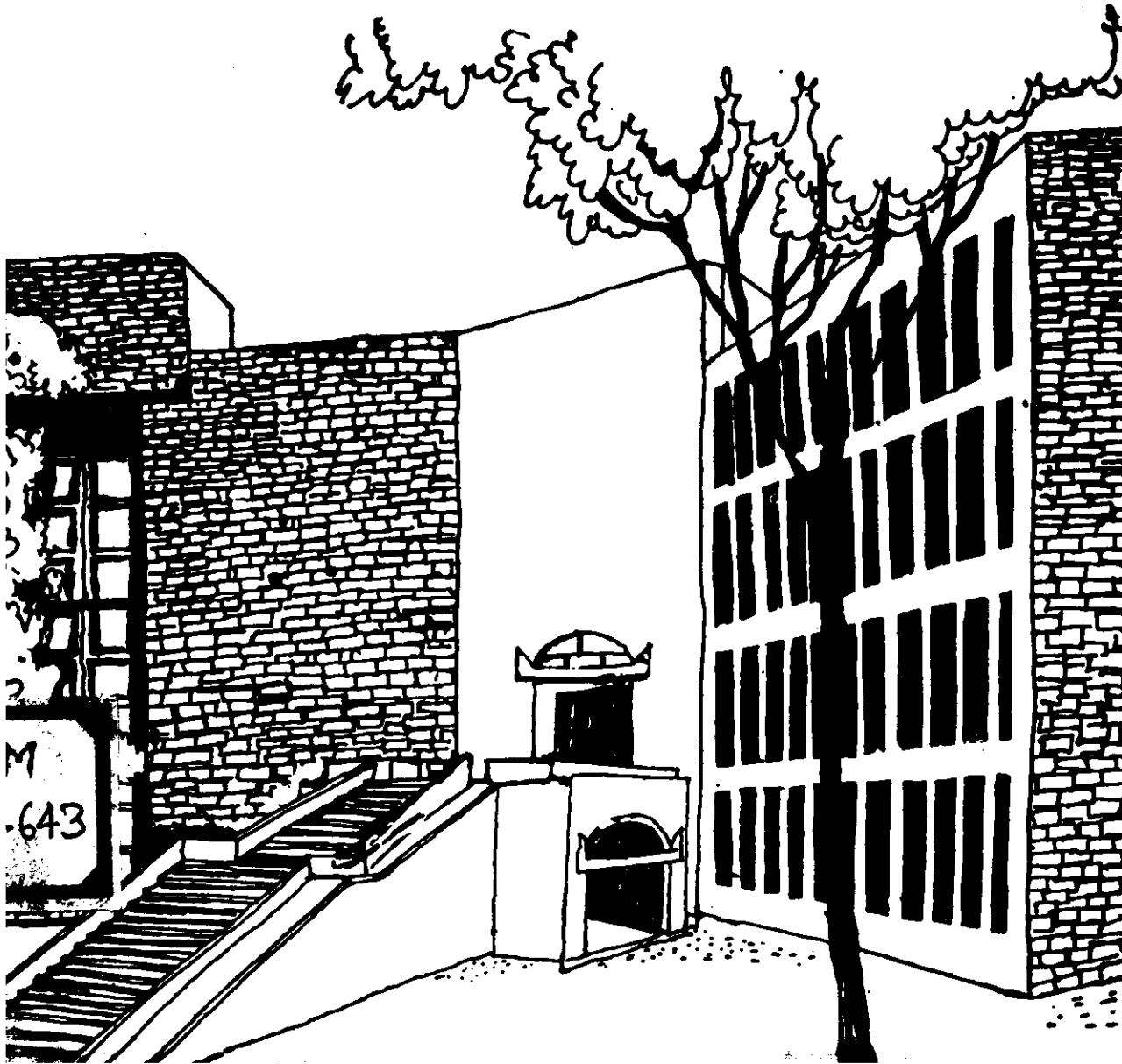
DEMAND FORECASTS FOR CULTURAL AND
INDUSTRIAL PAPERS IN INDIA:
SOME POLICY IMPLICATIONS

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DEMAND FORECASTS FOR CULTURAL AND INDUSTRIAL PAPERS IN INDIA: SOME POLICY IMPLICATIONS

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There has been a rapid growth in the total number of pulp and paper mills in India from 17 in the early 1950s to 175 in 1983, and to 250 in 1985. The domestic output of paper and paperboards has increased from 1,35,000 tonnes in 1951 to 1,50,000 tonnes in 1985. Normally this must be attributed to a substantial increase in demand for these goods in the past and to an anticipation of continuation of that trend in the future particularly because pulp and paper is a capital intensive industry with a long pay back period. In that context, the main objectives of this study are to

- assess the past work on demand forecasts for paper and paperboards for India; and

- assess some policy implications of the demand forecasts.

For ease of presentation, the available studies have been divided in three main groups on the basis of the methodologies used. These are

- analysis of changes in demand due to changes in income as the only explanatory variable

- analysis of demand due to changes in two or more explanatory variables, and

- demand forecasts based on end use surveys.

This study is confined to writing and printing papers and paperboards. Newwsprint has not been covered as growth in its demand has been somewhat independent of or only indirectly

related to the demand for other papers. Moreover, most of the newsprint consumption in India is accounted for by those sections of the urban population which are relatively better off in terms of per capita incomes, educational levels, etc. The expenditure on newspapers accounts for a small portion of their total household expenditure, and the price elasticity of demand has been extremely low.[1] A good portion of the demand for newsprint in the shape of magazines could even be characterised as ostentatious consumption.

1. Availability of Paper and Paperboards in India: Some Facts and Observations

Data in Table 1 show that domestic output of paper and paperboards in India increased from 1,35,000 tonnes in 1951 to 1,500,000 tonnes in 1985 but the growth rate of production during 1951-61, 1961-71, 1971-81 and 1981-85 declined continuously from nearly 170 per cent to 114 per cent to 58 per cent and to 22 per cent. Could these trends be adequately explained by continuous rise in the total outputs and subsequent change in base observations?

Search for an answer is complicated as an unprecedented increase in demand for paper and paperboards was and continues to be anticipated for a number of reasons: rising incomes, heavy emphasis on education and adult literacy, development of industry

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1. This can be true for writing and printing paper also upto some minimum level of absolute consumption, but even at that level, social/cultural/administrative/politica implications of rise in prices of these goods could be of much greater concern than those of newsprint.

Years	Domestic Output of P&PB ('000 tonnes)	P and PB Imports ('000 tonnes)	Total Availability of P and PB ('000 tonnes)*	Imports as percent of total availability of P and PB	NNP at 1970-71 prices (Rs.in crores)	Popu- lation (Milli- ons)	Per Capita income at 1970-71 prices (Rs.)	Per capita consumption of P and PB (Kgs)	Number of adult literates (Millions)	Income elasti- city of demand for P and PB
1951	135	84	219	38.0	16,731	361	466	0.61	41.4	-
1961	364 (169.6)+	116	480 (119.2)	24.2	24,250 (44.9)	493 (21.6)	558 (19.7)	1.09 (78.7)	81.99 (16.6)$	2.65
1971	780 (114.3)	221	1,001 (108.5)	22.1	34,235 (41.2)	584 (24.8)	633 (13.4)	1.83 (67.9)	108.3 (18.5)	2.63
1981	1,232 (58.0)	257	1,489 (48.8)	17.3	47,490 (38.7)	680 (24.1)	700 (11.6)	2.19 (19.7)	156.0 (25.7)	1.26
1985	1,500 (21.8)	-	1,500 (Negligible)	-						

* Exports not considered

+ Figures in parentheses are rates of growth over the preceding period except those in column 10.

$ Figures in parentheses in column 10 are percentages to total population.

Sources: 1. DCPPI, 1983e, p.10, for columns 2-4, 7 and 10.
2. GOI, 1983a for column 6.

and commerce, etc. Moreover, in spite of a substantial increase in the quantity of imports during 1951-1981, the share of imports in the total availability continually declined from 38 per cent to 17 per cent up to 1981 and there have been no imports of paper since 1983. Capacity utilization by the industry in India declined continually from 98 per cent in 1951 to 63 per cent in 1985. The ~~growth~~ rate of total availability also declined significantly, but there have been no critical shortages of paper in the recent past.

These facts, in turn, may be analysed in the context of changes in explanatory variables such as growth rate of NNP and per capita incomes at constant prices, proportion of adult literates to total population. The growth rates of NNP and per capita incomes during 1971-81 indicated a consistent trend. On the other hand, the growth rate in per capita consumption of paper and paperboards was higher than that of NNP and per capita incomes during 1951-61 and 1961-71, but the situation changed during 1971-81 when the growth rate in per capita consumption of papers and continued to be higher than the growth rate in per capita incomes, while it was substantially lower than the growth rate in NNP at constant prices.

The issue would be further complicated with the consideration of income elasticities of demand for paper and paperboards estimated at 2.7, 2.6, and 1.3, respectively, in 1961, 1971, and 1981. The income elasticity of demand, of course, declines with rise in

incomes as well as aggregate consumption beyond a certain level, but has that level been reached in India?

The data in Table 1 also show that the proportion of adult literates to the total population increased significantly from 11.5 in 1951 to 25.7 in 1981, and this increase was most marked during 1971-81. Could this not have compensated for a relatively higher decline in the growth rates (not absolute) of NNP and per capita incomes during the decade and, thus, arrested the sharp decline in the income elasticity of demand; and growth rates of i) domestic production, ii) total availability, and iii) per capita consumption of paper and paperboards?

Table 2 unfolds yet another story. The number of paper mills in India increased from 17 in 1951 to 250 in 1985. The average annual installed capacity increased from 8,100 to 19,600 tonnes during 1951-71 but declined continuously thereafter to reach 9,400 tonnes in 1985. Most of this has been a result of the policy to encourage small scale paper units through i) incentives in excise duties and other taxes, and ii) duty free imports of used papermaking machinery. The presumption has been that the small scale units would use unconventional raw materials, particularly agricultural and agro-industrial residues such as wheat and paddy straw, bagasse.

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2. Studies for European countries and the United States, have shown that elasticity of consumption ranged between 2.5 to 3.0 and 1.5 to 2.5, respectively, with per capita incomes at $100, and $200 to $400. With per capita incomes ranging between $500 and $1000, the range over most of the European countries was more than unity but with per capita incomes at over $2000 it was below unity for the United States (ESRF, 1969, pp.42-43).

Table 2: Number of Integrated Pulp and Paper Mills in India
by Size Groups of Annual Installed Capacity: 1951 to 1985

| Years | Capaticy '000 Tonnes/Year | | | | | Total | | Average Capacity ('000 tonnes/ annum) |
	Above 20	10 to 20	5 to 10	2 to 5	Below 2	Number of Mills	Capacity ('000 tonnes)	
1951	2	3	2	5	5	17	137	8.1
1961	6	4	3	8	6	27	410	15.2
1971	14	3	7	12	10	46	901	19.6
1979	19	6	23	27	31	106	1,530	14.4
1980	21	8	24	31	27	121	1,538	12.7
1981	22	9	31	33	41	136	1,657	12.2
1982	22	10	40	41	44	157	1,817	11.6
1983	23	11	41	49	51	175	1,907	10.9
1984	23	11	60	65	61	220	2,165	9.8
1985	23	15	68	80	63	249	2,350	9.4

Sources: 1. DCPPI, 1983b, for 1951 to 1978
2. DCPPI, 1983a, for 1979 to 1983
3. DGTD, GOI, for 1984 and 1985

While a discussion of this policy is not within our scope, yet it may be noted that there have been a number of problems. It can even be argued that the concept of small scale cannot be relevant to integrated pulp and paper mills as the production processes do not differ between large and small units. Opportunity costs of agricultural and agro-industrial residues have also not been studied. Therefore, the policy did not appear to be a product of economic logic. This could further emphasize the essential point that the past and recent trends in India in

- growth rates in total availability of paper and paperboards

- growth rates in per capita consumption of these goods, and

- changes in price and income elasticities of their demand

are not easy to analyse and understand, but must be understood as far as possible to facilitate objective and dispassionate discussions for designing self sustaining long term policies for the growth of the industry. A part of this understanding can emerge from an assessment of the state of the art for demand forecasts.

2. Demand Forecasts Made by the Planning Commission And Other Agencies and a Few General Observations

The Planning Commission of India has been estimating the future demand for Paper and Paperboards in the country. A perusal of the available demand forecasts, data on planned and realized production capacities, and review of the plan documents and related literature could, however, not be of much help in understanding their methodology. Moreover, estimates of future demand have not ben a regular feature of the planning process but targets for installed capacity have been fixed for each plan period without exception. This would mean that aspirations or, at best, presumptions have been relied upon rather than pragmatic considerations. The observation is further supported by interchangeable use of the words demand and requirements.[3]

During the First Five Year Plan it was assumed that the annual rated capacity for paper and paperboards would increase from 1,37,000 tonnes in 1951 to 1,98,000 tonnes in 1956. Comparable

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3.   The term demand signifies the quantify of a good that would be bought at a specified price and, thus, implies that the consumers' desire for the commodity must be accompanied by their willingness and ability to pay for it. Requirements, on the other hand, merely signify wants.

figures for output were 1,14,000 tonnes and 1,88,000 tonnes (GOI 1953, p.448, Appendix II). There was, however, no mention of estimated demand. One possible, though weak, reason for this could be a realization that any efforts to enhance the production capacity at home during the period would not meet the demand.

For the terminal year of the Second Five Year Plan, the requirements for paper and paperboards were assumed at 3,50,000 tonnes (GOI, 1956, p.424, Appendix II). On the contrary, the Third Five Year Plan document used the term demand which was estimated to reach 7,00,000 tonnes by 1966 (GOI, 1962, pp.488-89). Once again, the Fourth and Fifth Five Year Plan documents made no mention of demand or requirements, but targets for installed capacity and production levels were fixed, respectively, at 10,00,000 tonnes and 8,50,000 tonnes for 1974, and 14,00,000 tonnes and 12,00,000 tonnes for 1979 (GOI, 1970 p.324; GOI, 1976a, Volume II, Appendix II, p.158). Actual consumption in 1980 was estimated at 11,00,000 tonnes and the demand in 1985, i.e., the terminal year of th. Sixth Five Year Plan, was anticipated at 15,40,000 tonnes (GOI, 1981, p.145).

A perusal of Table 3 can also show that during the different plan periods, planned outputs varied between 85 and 73 per cent of the planned capacities. The expected capacity utilization does not indicate a consistent trend, and reasons for such variations were difficult to comprehend. The issue, of course, is of vital importance. The extent of capacity utilization must have a significant bearing on costs per unit of outputs, particularly of

capital intensive enterprises. That in turn, should affect the market price and the demand for the final product, the demand for raw materials, and the industry's capacity to pay for the inputs including cellulosic raw materials.

Table 3: Estimated Demand, Planned and Installed Capacities, and Observed Outputs of Paper and Paperboards in India: 1951 to 1985

('000 tonnes)

Plans and Years	Estimated Demand	Planned Capacity	Installed Capacity	Planned Output	Observed Output	Planned Output as per cent of planned capacity	Observed Output as per cent of installed capacity
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First 1951-56	*	212	210	165	187	77.8	89.1
Second 1956-61	350	450	410	350	350	77.8	85.4
Third 1961-66	700	820	711	700	558	85.3	78.5
Annual Plans 1967-69	*	750	730+	635	647	84.6	88.6
Fourth 1969-74	*	1,000	1,025	850	776	85.0	75.7
Fifth 1974-79	1,100 ++	1,400	1,538	1,200	1,050	85.7	68.3
Sixth 1980-85	1,540	2,050	2,350	1,500	1,360	73.2	57.8

* Not stated or estimated
+ Estimated
++ Observed consumption as stated in the Sixth Plan document

Source: 1. GOI, Respective Plan Documents
        2. DGTD for last row in columns 4 and 6

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The observed outputs also varied between 89 per cent and 58 per cent of installed capacity and, excepting the period 1967-69, there has been a consistent decline in this respect. Various reasons including shortages of inputs have been advanced for this situation. The important ones of these in the present context, however, appeared to be that i) the capacity created was substantially higher than the effective demand for paper and paperboards, and ii) the production technology used could not meet the desired standards of efficiency and efficacy.Inventories of paper and paperboards have been rising and ranged around 10 per cent of the annual outputs in the recent past. Another set of indications of excess production lies in the industry's plea for i) reduction in imports of newsprint to encourage the use of creamwove paper weighing 56 grams per metre^2 (gsm) for periodicals (Jatia, 1983, pp.4-5.), and ii) withdrawal of restrictions on exports introduced in 1976(IPMA, 1982, p.19; Jatia, 1982, pp.4-5; Jatia, 1983, p.4; and Mehta, 1981, p.7).

These points also show that the declining trend in capacity utilization could not be adequately explained by structural and even technological variables. Technological advancement can play an important role in demand creation through improving the quality and/or reducing the costs per unit of outputs. Irespective of that, it can be said that if the demand was to be anywhere near as high as anticipated, capacity utilization would have been enhanced; and the industry would not have excess

capacity, at least in its current dimension, if a distinction between demand and requirements was made and the former was used as the basis for planned increase in outputs.

Estimates of India's requirements, not demand, for paper and paperboards have also been made through a few other studies conducted on behalf of the Planning Commission. One study, for instance, observed that the per capita consumption at 1.4 kg in 1964-65 was far below the level which could be considered reasonable and the barest minimum should have been 4 kg at that stage of the country's economy, and the consumption level by 1980-81 could be raised to 6 kg per capita (GOI, 1965, p.5). Even if ambitions were to be accepted, could a change in per capita consumption from 1.4 kg to 6 kg within a span of 25 years be considered feasible and/or logical? The answer has to be negative as soon as it is appreciated that a major portion of the demand for paper and paperboards is derived.

Similarly, some organizations of the United Nations hold that India's social and economic status in the world and the pursuit of her business activities and developmental policies would require that per capita annual consumption of papers should reach 30 kg in the foreseeable future. This, however, is accompanied by recognition of problems in traversing the astronomical distance between 2 kg and 30 kg.

A number of others in their official and/or personal capacities have also been interested in making demand forecasts without specifying their methodologies. One such forecast has been that

the demand would be 4.25 million tonnes by the turn of the century. This implied that the future demand should grow at the rate of 10 per cent a year (Biswas, 1981, p.5).

Another thought has been that the pace of developmental activities in India, the uses to which the paper is being put, and enhancement of education of the masses would result in a 400 per cent increase in demand by the turn of the century compared with the 1981 level (Singhal, 1982, p.36). If this is to be correct, the demand in the year 2000 should be around 60,00,000 tonnes. This, to say the least, is mind bogling.

The discussion in this section may be concluded with an observation that the demand forecasts in this category have contributed to the prevailing environment of tensions among groups such as paper and paperboards manufactures, producers/suppliers of cellulosic raw materials, administrators, and policymakers. A number of somewhat systematic attempts to estimate the demand for paper and paperboards in India have, of course, been made. These have been discussed in sections 3 to 5. Prior to that a few general observations could be useful.

1. Demand projections for a number of commodities or sets of commodities have been based on the correlation of their past consumption data with a set of independent variables which have a bearing on the consumption level(s). This is generally true where data for application of sophisticated methodologies are lacking.

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2. Paper and paperboards are not homogenous products. Variables directly affecting the demand would include income (standard of living), price, extent and the level of literacy and education, availability and relative prices of complements and substitutes (particularly for industrial papers), changes in product mix (especially introduction of new and sophisticated varieties), extent of international markets, changes in consumption habits over time due to exogenous variables, etc. Moreover, paper and paprboards have multiple uses and a good portion of the demand is derived from the demand for other products and services.

3. Larger the number of independent variables in a correlation equation, higher the possibility that the results would explain not only the secular trend but also short term variations in consumption. At the same time, relatively more complicated models could obscure some of the fundamental factors affecting long term consumption trends while relationships which explain short term market changes may also dominate.

3. Analyses of Changes in Demand Due to Changes in Income

This section contains a discussion on the studies based on estimating demand for paper and paperboards as a function of changes in only one explanatory variable: per capita incomes.

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3.1 Studies Based on Log Normal Relationship Between Per Capita Incomes and Demand

Initial studies to estimate future demand for paper and paperboards assumed a straight line logarithmic correlation between consumption and income data from a number of individual countries (FAO, 1960, p.3). The equation was of the form:

$$\log Y = b \log X + a$$

where

Y = per capita consumption
X = per capita income at constant prices, and
a and b were constants.

The model had drawbacks as i) it assigned equal weight to each country, and ii) the straight line relationship implied constant income elasticity of demand irrespective of differences in population, income levels, observed consumption levels, etc. The approach was subsequently improved upon by using curvilinear regression (Parabola) function of the form:

$$\text{Log } Y = b \log X - c (\log X)^2 + a \text{ with a maximum at } \log x = b/2c$$

provided $c > 0$ and Y, X are positive

where

Y = per capita paper consumption
X = per capita income, and
a, b, and c were constants (Ibid, p.3).

This dispensed with constant elasticities of demand for all income levels. On the other hand, it resulted in high degree of collinearity between $\log x$ and $(\log x)^2$ as a result of which the constants could not be determined. Moreover, the results were highly erratic due to large variations in the independent variable. The problem of equal weight for all countries,

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irrespective of their income levels, also continued though some improvement was achieved by weighing the data according to population levels in each country.

Yet another approach based on log normal distribution attempted to correlate income and consumption (Ibid, p.3). This dispensed with the theoretical objection to a parabolic function. It also provided a better fit of the demand function to identical historical series of individual country and regional data compared with the straight line logarithmic and log normal demand functions, but it cannot be conclusively said that any one functional form is decidedly better than the other (Gupta and Shah, 1986, pp.28-29 for details).

The log normal function, however, presupposes that, as incomes increase, the per capita consumption would gradually aproach varying saturation values for different categories of paper and for different countries/regions due to differences in consumption patterns and habits. The saturation values may also change with time and would, thus, reflect such secular trends which are essentially independent of variations in income (FAO, 1960, p.7).

This is logical as i) paper and paperboards are not a distinct set of consumable goods as food and clothing, ii) the income elasticity of demand for papers declines with rise in income, and iii) growth in consumption of each of the major categories of papers declines with rising income but not at a uniform rate such that the income elasticity of consumption for cultural papers is somewhat higher than that for industrial papers at low income levels and vice verse (ESRF, 1969, pp.42-43).

Saturation values in consumption can be determined through a process of successive iterations with an initial guess value until the relationship between t and lnx takes the form of a straight line. The procedure lends itself to a graphical solution and can be facilitated by the use of a log normal probability diagram. The FAO study, however, estimated average saturation values for different regions and countries, and used these to project the demand for various types of papers (Ibid, pp. 7-8). The estimated saturation values were:

Types of paper	Saturation values (Kg/per capita)
Printing and writing	60
Other Papers	80
Paperboards	420
Total paper and boards	620

The model further assumed that consumption would rise as incomes increase according to the sigmoid represented by the integral of a log normal distribution of the form:

$$Y = S_\infty \int_{-\infty}^{t} \frac{1}{\sqrt{2\pi}} e^{-t^2/2} \, dt$$

Where

Y = consumption in kg per capita
S_∞ = saturation value in kg per capita

$t = \frac{lnX}{\rho} - \mu$ = Variable of integration

x = income per capita
μ & ρ are logarithmic constants

The first step to use this would be to determine μ and ρ where these are logarithmic mean and logarithmic standard deviation of income, respectively. In the next step, t can be determined, and

the $\underline{t}$ value transformed into consumption level by using statistical values for the Gauss integral and multiplying the saturation level thus obtained with saturation value (FAO, 1960, p.100).

The approach, however, is not free from problems. First, the study under reference computed μ and ϱ from the GNP values of historical regional data. Therefore, their values should have been the same for different types of papers, but they varied. There has been no explanation for this. Second, the ground rules for guessing the starting point of the saturation value have not been specified. Third, the forecasted levels of per capita consumption for different types of papers at varying income levels did not appear to match with the GNP values projected in the study, and another set of GNP values appear to have been used for projecting the demand for different types of papers.

To trace the discrepancies, we estimated the per capita incomes with the given demand forecasts. It was observed that the per capita incomes projected in the study and those estimated with the given demand forecasts were significantly different for all categories of paper, and the differences were not consistent in any one direction. Reasons for such situations were difficult to comprehend. An exercise was also carried out to estimate per capita consumption of different types of paper using the FAO projections for per capita incomes. Once again, the FAO estimates were substantially higher and the differences between the two types were significant except for the category labelled as 'other papers' (Gupta and Shah, 1986, pp.33-36 for details).

There are reasons to believe that the FAO estimates influenced paper production capacities in India and the world as a whole. It would, therefore, be interesting to compare the projected total demand with the observed levels for India. This has been done using the projected and observed population levels for 1965 and 1975. The results have been summarized in Table 4.

Table 4: Estimated Demand for Paper and Paperboards Using FAO's Projections for Per Capita Consumption and Population, and Observed Population in India: 1965 and 1975

('000 tonnes)

Types of Papers	Assumed Growth rate in per capita incomes (%)	Estimated Consumption			
		With projected population at		With observed population	
		473 millions in 1965	569 millions in 1975	483 millions in 1965	601 millions in 1975
Writing	2.00	263	486	269	512
and	2.50	292	591	298	623
printing	3.00	324	713	330	752
Other	2.00	107	207	109	218
papers	2.50	120	257	123	271
	3.00	130	318	137	335
Paper-	2.00	153	305	156	323
boards	2.50	173	390	176	411
	3.00	195	488	199	514
Total	2.00	523	998	534	1,053
	2.50	585	1,238	597	1,305
	3.00	649	1,519	666	1,601

Source: FAO, 1960, p.42, for column 1-4.

It can be noted that the projected population levels were substantially lower compared with the observed. In spite of that, a comparison of Tables 1 and 4 would show that the demand

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estimates were substantially higher than the actual consumption. The issue is more serious as there has been unprecedented growth not only in population but also in other explanatory variables: per capita incomes, educational facilities, literacy ratio, industrial production, etc. One can think that rapid rise in paper prices could have checked the anticipated growth in demand. This, if true, has definite implications for the choice amongst prediction models, data required for demand projections. The issues would be discussed in section 6.

Another study based on the methodology suggested by the FAO in the 1960s assumed three growth rates for national income in India: 4, 5 and 6 per cent (NCAER, 1972, p.18). It also used the FAO's saturation consumption levels at 60 kg and 80 kg per capita for cultural and for other types of papers. Population estimates of the Registrar General of India were used to

Table 5:   Demand Estimates for Papers in India made by the NCAER
           Using Log-Normal Distribution Function: 1976 and 1981

Assumed growth rates in NNI	Per Capita (Kg)		Total ('000 tonnes)	
	1976	1981	1976	1981
Cultural paper				
4	0.895	1.156	563.6	803.7
5	0.971	1.448	611.5	1006.5
6	1.142	1.832	719.7	1273.5
Industrial paper				
4	0.581	0.773	366.1	537.5
5	0.635	0.998	399.8	693.9
6	0.763	1.320	481.0	917.6

Source: NCAER, 1972, p.89

estimate per capita incomes at the assumed growth rates in national income (Ibid, p.17). The results have been summarized in Table 5. Once again, a comparative study with Table 1 can show that even at 5 and 6 per cent growth rates in NNP, the estimated demand was significantly higher than the observed levels for 1975 and 1981.

3.2 Studies based on Log Log Relationship Between Per Capita Incomes and Demand

One study in this group was sponsored by the Economic and Scientific Research Foundation (ESRF). Time series data pertaining to per capita incomes and paper consumption during 1951 and 1966 were used. It was assumed that

- the income consumption correlation during 1965 and 1975 would be the same as observed during 1951 and 1965, and

- the growth rates in per capita incomes and population would be 2.0 and 2.4 per cent per annum (ESRF, 1969, pp.50-51).

Estimates of income elasticities of demand used were 4.3905 for paper and paperboards as a whole, 5.0442 for cultural paper, and 4.3317 for industrial paper (Ibid, pp.51-65). The form of the equation used was

$$Y = a X^b \quad \text{or} \quad \log Y = \log a + b \log X$$

where

Y = per capita consumption
X = per capita income
b = estimate of income elasticity of demand estimated from past date, and
a = constant

Estimated demand levels for 1975 by types of paper were

Cultural   : 10,19,000 tonnes
Industrial   :   5,44.000 tonnes, and
Total   : 15,63,000 tonnes (Ibid, pp.58-66).

These, once again, were significantly higher than the observed

consumption of 8,40,000 tonnes. In fact, the projected demand

for 1975 had not been reached even in 1981.

3.3 Studies Using Linear Regression for Correlation Between Per Capita Incomes and Consumption

The study conducted by the NCAER referred to earlier also used a

linear regression equation for estimating per capita consumption

(NCAER, 1972, p.15). The computed equations along with values of

the constants were:

$$Y_1 = (-) \ 1537.321 + 7.131 \ x_1 \qquad r^2 = 0.94$$

$$Y_2 = (-) \ 1011.973 + 4.599 \ x_1 \qquad r^2 = 0.94$$

Where

Y_1 = per capita consumption (kg) of cultural, i.e. writing
      and printing papers
Y_2 = per capita consumption (kg) of Industrial papers, and
X_1 = per capita incomes (Rs) at constant prices.

The exercise was done to estimate the demand at 4, 5 and 6

percent growth rates in NNP. The estimated total demand in 1981

at 6 per cent growth in NNP was 21,08,700 tonnes. The observed

demand even in 1985 has been lower than this level by at least

6,00,000 tonnes, and there have been no scarcities of paper in

the Indian markets. It was also noted that the estimated per

capita consumption and total demand for both cultural and

industrial papers were consistently higher with the linear

regression model than the results obtained with the log normal

distribution function, and these were difficult to understand.

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Yet another set of projections of the demand for paper and paperboards for 1980, 1985, and 2000 was made by the National Commission on Agriculture (NCA). Time series data for per capita GDP and per capita consumption of printing and writing paper, industrial paper, paperboards, and dissolving pulp were used. It was hypothesized that

- the per capita paper consumption would be a function of per capita GDP;

- the relationship between per capita GDP and per capita paper consumption during 1970 and 1980 would be similar to that observed during 1950 and 1970, and the latter should be arrived at by choosing the regression equation with the best fi

- without changes in the estimated population levels, there could be a low growth and a high growth scenario of per capita GDP at 1971-72 prices and consequently there could be two scenarios of growth in demand for papers (GOI, 1976a, p. 195).

The main consideration behind the model for low growth in demand was that only marginal imports of paper and paperboards would take place or would be allowed. It appears that the NCA did not expect continutation of the observed trends in consumption as it suggested that _expansion in production capacity at home should be planned at a lower level_. On the contrary, considerations behind the high growth scenario were either to _allow_ the _observed trends_ in consumption _to continue_ in the long run, or to _plan_ for a _further and more steep rise in demand_ as actual consumption could have been constrained by import restrictions (GOI, 1976c p.194, emphasis added).

The high growth scenario implied significant increase in imports and, necessitated a change in the choice of the best fit equations in some cases from linear to log log. The distinction

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between high and low growth in demand was considered relevant only in the long run: AD 2000. The equations used for projecting the demand for various types of paper were

Categories of paper	1980 & 1985	2000	
		Low	High
Printing and Writing	Y = a+b log X	Y = a+b log X	Y = a+b X
Industrial	Y = a+b X	Y = a+b X	Log Y = a+b log X
Paperboards	Y = a+b log X	Y = a+b log X	Y = a+b X

Where
Y = per capita consumption for different types of paper
X = per capita GDP, and
a and b were constants

The demand estimates have been summarised in Table 6.

Table 6:   Demand Estimates for Paper and Paperboards for India Made the NCA: 1980, 1985, and 2000

('ooo tonnes)

Paper Categories	1980		1985		2000		1980 to 2000	
	Low	High	Low	High	Low	High	Low	High
Printing and writing	733	832	935 (5.5)*	1175 (8.2)	1777 (6.0)	3675 (14.2)	(7.1)	(17.1
Industrial	244	284	319 (6.1)	428 (10.1)	701 (8.0)	1346 (14.3)	(9.4)	(18.7
Paperboards	330	370	413 (5.0)	515 (7.8)	776 (5.9)	1643 (13.3)	(6.8)	(15.2
Total paper & paperboards	1307	1486	1667 (5.5)	2118 (8.5)	3254 (6.3)	6564 (14.0)	(7.4)	(17.1

*Figures in parenthesis are annual growth rates over the previou period.   In the last two columns these are for the specified period.

Source: GOI, 1976c, p.195.

It can be seen that even the lower of the projected levels for 1980 and 1985 were substantially higher compared with the observed levels. The issue is much more serious in the context of the earlier observations regarding inventories with the producers, reasoning for relaxation in export quotas, etc.

A perusal of Table 6 can also show that the rates of growth in demand for all types of papers for both the scenarios were expected to continually increase during 1980 to 2000. This is not logical and contradicts a general observation made by the NCA itself. How much faith could the authors themselves place on their study which could not answer even a basic question whether the long run demand should be expected to grow at a faster or slower rate than the growth in GNP? Simulation models like this generally cause problems as groups of people with varyng interests can interpret the results differently.

3.4 Studies Based on Log-Log Correlation and Cross Sectional Data on Observed Per Capita Incomes and Per Capita Consumption

The FAO of the UN published another study in 1977 which grouped the countries into developed, developing, and centrally planned; and suggested three approaches for demand projections. One of these is based on analyses of relationships amongst more than two variables and would, therefore, be discussed in the next section.

The first of the other two approaches, known as a 10 year projection model, estimated the demand in 1984 and 1994. Cross-sectional data from 126 countries for the years 1963-65 to 1973-

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75 were used. The variables were i) observed per capita

consumption, ii) observed per capita incomes, and iii) projected

per capita incomes indirectly related with projected population.

Two scenarios (high and low) were developed for estimating growth

in incomes. The equation used for projecting the demand for

paper and paperboard was of the form

$$C_f = e^a \, C^b \, I^c \, I_f^d \quad \text{or}$$

$$\text{Log } C_f = a + b \log C + c \log I + d \log I_f$$

Where

C_f = future consumption (tonnes per 1000 persons)

C = observed consumption (tonnes per 1000 persons)

I = observed per capita GDP (US$ at 1975 prices)

I_f = future per capita GDP (US$ at 1975 prices) .

e = base of the natural log

This model is essentially based on a log-log correlation and the

resulting demand curve has to be a straight line.[4] A few other

points must also be noted.

1. The study recognized the need for adjustments to account for

slow growth in production capacities and the apparent higher

demand than the supply during 1973-74 which resulted in

shortages and rising prices, and supposedly changed the demand

structure.

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4. If price was a dependent variable, demand curve would be a
hyperbola. The same would be the case if observed and estimated
per capita GDP were taken at current prices. In this case,
however, price is a constant variable. One may even argue that it
is not a demand function.

2. Two mutually exclusive assumptions for projecting the world GDP were made. The first considered growth rates at 4.0 and 5.0 per cent per annum during 1975-76 and 1985-90. The second considered growth rates at 6.1, 6.3, and 6.6 per cent per annum, respectively, for the years 1975-80, 1980-85, and 1985-90.

3. The assumed annual population growth rates were 0.9 per cent for the developed and centrally planned economies, 2.7 per cent for the developing economies, and 2.0 per cent for the world.

4. While observation for the years 1963-75 were used to project the demand in 1984, the 1984 projections were used to further project the demand to 1994. For ease of comparisons, however, the estimates were interpolated to 1980, 1985, and 1990.

Table 7: Difference Between Demand Estimates for Paper and Paperboards made by the FAO in 1977, and the Observed Consumption levels by Country Groups and the World: 1980

(Million Tonnes)

Country Groups	Printing and Writing Paper		Other paper and paperboards		Total Paper and paperboards	
	LG*	HG*	LG	HG	LG	HG
Developed	1.37	3.77	5.29	9.64	6.66	13.41
Developing	- 0.29	0.42	0.64	2.97	0.35	3.39
Centrally planned	0.19	0.67	0.91	2.23	1.10	2.9
World	1.27	4.86	6.84	14.84	8.11	19.7

*LG = Low growth scenario, HG = High growth scenario

A comparison of the observed demand for paper and paperboards in 1980 for the world, and the estimates made in the study with the assumptions of both low and high growth rates in per capita incomes, respectively, indicated that the latter were higher by

over 80,00,000 tonnes and nearly 200,00,000 tonnes or by 5.5 per cent and 15.4 per cent (FAO, 1977a, pp. 56-57; FAO, 1983).Table 7 presents data on such differences for different types of paper by country groups. A number of issues arise of which two could be relatively more important.

1. Could such models be relied upon for projecting the demand at a country level when the projections for only 3-4 years ahead at the aggregate world level were nowhere near reality, and the gap between estimated and observed demand was much more pronounced for the developed countries which have a better data base?

2. Given the discrepancies between observations and estimates for 1980, could the forecasts for 1990 and 2000 be appropriate bases to plan for future production capacities?

The second approach of the study was suggested by an Industry Working Group of the FAO Advisory Committee of Experts on Pulp and Paper. It was based on a perusal of the data on i) growth in GDP, and ii) growth and rate of change in consumption/income ratio (CIR). The latter suposedly represented all aspects of demand and supply including those which are not directly related with changes in income. It was also assumed that the future changes in GDP and the CIR would be governed by past growth and future expectations (FAO, 1977a, p.20).

These assumptions were examined and commented upon by 98 executives from the world pulp and paper industry. As a result, the FAO's initial outlok for GDP and CIRs were revised. Demand estimates for paper and paperboards for the years 1980, 1985 and

1990 were derived. Once again, the projected demand for paper and paperboards as a whole for 1980 was substantially higher than the observed level, but the demand for printing and writing papers was marginally underestimated. A question which repeats itself is whether the exercise done by an experienced body with the help of a technically sound organization could be used for planning and policy making when the results for just 3-4 years in the future were not realistic even at the macro (world) level?

3.5 Demand Projections Based on Trend Explorations

Yet another attempt at projecting the demand for cultural and industrial papers used two mutually exclusive approaches. The first, based on an income elasticity equation was similar to the approach adopted by the ESRF and would not be discussed here. The second comprised trend extrapolation of the form

$$Log\ Y = a_0 + a_1(t)$$

Where

Y = consumption of any given category of paper
a_0 and a_1 = intercept and slope coefficients to be estimated
t = time/years

Using the data for the years 1960-61 to 1975-76 as the base, demand projections for cultural and industrial papers were made for 1983, 1988, and 1993. The equations used by types of papers were

Cultural   : Log Y = 5.4435603 + 0.056274 t
Industrial   : Log Y = 4.9674629 + 0.058179 t

The results have been presented in Table 8.

Table 8: Demand Projections of Papers Based on Semi log Time Trend Method,India: 1983, 1988, and 1993

Years	Cultural Paper	Industrial Paper	Total paper and Paperboards
1983	844	547	1,391
1998	1,118(5.0)*	663(6.5)	1,781(5.6)
1993	1,481(6.5)	980(9.5)	2,461(7.6)

*Figures in parentheses are growth rates over the preceding period.

Source: Sharma, 1978b.

Most of the observations made earlier would be relevant here. Moreover, the demand for all types of paper was expected to grow at significantly faster rates during 1988-93 than during 1983-88 whereas even a cursory reflection on the state of the markets could suffice for serious doubts about the validity of this expectation. This could be more true for industrial paper if the environment including availability and price of substitutes was scanned. The results were, thus, a product of i) the data used, ii) inadequacy of the methodololgy to accommodate logical and expected changes in the explanatory variables in the short and the long run, and more importantly, iii) treating the issue mechanically or as a one shot affair such that the author did not feel the need to reflect on them.

Another exercise in this category in the recent past suggested four approaches: trend extrapolation, casual relationship(s), end use, and input-outut. The last two of these were, however, not considered practicable mainly for want of relevant data (DCPPI, 1983a, pp.17-18). In this case, however, use of the time trend

approach was not limited to past observations on explanatory variables. On the contrary, data for 1969 to 1971 were also used to forecast the variables such as GNP, index of industrial outputs, price index of paper and paperboards, weighted price index of cultural paper and total number of literates, total enrollment in educational institutions, and population. Folowing this, separate equations for projecting the demand for various types of paper were computed. These were

Cultural Paper : $\text{Log } Y = 5.476 + 0.059 \ (t)$
Industrial Paper : $\text{Log } Y = 4.997 + 0.054 \ (t)$
Total Paper and Paperboards : $\text{Log } Y = 6.032 + 0.051 \ (t)$

The results have been presented in Table 9.

Table 9: The 1983 Demand Forecasts for Paper and Paperboards by the DCPPI using Time Trend Method, India: 1985 to 2000

('000 Tonnes)

Year	Cultural paper	Industrial paper	Total Paper and paperboards
1985	841	572	1,473
1990	1,081(5.7)*	750(6.2)	1,897(5.7)
1995	1,391(5.7)	984(6.2)	2,442(5.7)
2000	1,789(5.7)	1,289(6.2)	3,144(5.7)

*Figures in parenthesis indicate annual growth rates over the preceding period

Source: DCPPI, 1983b, Appendix Tables A1, A3, and A4.

It is somewhat surprising that the demand estimates for 1985 made by an organization which is in constant touch with and has representatives of the industry and the consumers with it were marginally lower than the total availability of paper and paperboards in India in 1981 (Table 1). This may be a refreshing

change compared with the results of almost all earlier studies.

Another major change introduced by this study is the stipulation of a constant growth rate in demand during 1985 and 2000. This may or may not be realistic, but is more logical than the rising growth rates stipulated by a number of earlier studies. The study also visualized a causal relationship amongst a number of explanatory variables with different types of estimation equations. The basic form of the equation was

$$Y = f(X)$$

Where

Y = demand for paper and paperboards, and
X = either time or one or more than one explanatory variable.

The equation can have a speific form in association with a predetermined income elasticity of demand. The estimated R^2 and F statistic would show the extent of correlation explained by this model. For instance, if the form of the equation is

$$Y = a_0 + a_1 \log X \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

the income elasticity of demand would decrease as X increases. On the other hand, if the equation is like

$$\log Y = a_0 + a_1 \log X \quad \ldots\ldots\ldots\ldots\ldots (2)$$

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5. It must, however, be noted that there are significant discrepancies in data pertaining to consumption of paper and paperboards used by the DCPPI and those available from other sources. The differences could not be reconciled.

the income elasticity of demand would be constant, and if the equation has the form

$$\text{Log } Y = a_0 + a_1 X \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

the income elasticity of demand would increase as X increases.

The 1977 study of the FAO, discussed earlier, used the first of these equations for projecting the world demand. The main reason for their choice of the estimation equation could be that some countries had crossed the saturation level in paper and paperboards consumption. On the other hand, the DCPPI study under reference used equation (2) above. This was justified by an observation that the increase in consumption of these goods in India had not been comparable with the increase in GNP (Ibid, p.17). The equations used for arriving at the demand estimates for different types of paper were:

Cultural paper   : Log Y = (-)11.968 + 1.485 log (GNP)
Industrial paper : Log Y = (-)13.722 + 1.508 log (GNP)
Total paper and   : Log Y = (-)11.509 + 1.413 log (GNP)
paperboards
(Ibid, Appendices pp.ii, iv, v).

Two sets of demand projections were made. One used GNP projections based on the past trend. The other assumed different growth rates of GNP: 3.5 to 5.0 per cent per annum with 1979 as the base year (Ibid, Appendices, p.30). The results have been summarized in Table 10.

Once again, exercises of this type could better be classified as simulations. Their utility for production planning and policy m..ing is anybody's guess. More importantly, the somewhat

Table 10: Demand Projections for Paper and Paperboards Made in 1983 by the DCPPI Assuming Different Levels of GNP in India: 1985 to 2000

('000 Tonnes)

Description	1985			1990			1995			2000		
	CP+	IP+	TP+	CP	IP	TP	CP	IP	TP	CP	IP	TP
GNP Trend Projections	821	557	1440	1047	723	1839	133	939	2349	1704	1220	3001
				(5.5)*	(6.0)	(5.5)	(5.5)	(6.0)	(5.5)	(5.5)	(6.0)	(5.6)
Growth rates during 1980 to 2000										(7.2)	(7.9)	(7.2)
GNP growth assumed at 4.0 per cent	820	556	1348	1080	748	1897	1423	1005	2503	1874	1351	3302
				(6.3)	(6.9)	(6.4)	(6.4)	(6.9)	(6.4)	(6.3)	(6.9)	(6.4)
Growth rates during 1980 to 2000										(8.6)	(9.5)	(8.6)
GNP Growth assumed at 5.0 per cent	889	607	1560	1253	877	2202	1765	1266	3108	2486	1829	4386
				(8.2)	(8.9)	(8.2)	(8.2)	(8.9)	(8.2)	(8.2)	(8.9)	(8.2)
Growth rates during 1980-2000										(12.0)	(13.4)	(12.1)

+CP = cultural paper, IP = industrial paper, TP = total paper and paperboards
*Figures in parentheses are annual growth rates over the preceding period except where otherwise specified.
Source: DCPPI, 1983e, Appendices pp.ii, iv, v, vii, ix and x.

refreshing change provided by the set of demand projections summarized in Table 9 wanes away following a perusal of Table 10, and the question which repeats itself is whether the demand for paper and paperboards in India in the long run could logically be expected to grow at a faster rate than the growth rate of GNP.

6 An Assessement of the Relationship Between Growth in Incomes and Demand

Following the discussion in the preceding five subsections, we made an attempt to assess the degree of dependence of consumption of paper and paperboards on income. Time series data on GNP at 1970-71 prices and consumption of paper and paperboards were used to estimate the correlation coefficients for India. The results were

Types of Correlation	'R' Values
Linear	0.9791
Log-log	0.9682
Semi-log	0.9827

These can mean that there is a strong correlation between growth in GNP and consumption of paper and paperboards, but that would not be the whole story. During the period under reference, for instance, educational facilities, literacy (both adult and overall), and transport and communication facilities have grown [6] at significantly faster rates than the growth rates of GNP. Moreover, as observed earlier, the income elasticity of demand has exhibited a declining trend in spite of a very low level of per capita consumption. It was, therefore, difficult to think that changes in income alone can explain most of the observed changes in per capita or total consumption of paper and paperboards.

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6. It can be thought that transport and communication facilities beyond a critical minimum level have strong demonstration effect on consumption of certain categories of goods including paper and paperboards.

This necessitated further testinhg the correlation between incomes and consumption from cross sectional data pertaining to 101 countries for the years 1970 and 1980. The countries were ranked on the basis of per capita incomes in 1970, and were divided in 10 groups. The 1970 ranks were retained for the year 1980 to facilitate a comparison of changes in correlation coefficients over time. Four types of correlation: linear, log-log, linear-log, and log-linear were tried. Of these, linear and linear-log relationships provided the best results (Table 11). A perusal of these can show that

- the correlation coefficients in 1970 did not exhibit a consistent behaviour but, on the whole, declined with declining per capita incomes; and

- the comparable values of correlation coefficients in 1980 were considerably lower than those in 1970.

Table 11: Correlation Coefficients Between Per Capita Incomes and Consumption of Paper and Paperboards in 101 Countries Ranked or the Basis of Per Capita Incomes in 1970

| Countries | 1970 | | 1980 | |
| | Types of Correlation | | Types of Correlation | |
	Linear	Linear Log	Linear	Linear Log
First ten	0.8227	0.8098	0.5140	0.4685
11-20	0.6677	0.6868	0.8093	0.8050
21-30	N.V*	N.V	N.V	N.V
31-40	0.5453	0.5498	N.V	0.1534
41-50	0.6272	0.5977	N.V	0.1111
51-60	0.3318	0.3278	0.4193	0.4636
61-70	0.5352	0.5283	0.5022	0.4647
71-80	0.3065	0.3333	0.6455	0.6287
81-90	0.3226	0.3246	0.1809	0.1652
91-97	N.V	N.V	0.1072	N.V

*N.V = Not Valid

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It can, thus, be said that a major portion of the total consumption of paper and paperboards, particularly beyond a certain minimum level, is governed by variables other than per capita incomes. This conclusion is further supported by the fact that individual demand accounts for a small part of the total, especially in developing countries. In India, for instance, an estimated 35-40 per cent of the total consumption of these goods is accounted for by the governments. Another 30-35 per cent is consumed by industry, trade and commerce, etc. The demand by these sectors is governed more by the growth of GDP and a whole lot of exogenous variables than the growth rate in per capita incomes.

For a further understanding of the issue, an attempt was also made to compare the ranks of 102 countries on the basis of per capita incomes and per capita consumption. Once again, the countries were grouped on the basis of their ranks according to per capita incomes. Table 12 shows the number of countries falling within the specified degress of dispersion for per capita consumption in each group. At least two pertinent observations can be made.

1. Only in 21 out of the 102 cases, the ranks on the basis of consumption of paper and paperboards were 1-3 degres away from their respective ranks on the basis of per capita incomes in 1970. This number further declined to 15 in 1980. Even out of these, at least 50 per cent of the countries belonged to the two highest per capita income groups.

Table 12: Comparison of Ranks of 102 countries on the Basis of Per Capita Incomes and Per Capita Consumption of Paper and Paperboards: 1970 and 1980

Country Groups Ranked on the Basis of Per Capita Incomes	Number of Countries ranked on the basis of per capita consumption which were within the specified degrees of dispersion from their ranks based per capita incomes										
	1970						1980				
	No. of countries in the group#	1-3	4-6	7-10	11-20	Over 20	No. of Countries in the group	1-3	4-6	7-10	11-20	Over 20
First 10	10	7	2	-	-	1	10	5	3	-	-	2
11-20	10	5	3	2	-	1	10	2	3	4	-	1
21-30	10	4	3	2	-	1	10	4	3	1	1	1
31-40	10	2	4	1	3	-	11	2	5	3	1	-
41-50	10	3	2	2	2	1	10	2	1	2	4	1
51-60	11	-	-	3	8	-	13	-	-	3	8	2
61-70	11	-	-	-	4	7	14	-	-	-	6	8
71-80	10	-	-	-	-	10	14	-	-	-	-	14
81-90	13	-	-	-	-	13	10	-	-	-	-	10
91-97	7	-	-	-	-	7	-	-	-	-	-	-
Total	102	21	14	10	17	40	102	15	15	13	20	39

#More than 10 countries in a group indicate that the same rank was assigned to two or more.

2. The extent of dispersion between the ranks based on per capita incomes and per capita consumption widened consistently as one moved to lower and lower per capita income groups, and this trend was somewhat more prominent in 1980 than in 1970.

Moreover, a persusal of the data on per capita incomes and per capita consumption (not presented here) showed that in almost all cases the former doubled between 1970 and 1980 but, excepting a few countries, the latter did not increase significantly. On the contrary, there have been at least a few cases where annual per capita incomes increased by US$3,000 to US $7,000 during 1970-80 but the per capita consumption either declined or remained constant during that period.

It can, thus, be concluded that growth rates in per capita incomes cannot be relied upon as the only one or even as a major explanatory variable for projecting the demand for paper and paperboards.

4. Demand Projections with Two or More Explanatory Variables

Having discussed the studies which used income as the only explanatory variable to forecast the demand for paper and paperboards, we go tq discuss the studies which used two or more explantory variables for that purpose.

4.1 Demand Estimates Based on Estimated Per Capita Incomes, Total Expenditure on Education, and Index of Industrial Production

One study in this category aimed at projecting the demand for cultural and industrial papers for 1971 and 1981 (IIPO, 1969, pp.10-19). Observations for the period 1951-52 to 1968-69 were used. It assumed that

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- per capita consumption of cultural peper is a function of per capita incomes, and the total national expenditure on education; and

- per capita consumption of industrial paper is a function of per capita incomes, and the index of industrial production.

Methodology used to analyse the relationship amongst these variables and the demand for papers was not described. The projected demand levels have been summarized in Table 13.

Table 13: Estimates of Paper Consumption for India made in 1969 by the IIPO: 1971 and 1981

('000 Tonnes)

Years	Cultural paper	Industrial paper	Total
1971	515	322	837
1981	1,311	948	2,259

It can be observed in comparison with Table 1 that the estimated total demand for 1971 was significantly (20 per cent) lower than the observed consumption in spite of the fact that the estimates were made as late as 1969. On the contrary, the projected demand for 1981 was higher than the observed level by at least 7,70,000 tonnes or 52 per cent even when population estimates were lower than observed. It is difficult to imagine the state of the product markets and the health of the industry if the production in 1981 was 2.26 million tonnes. It must, of course, be noted that observed expenditure on education and scientific research was Rs.20,476 million in 1981 (GOI, 1984, pp.118-119) against Rs.29,842 million estimated for use in the study. But this cannot suffice to explain the significant discrepancies between the estimated and observed demand.

4.2 Demand Estimates Based on Changes in Income Elasticity, Per Capita Incomes, Paper Prices, Literacy Levels, etc.

The 1983 study of the DCPPI referred to earlier also projected the demand for papers upto the year 2000 with three explanatory variables: number of literates, price indices for cultural paper and for total paper and paperboards, and GNP. The equation used was

$$Log\ Y = a_0 + a_1 \log X_1 + a_2 \log X_2 + \ldots\ldots a_n \log X_n$$

Where

Y = demand for various types of paper and paperboards,
$a_0, a_1 \ldots a_n$ = coefficients to be estimated, and
$X_1, X_2 \ldots X_n$ = estimated explanatory variables

(DCPPI, 1983e, p.18)

Some other explanatory variables: index of industrial production, enrolments in educational institutions, weighted price of papers, and population were also used (Ibid, p.22). The computed demand equations by types of papers were

Paper and   : Log Y = -1.081 + 1.628 log (Number of literates)
paperbords   -0.287 log (Price index of p and pb) + 0.061 log(GNP)'

Cultural   : Log Y = -3.104 + 1.689 log (Number of literates)
paper   -0.317 log (Price index of cultural paper) + 0.162(GNP)

(Ibid, Appendices pp.ii, iv)

The results have been summarized in Table 14. It can be observed that the demand for cultural paper as well as total paper and paperboards was expected to grow at a constant rate during the 15

year period. This is contrary to the usual expection of a decline in the growth rates. In fact, that trend was visible when the study was in progress.[7]

Table 14: Demand Projections for Papers made by the DCPPI in 1983 using GNP, Paper Prices, and Number of Literates in India: 1985 to 2000

('000 Tonnes)

Years	Cultural Paper	Total paper and paperboards
1985	841	1475
1990	1082 (5.7)*	1899 (5.7)
1995	1391 (5.7)	2446 (5.8)
2000	1790 (5.7)	3150 (5.8)

*Figures in parentheses are growth rates over the preceding period.

Source: DCPPI, 1983b, AppendixTables A-1 and A-3.

The brief discussion in this section could be concluded to say that even with additional explanatory variables and use of more sophisticated models, the projected demand levels continue to be higher than observed. An issue for further discussions by all concerned could, therefore, be whether studies conducted by national and international organizations, or a scanning of the environment coupled with experience based judgements, or a combination of these should be more dependable for long term production planning and policy for demand-supply management for paper and allied products.

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7. Our discussions with a cross section of people including some of those who contributed to the study under reference indicated that demand for paper and paperboards in India could grow @ 3.5 to 4.0 percent per annum by the turn of the century. Even these estimates would appear on the higher side if reasons behind the market trends in the recent past and gross underutilization of installed capacity were adequately studied.

5. Demand Forecasts Based on End Use Surveys

In contrast to the discussions in the preceding two sections, a study conducted by the Institute of Economic and Market Research (IEMR) adopted the end use survey approach to estimate the future requirements (not demand) only for "white printing paper" (WPP). The limited scope to cover only WPP was justified as the governments and the educational sector have been and continue to be the largest users of this type of paper, and a portion of its total output is earmarked for these purposes at statutory prices. The term WPP, thus, covered all those varieties of papers which the producers had to supply at the statutory prices.

The IEMR conducted field surveys, collated the available secondary data, and organized personal discussions and interviews with education secretaries, school principals, exercise book manufacturers, publishers, and paper traders in different states of the Indian Union to collect data on i) prescribed text books including the number of pages and weight of each, and ii) requirements of the number of exercise books together with the number of pages in each at different levels of education. Attempts were also made to adjust the survey data to account for use of text books for more than one year; and use of reference books, guide books, and recommended supplementary reading; etc. This could be considered as a commendable task.

The next step was to estimate the student populations in three categories at the school level: standards I to V, VI to VIII, and IX onwards; and the total in colleges and universities. Using the

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past data on growth of student population by groups at school level in different states of India, it was estimated that the number of school students would increase from 855,60,000 in 1975-76 to 947,79,000 by 1978-7 and further to 1,129,60,000 by 1983-84. Secondary data on enrolments in post-school/collee courses (other than those offered by private institutions) were used to derive statewise geometric rates of growth and total student population beyond the school stage for the reference years.[8]

Following this, statewise yardsticks for per capita consumption of i) text books, ii) exercise books, and iii) examination books were derived. These were used to arrive at the aggregate per capita and total requirements of WPP. Requirements for examination books, and guides and reference books were estimated, respectively, at 15 per cent of the estimated requirements for exercise books and text books. Results have been summarized in Tables 15 and 16.

It can be observed that the estimated per capita requirements were constant for all the three reference periods. This could not be a logical basis for planning for a number of reasons.

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8. Students enrolled with private educational institutions were considered employees or those belonging to high income families. They were not eligible for WPP at concessional prices, and were, thus, excluded.

Table 15: Estimated Average Per Capita Requirements of WPP for Text Books and Exercise Books in India: 1975-76, and 1983-84

(Kgs)

| Description | Per capita requirements of WPP for | |
	Text Books	Exercise Books
School Level		
Grades I - V	0.338	0.252
Grades VI - VIII	1.421	1.241
Grades IX onwards	2.346	1.910
Aggregate School	0.718	0.583
Aggregate University	3.126	2.379

Source: IEMR, Year not known, p.26-27.

1. The **demand, not** necessarily **requirements,** of paper for educational purposes has to be price elastic. Over 53 per cent of the estimated total demand in this cateogry is accounted for by text books which are and can be used for more than one year and/or by more than one student. This pattern could, in fact would, be more widely adopted with rise in prices.

Table 16: Requirements of WPP for Text Books and Exercise Books Estimated by the IEMR for India: 1975-76, 1978-79, and 1983-84

(Tonnes)

Description	1975-76	1978-79	1983-84
School stage	1,18,810	1,34,566	1,65,858
University level	20,362	23,180	29,046
Guide/Reference/ General Books	3,615	4,097	5,059
Total	1,42,787	1,61,843	1,99,963

Source: IEMR, year not known, pp.32-39.

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2. The per capita requirements by weight can also be reduced with enhanced use of lower grammage induced by a number of variables: changes for the better in printing technology,rise in paper prices,etc. It could even be feasible without compromising on quality with appropriate changes in production technology.

3. The educational systems and modes would change over time and so would requirements of paper per student, but such changes are not easy to visualize.

In spite of these problems, the data in Table 16, other primary and secondary data, and qualitative information were used to project categorywise and total requirements for WPP for 1976, 1979, and 1984. The results have been summarized in Table 17.

Table 17: Estimates of Demand for WPP at Statutory Prices Made by the IEMR for India: 1976, 1979, and 1984

('000 Tonnes)

Users/Uses	1976	1979	1984
Governments	50.1 (26.o)*	52.8 (24.6)	53.8 (21.1)
Textbooks	72.3 (37.5)	81.9 (38.2)	101.2 (39.9)
Exercise Books	58.1 (30.1)	65.9 (30.7)	81.5 (32.1)
Examination Books	0.9 (0.5)	1.0 (5.6)	12.2 (4.8)
Others	3.6 (1.9)	4.0 (1.9)	5.0 (2.0)
Total	195.0 (100.0)	215.7 (100.0)	253.7 (100.0)

*Figures in parenthesis are percentage to the respective column totals.

Source: IEMR, Year not known, p.12.

A perusal of Table 17 would show that proportionate requirements of governments in the total were expected to decline over time while those of the educational sector were expected to grow. The

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reasoning was that the governments had overestimated their requirements as the quantities indented during 1969-72 were substantialy higher than those actually supplied to them. The argument is faulty on at least two counts.

1. The WPP supplied by the manufacturers to the governments could not represent their actual total consumption . The latter have been purchasing from the open market, and have also used imported paper. Morevoer, the quantities indented during the early years of statutory prices could have been substantially higher than the expected supplies from the producers but not necessary higher than the requirements. Moreover, the study itself recognized lack of data on paper consumed by the governments.

2. As noted earlier, the consumption of paper and paperboards by the governments in India accounts for 35-40 per cent of the total . This proportion should be substantially higher for WPP. More importantly, the governments' demand is, by and large, price inelastic. It is related more to exogenous variables such as the number of employees, design of the administrative fabric, technology used for storage and retrieval of information. Improvements in governmental working could reduce their share in the total requirements of paper, but there were no indications to that effect during the late 1960s when the study was possibly conducted.

It can, thus, be said that studies of this type with very limited objectives and untenable assumptions could hardly be used for production planning, much less for long term policies aimed at demand-suypply management and systematic pricing.

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This is not to minimize the value of end-use surveys as an instrument for demand forecasts in conjunction with sophisticated statistical models and/or experience based judgements. A data based understanding of why, by whom, and how much of paper and paper products are consumed would be extremely useful for policy and planning purposes. Such information can also widen and facilitate the choice among demand projection models.

6. The Science and Art of Demand Forecasts for Paper and Paperboards: An Assessment

This section contains a brief assessment of the demand forecasts with the objective of discussing the problems specifically for paper and paperboards which have multiple values: economic, social, cultural, administrative, etc.

It would be useful to recapitulate the methodologies used and the main results arrived in the studies. These have been summarized in Table 18. An appreciation of the discrepancies did not require any statistical analyses. It can be seen that with the sole exception of one out of three demand forecasts for the year 1965 (5,23,000 tonnes against the observed level at 5,86,000 tonnes), the forecasts for the period 1965 to 1985 have been higher by 7 to 97 per cent compared with the observed consumption levels.[10]

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9. The exception pertained to an assumption by the FAO that per capita incomes during 1960-65 would grow @ 2.0 per cent a year.

10. This conclusion can be marginaly disputed as total availability of paper and paperboards has been treated as observed demand while there were reports of marginal scarcities or perceptions of scarcities during the latter half of the 1970s.

Table 18: Demand Forecasts for Paper and Paper Boards in India Made by Different Studies : 1965 to 2000

('000 Tonnes)

Studies and Methodologies Used	Assumed Annual Growth Rate in Per Capita Incomes/GNP (%)	1965	1971	1975	1981	1985	1990	1995	2000
1. Five Year Plans	-	700	-	-	-	1,540	-	-	-
2. FAO, 1960 (Log normal distribution)	2.0	523	-	998	-	-	-	-	-
	2.5	585	-	1,238	-	-	-	-	-
	3.0	649	-	1,519	-	-	-	-	-
3. ESRF, 1969 (Log-log distribution)	-	-	-	1,563	-	-	-	-	-
4. IIPO, 1969	-	-	837	-	2,259	-	-	-	-
5. NCAER, 1972 (Log normal disribution)	4	-	-	930	1,342	-	-	-	-
	5	-	-	1,012	1,701	-	-	-	-
	6	-	-	1,201	2,192	-	-	-	-
6. NCAER, 1972 (Linear Regression)	4	-	-	1,040	1,462	-	-	-	-
	5	-	-	1,121	1,751	-	-	-	-
	6	-	-	1,298	2,109	-	-	-	-
7. NCA, 1976 (Linear Regression)	Low	-	-	-	1,307	1,667	-	-	3,254
	High	-	-	-	1,486	2,118	-	-	6,564
8. Sharma, 1978[1] (Income Elasticity)	-	-	-	-	-	1,421	2.090	3,071	-
9. Sharma, 1978[1] (Semilog trend)	-	-	-	-	-	1,391	1,781	2,461	-
10 DCPPI, 1983 (Time Trend)	-	-	-	-	-	1,440	1,839	2,349	3,001
11. DCPPI, 1983 Log-log Regression)	4	-	-	-	-	1,348	1,897	2,503	3,302
	5	-	-	-	-	1,560	2,202	3,108	4,386
Observed Consumption		566[2]	787[2]	840[2]	1,144[2]	1,255[3]	-	-	-

1. The forecasts pertained to the years 1983, 1988, and 1993 but have been taken as 1985, 1990, and 1995, respectively.

2. Assumed equivalent to total availability including imports but without considering exports.

3. There have been no imports in India since 1983. Output at home in 1985 estimated at 1.5 million tonnes of which at least 2,00,000 tonnes exported and another 15 percent reported as inventories.

The one way difference between the forecasted demand and the observed consumption levels must be considered a relatively more serious problem in view of the earlier observations regarding comfortable state of the markets since 1980, rising inventories, producers' reasoning for enhancement in the export quotas of printing and writing papers and restrictions on imports of newsprint, etc.

It must also be observed that there have been considerably wide variations within the projected levels of demand for any of the years under reference. Such differences for the period starting 1975 have been summarized in Table 19. These exhibited no consistent trend.

Table 19: Differences Between Lowest and Highest Demand Forecasts for Paper and Paperboards for India: 1975 to 2000

Years	Number of Forecasts	Absolute differences ('000 Tonnes)	Percentage
1965	4	177	34
1975	10	723	78
1980	9	952	73
1985	7	770	57
1990	5	421	23
1995	5	729	32
2000	5	3,563	119

Source: Table 18.

Some of the main sources for these variations were differences in either i) the type of association assumed between explanatory and dependent variables: Linear, log-normal, semi-log, log-log; ii) type of data used: cross sectional vis-a-vis historical; iii) assumed/estimated growth rates for explantory variables: per capita incomes, GNP, population, income and price elasticities of

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demand; and iv) number of explanatory variables included in the
models used for forecasting.[11]

It is, of course, recognized that irrespective of ingenuity of a
methodology, observed consumption would rarely equal a
previously estimated demand level. Projections have to rely on
assumptions all of which would rarely hold good in real life.

This, however, cannot suffice to explain the one way differences
between the forecasts and the observations. Some factors leading
to the erroneous estimates can, of course,be identified.

6.1 Some Possible Reasons for Overestimates of Demand

1. The basic data available for analyses were inadequate or
inaccurate. Even in some of the developed countries with well
organized statistical services, precise information regarding
actual consumption of paper by types, real per capita incomes,
and other economic indicators necessary for analyses of
historical growth trend are often difficult to find. In most of
the less developed regions and countries, estimates have to often
serve as substitutes for statistics. This would be particularly
difficult for disaggregated data on consumption of various
categories of paper and paperboards (FAO, 1960, p.2).

Majority of the studies discussed here recognized that paper and
paperboards is not a homogenous set, and projected the future

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11. Reasons for the choice of a projection model and the merits
and demerits have rarely been discussed in the studies reviewed.

income and price elasticities of demand for each sub set. The explanatory variables were, however, similar in most cases. More importantly, almost all of the studies used highly aggregated models whereas, due to their very nature, income and price elasticities of demand for any specific type of papers and the whole set of these goods have to vary amongst states, amongst groups of people, and within a state.

2. Increases in per capita incomes should have positive impact on the demand, but a whole lot of other variables would be simultaneously relevant. Some of these would be changes in the general price index/the cost of living index as it affects the real purchasing power, price of paper, availability and price of substitutes, etc. These would determine whether the income elasticity of demand over a specified period of time should be expected to be greater than or equal to or less than unity.

3. It has long since been observed that the extent of the impacts of expanding education and literacy on the demand for writing and printing paper is not fully known or apparent. This would be particularly true of the direct effects (ESRF, 1969, p.7). Estimates based on an assessment of indirect effects could be impulsive. The consumption levels by different entities would have to depend not only on the level of literacy/education and public expenditure on education but also on the methods of instructions, the extent and types of literature used, availability of books from libraries/book banks, socio-cultural

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norms regarding borrowing books from neighbours/ acquaintances,general writing and reading habits of the people, etc. These could vary significantly among comparable income classes in different parts of a country such as India. Considerable differences in use levels of text books and exercise books between urban and rural areas is too well known, but the extent of such differences and the likely changes in them have yet to be understood.

On the other side, a significant proportion of the total demand characterized as structural would have near zero price and income elasticities. Smiliarly, the demand for industrial paper would depend not only on the level of industrial production and disposable incomes but also on consumers' preferences for packaging, price discrimination that the producers may be able to practise with different forms of packaging, price of substitutes for packaging materials: paper versus plastics/polythelene/ aluminium foil, etc. Availability and use of substitutes appears to vary amongst regions/states but has, on the whole, substantially increased during the recent past. Such variables have not been accounted for in the demand forecasts for want of relevant data, and for want of a systems approach.

4. There has been a tendency to compare in absolute terms the extremely low per capita consumption of paper and paperboards in India with those of very high levels in the developed countries such as USA and Canada. It has not been recognized that a good part of the demand in economically advanced countries emanates

from the proliferation of uses other than writing and printing. One meets single use milk cartons in place of polythelene or reusable bottles, facial tissues in place of handkerchiefs, disposable kitchen towels in place of wipe cloth, etc. India need not emulate such consumption patterns. This should be better appreciated in relation to the concerns for quality of the physical environment, problems of waste disposal faced by the developed world, and a reversal in the practices for packaging some of the consumables.

Another way to appreciate this issue could be that in North America and Europe, industrial papers account for over 60 per cent of the total consumption of paper and paperboards whereas in India 70 per cent of the total consumption consists of cultural paper. Income elasticity of demand of the two types cnnnot be compared. Moreover, the demand pattern for industrial papers, particularly for packaging, has witnessed a seachange in the recent past but the experiences have not been accounted for in the projections. The task, of course, is not easy. Experiences around the world show that packaging paper has been both gaining and losing ground. Paperboards are invading the markets where rigidly is required but otherwise they are losing to plastics. The extent to which paperboard cartons and wooden crates could be reused is also not known.

5. An equally important set of considerations would be the level of awareness, acceptability, and feasibility of discriminating amongst grades/quality of papers in acordance with life of the end uses. Text books may be printed on paper with lower

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grammage. Writing paper of lower strength can be used f.. notes in the classrooms and offices. In general, consumers are interested in surface area more than weight of paper and quality of the material consumed can vary with expected life of the use to which it is put. If that be the case, the demand for paper and paperboards in general and printing and writing papers in particular would not grow as fast as may otherwise be expected, but such considerations are difficult to incorporate in a projection model.

6. Government policies regarding trade practices in general and pricing the printing materials in particular have to be some of the important factors affecting the demand. An interesting example in the recent past is offered by the restrictions placed by the Ministry of Finance on the number of application forms and prospectus which can be suplied free of cost to stock brokers/ underwriters/managers to capital issues by public limited companies. The objective of this polity does not apear to be demand management, but at least a marginal reduction in consumption of WPP can be expected.

Similarly, it is a matter of common knowledge that the size of the railway reservation forms in India has reduced by at least 50 per cent over the years. More importantly, in spite of a significant increase in commercial advertisements which pay for a

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12. Lower grammage need not necessary mean poor quality or : reduced strength. That, however, may generally be true for India mainly due to the production technology in use.

major portion of the cost of production of railway time tables, their price has been increased continuously during the last ten years or so and the increase has been significantly higher than the increase in paper prices. The number of railway time tables produced and sold per passanger or per passenger kilometer has declined considerably since 1980. Once again, these changes did not appear to be due to any conscious effort at demand management. Aggregative demand projections can account for such changes provided those responsible for the work have the neded resources, patience, and professional aptitude to collect data and to scan the environment.

7. For well over two decades, a number of international agencies have been increasingly concerned about ensuring adequate supplies and a fair distribution for cultural and economic development (FAO, 1960, p.1 emphasis added). It is, however, difficult to determine the quantity which would be adequate for the purpose. The net result of this concern has been an overemphasis on the need rather than demand for enhanced outputs of paper and paperboards. This situation appears to have been played up further by some economic groups in India without recognizing the likely adverse consequences in the long run.

6.2 Some Consequences of the Demand Projections

In view of the nature of the problems discussed here, it has long since been recognized that the results obtained from seemingly sophisticated exercises aimed at forecasting the demand for a set of goods such as paper and paperboards could not only

be substantially away from reality but could also be subject to varying interpretations depending upon the attitudes (optimistic versus pessimistic), subjective judgements, and even biases of those engaged in or using the work (FAO, 1960, p.2). This would be more true when the modelling work is not satisfactory to approach the issue in a systems framework. An almost natural consequence would be that demand forecasts cannot serve as an appropriate tool for production planning and policy making.

It is known that installed capacity of the paper industry in India during the current decade has grown at a much faster rate (almost 7 per cent per annum) than the growth rate experienced by most other capital intensive activities and the economy as a whole. At the end of 1985, it was around 2,50,000 tonnes which is more than the estimated requirements (not demand) at the end of the Seventh Five Year Plan. Capacity utilization has declined from over 75 per cent in 1981 to just around 60 per cent in 1985. Neither the industry nor the nation can afford to continue with this situation.

Another important consequence of such forecasts particularly in an environment of i) perceived (more than actual) scarcities, and ii) ambitions receiving higher weightage than realities such that the concerned people are oblivious of the distinction between need and demand; could be that different organizations or economic entities: pulp and paper producers, producers and suppliers of cellulosic raw materials, paper making machinery producers, those who wish to discard outdated or inefficient pulp and paper making units, etc. would succeed in creating tensions

as well as acquiring some kind of expertise to manage t
tensions for themselves and advising the policy makers on ways
do the same. The long run consequences can rarely be desirab
for any group or society.

7. Some Thoughts for Further Work

This does not mean that demand projections for a set of goo
such as paper and paperboards for a country like India should n
be attempted. On the other hand, one major lesson from the pa
experiences could be that the demand projections have n
provided the desired and necessary guidelines for long te
production planning and policy. Another important conclusi
must be that the state of the art cannot be expected
substantially change for the better unless adequate and reliab
data on consumer profile are collected and processed.
essential characteristic of such data should be to enlighten t
analyst(s) on how much paper and paperboards of different typ
are consumed by which economic and social groups, and for wh
purposes. This means that time series and cross-sectional dat
pertaining to

- disposable income
- total population
- consumption of paper by types and user groups
- number of literates/literacy ratio
- public expenditure on education
- price indices by varieties and grades of paper
- index of industrial output
- price indices of materials which are substitutes for paper
- consumption of different grades of paper by sectors
- number of government employees at different levels
- growth and adoption of footloose industries and services suc
  as computers and consulting firms

must be made available. The list is suggestive and no

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exhaustive, but a good portion of these data do not seem to exist. This would be more true for disaggregated data below state levels. Costs of generating the data may be assessed as extremely high to start with, but must not be so once a system is operationalized.

Besides faciliticating somewhat realistic demand projections these type of data would be of considerable value for enhancing an understanding of the likely trends in demand for different types of paper and paperboards, and for interpreting the results emanating from systematic demand forecasts. On the whole therefore, the costs of building a data base can be expected to more than pay for themselves in not too distant a future.

The present juncture in the history of pulp and paper industry in India could be adjudged as the best time to organize and initiate the work. The nation should be in no haste to create additional production capacity for paper and paperboards and can, therefore do without fresh demand forecasts for at least 5 years to come.

References

Aberg, C.J. 1968. The Demand for Paper and Paperboard in Western Europe: 1950-1962, Alinquist & Wiksell, Stockholm.

Anonymous. 1960. "Marked Expansion in Paper" Journal of Industry and Trade, 10(9):1420.

Arne,Sundelin. 1963. Pulp and Paper Prospects in Western Europe FAO, Rome.

Bat a, V.P. 1981. "Growth Potential of Paper Industry," The Financial Express, May 18, Bombay.

Bilgrami, I.A. 1979. "Capacity Utilisation in the Paper Industry Need for Incentives and Reliefs", National Investment and Finance Weekly, 37(20): 1561-63.

Biswas, Souren. 1981. Presidential Address, Annual General Meeting of the Indian Paper Mills Association, Calcutta

CRB. (Commerce Research Bureau). 1979. "Paper Industry: Profile" Commerce, 139 (3569): 923-929.

DCPPI (Development Council for Paper, Pulp and Allied Industries). 1983a. Report of the Sub Committee Problems of Small Paper Mills with Special Reference Recovery, DCPPI, New Delhi, (Mimeo).

_____.1983b. Demand Forecast on Paper and Paperboard upt 2000 AD, DCPPI, New Delhi.

_____.No. Date. Formulation of Targets for the Fourth Pla and Perspective Planning for 15 years: 1966-81, DCPP New Delhi.

ESRF (Economic and Scientific Research Foundation).1969. Pulp ar Paper Prospects for 1975: A Study of the Basic Ra Material Requirements of the Indian Pulp and Pape Industry in the Series Natural Resources and Industria Development, ESRF, New Delhi.

FAO (Food and Agriculture Organisation of the United Nations) 1960. World Demand for Paper to 1975, FAO, Rome.

_____.1962a. Proceedings of the Conference of Pulp and Pape Development in Asia and the Far East, Volume 1, FAO Bangkok.

_____.1962b. Proceedings of the Conference of Pulp and Pape Development in Asia and the Far East, Volume 2, FAO Bangkok.

_____.1977a. World Pulp and Paper: Demand, Supply and Trade Volume 1: Selected Papers of an Export Consultation held in Tunis, 20-22 September 1977, FAO, Rome.

_____.1977b. World Pulp and Paper: Demand, Supply and Trade Volume 2: Selected Papers of an Export Consultation held in Tunis, 20-22 September 1977, FAO, Rome.

_____.1981. Production Year Book 1980, FAO, Rome.

_____.1983. Year Book of Forest Products: 1970-81, FAO, Rome.

FAO and ECAFE.1962a. Pulp and Paper Prospects in Asia and the Far East: Volume 1, FAO, Rome.

_____.1962b. Pulp and Paper Prospects in Asia and the Far East: Volume 2, FAO, Rome.

GOI (Govenment of India). 1953. First Five Year Plan, Planning Commission(PC), New Delhi.

_____.1956. Second Five Year Plan, PC, New Delhi.

_____.1962. Third Five Year Plan, PC, New Delhi.

_____.1965. Study on Forecast Raw Materials for Pulp, Paper and Newsprint, Committee on Natural Resources, PC, New Delhi.

_____.1970. Fourth Five Year Plan, PC, New Delhi.

_____.1976a. Fifth Five Year Plan, PC, New Delhi.

_____.1976b. Report of the National Commission on Agriculture, Part III: Demand and Supply, Ministry of Agriculture and Irrigation, New Delhi.

_____.1976c. Report of the National Commission on Agriculture, Part IX: Forestry, Ministry of Agriculture and Irrigation, New Delhi.

_____.1981. Sixth Five Year Plan, PC, New Delhi.

_____.1983. Economic Survey: 1982-83, Controller of Publications, Delhi.

_____.1984. Economic Survey: 1983-84, Controller of Publications, Delhi.

Gupta, Tirath. 1983. "Demand-Supply Management and Pricing Policy of Forest Based Raw Materials for the Paper Industry in India: Some Issues", Indian Journal of Agricultural Economics, 38(3): 291-299.

Gupta,Tirath and Shah,Nitin. 1985. Demand Forecasts for Paper a
    Paperboards in India: Some Policy Implications, Cent
    for Management in Agriculture, Indian Institute
    Management,Ahmedabad(Manuscript).

IEMR (Institute of Economic and Market Research). Year not know
    A Report on Requirement of White Printing Paper, IICPP
    New Delhi.

IIPO (Indian Institute of Public Opinion). 1969. "The Grow
    Pattern of Paper Consumption: A Study for Se
    Reliance", Quarterly Economic Report, 16(2): 10-19.

IPMA (Indian Paper Makers Association). 1979. Directory of Indi
    Paper Makers Association, Calcutta.

_____.1982. Directory of Indian Paper Makers Associatio
    Calcutta.

Jatia, J.M. 1982. Presidential Address, Annual General Meeting
    the Indian Paper Mills Association, Calcutta.

_____.1983. Presidential Address, Annual General Meeting
    the Indian Paper Mills Association, Calcutta.

Mehta, M.M. 1981. Towards Greater Energy Conservation and Optim
    Capacity Utilization, Address at the 86th Annual Gener
    Meeting of IPMA held at Calcutta, IPMA, Calcutta

NCAER (National Council of Applied Economic Research). 197:
    Paper Industry: Problems and Prospects, NCAER, N
    Delhi.

Raina, M.K. 1982. A Perspective for Paper, Address at the 86
    Annual General Meeting of Indian Paper Maker
    Association held at New Delhi, IPMA, Calcutta.

Raina,L.N. 1981. "Paper Industry: Victim of Neglect", Easter
    Economist, 76(4): 255-264.

_____.1982. "Paper in Plenty", Eastern Economist, 78(3):
    223-228

Sharma, L.C. 1978a. Development of Forests and Forest Base
    Industries, Bishan Singh Mahendrapal Singh, Dehradun.

_____.1978b. "Paper and Pulp Industry: An Economic Analysis
    The Economic Times, November 24, Bombay.

Singhal, R.M. 1982. "Forest Resources:Observations", j
    Proceedings: Seminar on Raw Materials for Pape
    Industry, IPMA, Calcutta, pp. 36-39.