

Manpower planning and training for the paper industry

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India has a long history of manufacture of paper and allied products. The first modern paper mill was set up at Serampore in 1812 and since then we have come a long way. The personnel required for the industry have essentially been trained by the industry itself. Training scheme for paper technologists was introduced for the first time probably in 1930 in Titaghur paper mills. Formal training came up with Forest Research Institute starting a course in pulp and paper technology in 1956. During this period some R & D activity also came up at FRI.

The first full fledged institute devoted totally to teaching and training in Pulp and Paper technology came at Saharanpur in 1964. Since then a large number of post matric Certificate holders, post B. Sc. diplomaholders and 4-years Bachelor of Engineering degree holders in Pulp and Paper Technology have passed out in pulp and paper technology field.

During this period a big change has come in the raw material base available. Energy sector has witnessed changes including tremendous rising costs. Pollution has become a major area of concern. Against this back drop we have paper industry with an annual installed capacity of 19.15 lakh tonnes, Through 175 units, about 11.6 lakh tonnes is in large sector while the rest is in medium and small sectors. The capacity utilisation of the industry is far from satisfactory being around 72% in large units and just about 52% in smaller units. The country has fixed a tentative target of 41.72 lakh tonnes of annual installed capacity by 2000 AD to raise the per capita consumption from the present 2 kg to 4.5 kg. The gap that exists between present capacity and planned capacity is very large. The performance of the industry is not satisfactory. Thus a pragmatic approach is needed if we are to succeed in our efforts of meeting the targets.

The reasons of under utilization have been many and include raw material shortage, power shortages and non availability of coal, shortages of inputs strained labour—management relations,

poor maintenance, absence of preventive maintenance of schemes, inadequate investment for renovation, modernisation and reconstruction. Further technological changes have not made significant dent on the paper scene. Increased raw material costs, scarceness of capital, increased wage bills, non availability of sufficient fibrous raw materials, demand for cleaner environment are going to be global phenomena. These pressures will persist and will probably grow. Are we having any strategies to face these realities and reverse the trend and show promising performance.

These issues clearly indicate that the first requirement is efficient management of resources namely the 3 M's. These are men, money and material. Right type of men can manage materials and Money. A competent manpower base is a must for very survival.

This single factor of competent manpower for paper industry has been neglected over the decades. Investment in this sector has been almost negligible. By giving proper emphasis on manpower planning and on education and training an inbuilt strength will be created and this would provide a platform to face the present problems pragmatically. The alternatives to ensure that paper industry is back in health and brim with activity have to be identified. There is no doubt that this list is headed by the factor relating to availability of the dependable and competent manpower.

Paper Industry is facing a series of external stresses which will continue to harass the industry for long time to come. The perturbations, the disturbances which will force us to make permutations or changes in the order of arrangement of things. The industry will be forced to alter its normal methods in vogue to cope with the increased costs, decreased availability of various material resources including investment capital be it for modernisation, reconstruction, rebuilding,

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renovation or for new ventures. Recognising the finite limitation of resources, a situation which intensify with time, we have to act. The action is obviously resource optimisation. The extent of alterations will vary quite widely depending on specific situations. The solutions are going to be novel, hitherto not tried. All of them will deal with new exciting alternative and appropriate technologies which will fit into the changing environs. Thus the focus has to be on the availability of a competent technical task force. This force will have to provide a proper design criteria for selecting and implementing one of the many abundant alternative projects to assure co-operation among various divergent factors to achieve the nations goals. This will be associated with the normal industrial risk. The human think tanks, being dynamic and ever vigilant will provide the timely alternatives to maximise the resource utilization in the face of varying degrees of external stresses. The forward looking R and D activity will have to be a thing of the present to achieve these aims. Only then can we propose the blueprints of plan of action of tomorrow based on ideas hitherto not practised.

The changing technological scene will give us the alternatives for internal changes. These will be centred around reduction in norms of consumption of materials, improvement of yields, use of alternative materials, improved recycling techniques, closed loop systems, energy conservation, high consistency processes, faster machines, improved pressing, use of bio and enzymatic techniques, reduced pollution, alternative uses to waste and production, improved productivity. All these activities must have an economic objectives. These can be tackled by a manpower with necessary technological skills, creative thinking with necessary leadership qualities. Industry must invest in creating this talent which in the years to come can perform the tasks in the areas of design, trouble shooting and hazard analysis, fault diagnosis, reliability in maintenance and operations, modelling various processing units to fix operating parameters at optimum levels for productivity gains, cost reduction and quality improvements. Thus there is an urgent need for a greater thrust on R and D activity, particularly of applied nature both within and outside the industry to keep pace with the on rushing technology to transform it to an appropriate shape for direct adoption in industrial scale. All this can be done by a competent highly qualified pulp and paper specialists. Continuing education of plant personnel at various levels has to be provided to meet these challenges. Formal programmes of technology development and transfer are essential from the point of sheer survival in decades ahead.

The contingent philosophy would suggest that training and development activities have to be need based.

LEVELS OF MANPOWER NEEDS

The manpower needs of a process industry like pulp and paper can be broadly classified into four classes as given below :

- i) Personnel associated with shopfloor production/maintenance and related operation or the so called operators and technicians.
- ii) Personnel associated with production and maintenance at middle and senior levels.
- iii) Personnel required for Research and development, teaching and training.
- iv) Personnel associated with activities like planning, erection, designing and trouble shooting.

The above classification does not include manpower related to development of conventional and non-conventional fibrous raw materials on a viable commercial basis either through captive plantations, high density plantation, social forestry or through renewable resources. It also does not include those personnel associated with supply of machinery and equipments, auxiliaries like chemicals Wires and felts, all of which are essential in the manufacture of paper and pulp.

Of the identified 4-groups of personnel, some facilities exist for catering first two groups of personnel to the industry. So far almost negligible effect has gone in, to cater to the needs of last two sectors which are very vital. Our strategy so far has been to train personnel to keep the wheels of industry moving. The cadres needed for higher intellectual activities has been grossly neglected. The availability of manpower in the last two sectors will be an insurance for the success in future. Our inability to concentrate on these sectors has been the cause of the woeful state in which Indian Paper Industry is today. The gaps in manpower needs have to be plugged if we are to think for a possible realisation of national target.

Thus the manpower planned has to have the following levels academic and training inputs.

- i) Post High School level Education and training (like polytechnic diplomas and Certificates, or ITI's with experience.)
- ii) Post B.Sc. level training with stress on pulp and paper technology (like the University diploma programmes or B.Sc. with experience).

iii) First degree level engineering programmes in pulp and paper technology.

iv) Advanced level engineering programmes like Master of Engineering and Ph. D. programmes.

v) Research and related activities centres.

vi) Continuous education programmes.

There is a necessity to assess the needs of manpower at each of these levels and find means to fulfil these gaps.

DISTRIBUTION OF MANPOWER

The Indian Paper Industry is more than a century old. The Industry has a wide base in terms of level of productions, types of raw materials used, technology adopted, degree of automation and levels of technical activities. The manpower needs are wide and varying depending on these factors.

The personnel required for various activities have to have varying educational and training backgrounds. The mills invariably give some amount of training/orientation to fresh entrants. The analysis of distribution of manpower Indian Paper industry is based on the data collected, based on a study by the Institute of Applied Manpower Research conducted in 1977 and other data.

In the developed countries it is a practice to have technical persons for every 500 annual tonnes of pulp installed capacity, 1-2 technical persons for every 500 annual tonnes of paper installed capacity with supporting operating staff to supervisory staff ratio of 2:1. In India, small mills employ about 40-50 persons per 1000 tonnes installed capacity in small mills against 40 in large mills in production activity alone. Table-1 below gives the total manpower used in Indian Paper Industry.

The categorisation as high, medium and low represents the productivity levels per worker. 'High' represents out put per worker around Rs. 50,000/- Price based on 1972 (usually mills of larger size with more capital investment, higher degree of mechanisation). The 'Medium' and 'Low' categories normally refer to medium and small size mills. Roughly high, medium and low represent daily capacities of above 60 tonnes, between 30-60 tonnes and below 30 tonnes.

The table indicates the personnel in production department per 1000 tonnes capacity in high, medium and low productivity units which are roughly 42,55 and 112 persons. In recent study by the author the number of persons per 1000 tonnes

TABLE-1 USE OF MANPOWER

Particular	Type of Mill			
	High	Medium	Low	All India
1. Employment/ 1000 Tonnes	57	67	121	78
2. Section-wise dis- tribution in different activi- ties, %				
a) Production	79.3	82.2	93.1	85.7
b) R & D	1.5	1.2	0.5	1.0
c) Other technical deptts. (Stores, Materials and Civil works etc.)	2.3	1.2	1.7	1.6
d) Non-Technical Deptts. (Finance, Sale, personnel)	16.9	15.4	4.7	11.7
Total :	100	100	100	100

of capacity in large mills is around 37 and in small mills it is about 40. The wide variation in small mills is probably due to non existence of conventional pulping activity. Further the table indicates that in nontechnical departments in high, medium and low productivity mills employ 10.10.6 persons per 1000 tonnes capacity. The R & D sections attract very little manpower. The 1.5 % used in high productivity mills in R & D is more associated with laboratory and quality control functions.

Manpower distribution by educational qualifications in different categories of mills is shown in table-2. It will be seen that persons with high school or lower qualifications constitute 54.1% of work force in high productivity mills while the corresponding figure in respect of medium and small mills is 92.7% and 83.7% respectively. This represented about 31,62 and 101 persons respectively in high, medium and low productivity units for 1000 tonnes production. Total technical degree and diploma holders represent 31.7%, 3.1% and 11.6% in the three categories against 10.1%, 3.5% and 3.9% other degree holders in high, medium and low production mills work force. Chemical Engineers represent only 3.7% of the work force in the high productivity units. The total technical work force with a degree or diploma in engineering or technology compared to no-technical work force

TABLE—2. MANPOWER DISTRIBUTION BY EDUCATIONAL QUALIFICATION

Qualification	Type of Mill							
	High		Medium		Low		All India	
	No.	%	No.	%	No.	%	No.	%
1. Degree holders (Technical)	10.45	18.3	1.05	1.5	12.71	10.5	6.47	8.3
a) Chem. Engg.	2.11	3.7	0.38	0.4	1.69	1.4	1.35	1.7
n) Other Engg.	8.34	14.7	0.67	1.0	11.02	9.1	5.12	6.6
2. Degree holders (Non-technical)	5.76	10.1	2.34	3.5	4.75	3.9	4.52	5.8
a) Science	3.71	6.5	1.54	2.3	1.46	1.2	2.81	3.6
b) Others	2.05	3.6	0.80	1.2	3.29	2.7	1.71	2.2
3. Diploma holders	7.64	13.4	1.07	1.6	1.34	1.1	4.37	5.6
a) Pulp & Paper & Chemical Engg.	6.50	11.4	0.20	0.3	0.02	0.02	3.20	4.1
b) Other Engg.	1.14	2.0	0.87	1.3	1.32	1.1	1.17	1.5
4. I. T. I. Certificate holders.	2.23	3.9	0.34	0.5	0.74	0.6	1.35	1.7
5. High School Cert. holders.	2.86	5.0	3.01	4.5	4.61	3.8	3.59	4.6
6. Not-High School	1.21	2.1	0.64	0.9	0.61	0.5	1.02	1.3
7. With experience	26.85	47.0	58.55	87.4	96.24	79.4	56.68	72.8
Total	57.0	100	67.0	100	121	100	78	100

in high, medium and low productive units are 3:1, 1.1:1; 3:1. Contribution of I.T.I. Certificate holders is small in all categories.

Taking the industry as a whole, 72.8 work force come with experience, and 78.7% have high school or lower qualifications. Diploma and degree holders in technical subjects represent 13.2% while general degree holders are 5-8% of total work force.

High productivity units in general are large in size, more capital intensive, employ more staff in R & D and other technical departments. The ratio of production to non-production staff is lower in higher productivity units (4:1) as compared to medium (4.6:1) and low productivity plants (13:1). Half the work force in higher productive units is educated (high school and above) while this figure is less than 20% for medium and low productive units.

The percentage of production personnel is highest in small sized units (91.6%) but declines significantly in medium sized plants (76.5%) proba-

bly due to faster increase in activities in non technical departments. Large sized plants again have about 90% personnel in production departments.

Broadly speaking about two-thirds of employees in paper industry are in production and related workers. 13% professionals, and 20% administrative, clerical and service personnel. This is shown in table-3. Further only 25% belong to educated categories as shown in table-2.

One significant factor to be noted is practically negligible involvement in works relating to project planning, process development and research even in large units. Further it is to be noted that many middle level positions are occupied by persons not suitably qualified. There is a need to correct this position by planning for the availability of suitable trained personnel. Similarly there is a need to change the staffing pattern to involve in more R & D and other technical activities. This can come from recruitment of people with higher professional qualifications who can suggest and implement technological changes in the context of the socio-economic environment.

TABLE—3. MANPOWER DISTRIBUTION BY OCCUPATION

Detail	Type of Mill		All India
	High	Medium	
1. Professional, Technical and related workers.	14.1	12.1	13.1
a) Chemists and other Scientists.	0.9	1.0	1.0
b) Chemical Engg./Tech.	3.2	0.7	2.0
c) Other Engineers.	1.4	1.3	1.5
d) Supervisors/Technicians.	7.7	8.7	8.2
e) Medical.	0.7	0.3	0.5
2. Administrative, executive and managerial.	2.5	2.1	2.3
3. Clerical and related workers.	13.5	9.4	11.6
4. Service workers.	5.6	8.4	7.0
5. Production and related workers.	64.3	68.0	66.0
a) Paper and Paper Board-	26.0	29.2	27.6
b) Chemical and process workers.	18.9	17.8	18.4
c) Engg. and other workers.	19.4	20.9	20.1
Total	100	100	100

Future Levels of man power inputs :

Thus limiting our discussions to technical manpower in production and related department and excluding the demand of the plantation side and auxillary industry side, we will have to have the following education level personnel.

1) Skilled shopfloor operation and maintenance operators (ITI) and related pre-post matric qualifications, high schools with training).

2) Middle level supervisory levels with knowledge in process technology and engineering (Diploma holders of polytechnics or similar institutions).

3) Degree level engineers for production and engineering function having engineering and technology degrees like Chemical, Paper and Pulp, Mechanical, Electrical and instrumentation.

4) Personnel with master of engineering and Ph.D. level qualification to take up R & D, planning, design and fabrication, erection, trouble shooting jobs.

The future staffing pattern must have to lay stress on R & D, trouble shooting and design. The present 1% work force on these areas must go up to at least 5% to provide new direction. Similarly to provide greater technological and engineering thrust in production and related functions, the manpower with technical degrees must go up from present 8.3% to atleast 15% and preferably to 20%. Similarly there is a need to improve technical content in supervisory level positions with recruiting more diploma holders upto 20%. The rest 60% position will go for non technical functions and production and engineering functions (ITI etc.) at the levels of clerks, operators, technicians. Professional and administrative managers should form 3-5% of total task force. The industry will tend to become more productive with greater automation. This is likely to reduce the present figure of 78 persons per 1000 tonnes, to about 50-60 persons per 1000 tonnes capacity.

The present assessment of manpower requirements are made on the following basis.

- The present installed capacity of paper and paper board units of 19.15 lakh tonnes will increase to 41.75 lakh tonnes by 2000 A.D.
- The average requirement of personnel will be 50 persons per 1000 tonnes capacity. This will be due to greater automation, productivity demands of higher wages etc. A case with 30 persons per 1000 tonnes capacity is also discussed for highly automatic units.

- There will be no workers with qualifications below matric or atleast ITI certificate, Unskilled labour will not be present.
- The manufacturing activity units will be engaged in more in house R & D and other advanced technical activities involving design, planning, trouble shooting and erection.
- These will demand greater professional skills in terms of larger number of qualified technical, diploma holders, engineers, post graduates, professionals and Ph.D.
- The present capacity has sufficient manpower and cannot spare any for future growth.
- The additional work force to cater to the replacement and wastages will be 5% of total demand.

Based on the above assumptions, the proposed manpower distribution in various sections will be as given in table-4.

TABLE—4
PROPOSED SECTION WISE DISTRIBUTION
OF MANPOWER IN FUTURE UNITS
(for 1000 tonnes)

Section	%	Case-I 50 persons/ 1000 tonnes	Case-II 30 persons/ 1000 tonnes
1. Production	75	37.5	22.5
2. R & D and advanced technical functions	5	2.5	1.5
3. Other technical functions (Stores, Materials & Civil works)	5	2.5	1.5
4. Non Technical departments	15	7.5	4.5
Total	100	50	30

The proposed manpower distribution by educational qualifications is given in table 5.

TABLE—5
PROPOSED MANPOWER DISTRIBUTION BY EDUCATIONAL QUALIFICATIONS
(for 1000 tonnes)

No.	Level of qualifications	%	Numbers	
			Case-I	Case-II
1.	I. T. I. Certificate holders/Matriculates with experience/other skills	50	25	15
2.	Graduates	9	45	2.7
	a) Science	5	2.5	1.5
	b) Others	4	2	1.2
3.	Management and other professionals	3	1.5	0.9
4.	Diploma holders in Technology and Engg.	20	10	6.0
	a) Pulp and Paper and Chemical Engg.	7	3.5	2.1
	b) Other Engineers	13	6.5	3.9
5.	Graduates in Engg.	15	7.5	4.5
	a) Pulp and Paper, and Chem. Engg.	7.5	3.75	2.25
	b) Other engineering	7.5	3.75	2.25
6.	Post-graduates in Engineering and Ph. D.s (Engg. and Sciences)	3	1.5	0.9
Total		100	50	30

Projected Manpower Demands :

The projected growth rate in the installed capacity for Paper Industry is shown along with the additional Manpower requirements by the year 2000 in Tables—6.

TABLE—6 ADDITIONAL MANPOWER DEMAND FOR ADDITIONAL NEW CAPACITY OVER THE PRESENT 19.15 LAKH TONNES PER YEAR

Year	Proposed Capacity Lakh Tonnes	Additional Capacity Lakh Tonnes	Additional Manpower	
			50 persons 1000 Tonnes	30 persons 1000 Tonnes
1985	20.07	0.92	4600	2763
1990	25.20	5.13	25650	15390
1995	32.59	7.39	36950	22170
2000	41.72	9.13	45650	27390
Total		22.57	1,22850	73710

Table-6 indicates the total required manpower at different times based on possible 30 persons/1000 tonnes capacity and a very optimistic automated plants employing about 30 person/1000 tonnes. If the existing capacity of 19.15 lakh tonnes also adopted modern technology and greater automation, the manpower need are likely to change to 95,750 and 57,453 and 50 and 30 persons/1000 tonnes capacity respectively. The distribution of this manpower for additional capacity at various academic levels on the proposed pattern indicated in Table-5 will be as given in Table-7. The figures shown in this table show the total impact of new production capacity at various levels by the year 2000. With greater emphasis on labour saving methodology, people with greater emphasis on labour saving methodology, people with greater technical skills and flexibility will be demanded. The concentrating on academic levels beyond Diploma in the technical disciplines, the manpower demands for the additional capacity for various times is given in Table-8.

These figures indicate a tremendous gap between available manpower and the needs particularly of those with specialised training in Pulp and Paper. The Institute of Paper technology trains roughly 30 graduate engineers and 20 diploma holders in Pulp and Paper annually. At best these people can meet only the replacement of the technical task force and facilities have to be created to man the newer units.

The manpower needs replacement due to wastage and normal human wear and tear (retirement). Its customary to assure 5% of total task force as replacement needs. The country probably will be able to meet the demand of Diploma and Degree holders in disciplines other than process (Pulp, Paper & Chemical) both for new capacity as well as for replacement. This is based on the presumption that the wide network of engineering and polytechnic institutions can gear up with marginal additional inputs to meet this

TABLE-7

ACADEMIC LEVEL WISE DISTRIBUTION OF ADDITIONAL MANPOWER
FOR NEW CAPACITY BY 2000 A. D.

LEVEL	%	TOTAL REQUIREMENT	
		50 persons/1000 tonnes CASE-I	30 persons/1000 tonnes CASE-II
1. ITI Certificate holders/Matriculates with Experience.	50	61425	36855
2. Graduates	9	11056.6	6633.9
a) Science	5	6142.5	3685.5
b) Other	4	4914	2948.4
3. Management and other professionals	3	3685.5	2211.3
4. Diploma holders	20	24570	14742
a) Pulp & Paper and chem. Engg.	7	8599.5	5159.7
b) Others	13	15970.5	9582.3
5. Graduates Engineers	15	18427.5	11056.5
a) Pulp & Paper and Chem. Engg.	7.5	9213.75	5528.25
b) Others	7.5	9213.75	5528.25
6. Postgraduates in Engg. and Ph.D.s	3	3685.5	2211.3
TOTAL	100	122850	73710

TABLE-8
ADDITIONAL TECHNICAL MANPOWER NEEDS FOR NEW CAPACITY

ADDITIONAL TECHNICAL MANPOWER NEEDS FOR NEW CAPACITY						
Year	Capacity Lakh tonnes	Diploma holders		Engg. graduates		Postgraduates
		Pulp & Paper & Chem. Engg.	Others	Pulp & Paper & Chem. Engg.	Others	
CASE—I: 50 Persons/1000 Tonnes						
1985	20.07	322	598	345	345	138
1990	25.20	1768.55	3284.45	1923.75	1923.75	769.5
1995	32.59	2586.5	4803.5	3002.19	3002.19	1200.87
2000	41.72	3195.5	5934.5	3423.75	3423.75	1369.5
CASE—II: 30 Persons/1000 Tonnes						
1985	20.07	193.2	358.8	207	207	82.8
1990	25.20	1077.3	2000.7	1154.25	1154.25	461.7
1995	32.59	1551.9	2882.1	1662.75	1662.75	665.1
2000	41.72	1917.3	3560.7	2054.25	2054.25	821.7

**TABLE-9 TOTAL ANNUAL DEMAND OF TECHNICAL MANPOWER FOR
NEW UNITS AND AS REPLACEMENT**

NEW UNITS AND AS REPLACEMENT

Academic Level	1983 replace- ment No./ year	1990			2000		
		Additorial for new units No./ year (over 1983)	Replacement for new units No./ year	Total No./ year	Additorial for new units No./ year (over 1990)	Replace- ment for new units No./Yr.	Total No./ year
CASE-I : Basis 50 persons/1000 tonnes capacity							
1. Diploma							
a) Pulp, Paper & Chemical	24	303	15	332	347	17	403
b) Others	39	562	26	639	644	32	743
2. Engineering graduates							
a) Pulp, Paper & Chemical	25	324	16	365	371	18	430
b) Others	25	324	16	365	371	18	430
3. Postgraduates & Ph D.s.	100	130	7	147	148	8	183
CASE-II : Basis 30 persons/1000 tonnes capacity							
1. Diploma							
a) Pulp, Paper & Chem.	15	181	9	205	209	10	242
b) Others	23	337	17	377	386	19	445
2. Engineering Graduates							
a) Pulp, Paper & Chem.	15	194	10	219	223	11	259
b) Others	15	194	10	219	223	11	259
3. Postgraduates & Ph. D.s.	6	78	4	88	89	10	109

challenge. This will not be true for people with process background, particularly in Pulp and Paper due to non-existence of any worthwhile infrastructural facilities, except the Institute of Paper Technology. The picture will be still gloomy, when it comes to post graduates and Ph.D's, with inter-disciplinary background of engineering and process. Thus, it is important to review the manpower needs in these sectors both for new units and as replacement. The TABLE-9 shows the annual demand of technical manpower in the years 1990 and 2000, taking 5% replacement rate.

Concentrating our attention only on specialists with Pulp & Paper background the required Degree and Diploma level task force by the year 1990 and 2000 will be about 165 and 180 and 200 and 215 respectively, assuming 50-50 ratio of Pulp and Paper Vs Chemical Engineering specialists at 50 persons/1000 tonnes. Similarly, these figures are 100 and 110 and 120 & 130 with 30 persons/1000 tonnes. Likewise, the requirement of post-graduates and Ph.D's, assuming 50% in Pulp and Paper area will be 75 and 90 in the years 1990 and 2000 respectively at 50 persons/1000 tonnes. The total picture vis-a-vis Pulp and Paper Specialists that emerges from this analysis assuming, a total of 50% of the process task force in this speciality as given in TABLE-10.

TABLE-10 ANNUAL REQUIREMENT OF PULP AND PAPER SPECIALISTS

Academic Level	Case-I 50 persons/1000 tonnes		Case-II 30 persons/1000 tonnes	
	1990	2000	1990	2000
Diploma	166	201	102	121
Graduate Engineer	182	215	110	130
Postgraduates & Ph. D.s	73	91	44	55

Assuming, one Ph.D. for every 4 Master of Engineering degree holder, the relative distribution can be worked out as 14 Ph.D.s and 59 Post-graduates Engineers in 1990 and 18 Ph.D.s and 73 Post-graduate engineers in 2000 for Case-I.

The increase in Diploma (3 years after High School) and Degree (4 years after 10+2) are almost 5 & 6 fold respectively by 1990 and 6.5 and 7 fold respectively by 2000.

Assuming, roughly Rs. 10,000/= recurring expenses per student per year, the annual recurring expenses alone will be of the order of 140-150 Lakhs and 170-180 lakhs in the years 1990 and 2000 respectively at 50 persons/1000 tonnes capacity. The infra-structural facilities for training such large numbers will be in the range of 40 crores by 1990 and 50 crores by 2000. These estimates are very rough and indicate only a measure of the possible magnitudes of investments to meet the national goal.

CONCLUSION :

The manpower strategy for Paper Industry in the coming decades has to concentrate on the following :—

- The labour productivity must increase reducing the task force per unit production.
- Emphasis on recruiting manpower with greater technical skills must go up. This segment will have to do activities connected with planing, trouble-shooting besides regular production.
- In house research must increase.
- Greater investment in manpower planning is a must, if the targets are to be achieved.