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.....
WORKING GROUP No.10

**APPROPRIATE TECHNOLOGY
FOR THE MANUFACTURE OF
PULP AND PAPER PRODUCTS**

.....
FURTHER DEVELOPMENT OF MINI-PAPER TECHNOLOGY IN INDIA
Background Paper

FURTHER DEVELOPMENT OF MINI-PAPER TECHNOLOGY
IN INDIA

by

M. K. Garg, and M. M. Hoda

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Most of the writing in ancient India was done on 'Sho-jpatra', a specially treated bark of a forest tree growing at high altitudes in the Himalayas. Later on some kind of handmade paper was manufactured from the pulp prepared from the bark of various other trees and rags. At what date the manufacture of paper from bark was started is not certain but records mention account books maintained by traders on such paper as early as 1000 A.D. During Mogul rule, paper making was propagated as an art and thousand of kaghzis (professional paper makers) found gainful and rewarding work under their patronage. However, this industry started declining from the last quarter of the 19th century with the establishment of mechanised paper mills in India*. In 1961 census, there were only 2000 kaghzis in the country. Some remnants of this industry are still available at ^{the} town of Kalpi in Uttar Pradesh (U.P.)

* Dogli, 1976, Khadi & Village Industries in India, p. 78-83.

and town of Sangner in Rajasthan. At both these towns there is an age-old tradition in the artisan families for making of hand-made paper, but the bark as raw material has been replaced by waste paper and rags. There are more than 2,000 people in these two centres involved in making special paper, some of which is finding export market also. Other smaller centres are scattered in various States but are not as productive as these two centres are.

The large scale mechanised technology of paper making was introduced as early as 1905, but it started growing during the first World War. The industry at present is very well developed but still not able to meet the growing demand of paper. Some of the figures are given below:-

Table 1
Installed and Production capacity

Year	Installed capacity (lac tonnes)	Production (lac tonnes)
1965	6.74	5.65
1970	7.04	7.73
1977	12.00	9.00

The total number of units are 75, out of which 60 are in the medium-scale sector. Only 4 big industrial houses of Birlas, K.C.Thapar, Somani and Banger Brothers produce 50% of the total production on an organised scale. The capacity of the

large-scale paper making industry, which was originally 30 tonnes per day grown to the order of 100 tonnes per day and many units are as large as 150-200 tonnes per day. The projection for paper demand as made in the 5 year Plan- 1978-83 is given as follows :-

" On the basis of the additional requirements on account of an accelerated programme of adult education, the demand for paper and paper board is expected to rise to 1.425 million tonnes in 1982-83. Capacity and production targets envisaged are 1.65 and 1.25 million tonnes respectively. Marginal imports, therefore, may be necessary.

The demand for newsprint is estimated at 2,70,000 tonnes in 1982-83. With the commissioning of the newsprint project in Kerala, capacity of the industry would reach 1,55,000 tonnes. A production target of 1,20,000 tonnes is envisaged for 1982-83".

The raw material for the paper industry is required to be planned on a more rational, systematic and long-term basis taking into account the limited forest resources of the country and the long gestation period needed for their regeneration. A policy to maximise

* Draft Five Year Plan 1978-83 pp.194.

the use of potential non-conventional raw materials for production of paper is being formulated. This has assumed importance in the context of a number of new small plants being set up based on agricultural residues and the emerging shortages of conventional raw materials to support a growing paper industry. The possibility of establishing large pulp mills to provide long-fibred pulp to small paper mills to upgrade the quality of their output will need consideration. Given the country's limited availability of the required long fibred timbers and the options available for making the optimal use of them, the establishment of additional capacity for newsprint may not be justified. In this background, the provision made in the public sector is limited to funds required for the continuing programmes and for a start for setting up a new pulp/paper project. At present despite shortage, only a very small amount i.e. to an extent of 15,000 tonnes of special paper is being imported in India.

The need to scale down the capacity of large scale paper unit was felt some time between 1954-60. The conventional paper-making raw material was getting scarce and was available in too far off places out of reach of modern transport. It was, therefore, felt that smaller units based partly on recycling of waste and partly on utilising agriculture waste as raw material

could be a possibility for augmenting the production specially for the requirement of school exercise books and cheap writing and printing paper. ^{An} All India Seminar on small-scale paper was held in Dalmianagar, Bihar in 1961⁴ where various aspects of the industry were gone into. Two type of the units were found feasible (1) a 2-ton paper plant per day capacity entirely based on recycling of waste paper, (2) a 10-20 tonnes paper plant based partly on recycled paper waste and partly on agriculture waste like paddy straw and wheat straw etc. Pulp unit for treating the agriculture waste was costly both per unit of capital investment and in operational cost. Though half a dozen units were installed by 1968 based on this process but these units were only marginally successful.

A new approach for preparing pulp for agriculture waste was worked out partly by the industry and to a great extent by ^{the} Forest Research Institute, Dehradun*. They developed the hot caustic soda process. The cost estimate is given below:-

Table 2

	10-20 TPD Plant (Conventional process).	10-20 TPD plant (New Process).
A. CAPITAL COSTS		
Estimated investment per annual tonne.	5500-6000	4500-5000
B. OPERATIVE COSTS		
Cost of Production	3500/- Per ton	2700/- per ton

* Paper Production- A new approach, N.I.D.C. Pamphlet, 1978.

With the adoption of this process by medium-scale paper units, the units became viable and have been expanding; 3-5 units every year are coming up and there is possibility of further growth and extension.

Handmade Paper:

As has been mentioned earlier ^{the} hand-made paper industry in India declined rapidly from the last quarter of 19th century when mechanised paper mills were established. The great depression of thirties and continuous shortage of old rags and gunny bags gave another serious blow to the hand-made paper industry. In the year 1935 the All India Village Industries Association founded by Mahatma Gandhi made some efforts to revive this industry. It was, however, only after the Khadi & Village Industries Commission was established in the year 1957 that serious steps were taken to develop this industry. ^{The} Hand-made paper industry at present makes up just 0.5% of the total production of paper in the country and is not expected to rise above 1% unless something dramatic and revolutionary is introduced in the programme.*

The hand-made paper has been mainly concentrating on the production of writing and printing papers from recycled waste, bond and drawing papers from rags and blotting paper, and marketing it virtually to protected markets like Central and State Government offices, Khadi & Village Industries Commission offices and publications, State Khadi & Village Industries Boards and some such national minded Institutions.

* Hand-made paper Project Report issued by Khadi & Village Industries Commission 1975.

Due to finding the manufacture of writing and printing papers not economically viable, the hand-made paper industry has now shifted its attention to the manufacture of non-competitive decorative, commercial and industry grade papers and in addition to that there is a great need for drawing papers, cloth-lined paper, special paper for preserving records, packing boards, electric insulation papers, filter papers, invitation cards etc. The following table shows the raw materials and the varieties of the paper that can be manufactured from them in the hand-made paper industry :-

Table 3
Raw material and varieties of
paper that can be manufactured.

Variety	Raw material
1. Art & Engineering drawing paper	White rags, tailor cuttings
2. Permanent document papers	White rags, tailor cuttings.
3. Water marked certificate paper for universities and commercial firms.	White rags, tailor cuttings.
4. High grade stationary, card sheets, greetings of fancy colours.	Coloured rags, white rags etc. cotton and jute.
5. Album papers	Gunny waste, rags and paper cuttings.
6. Filter papers used in commercial firms, mercantile companies and distilleries.	Old rags, paper waste cotton.
7. Blotting paper(white and pink).	Old rags, and paper cuttings.
8. Packing boards (plane and laminated).	Grasses, bagasse, paper waste, rags, citronella grass, bejal grass, gunny waste etc. (Jute waste).

cont...

Variety	Raw material
9. Electrical insulation Boards and paper.	Bagasse, rags, citronella grass and gunny waste.
10. Cover papers	Rags, paper waste, gunny waste etc.
11. File Boards	Mixed colour rags, and paper cuttings.
12. Grey boards	Road sweepings and any cheap fibrous material locally available.
13. Straw boards	Local available straws with no fodder value.

The Khadi & Village Industries Commission has taken up this industry since 1953 and during the last 20 years great developments have been achieved in the spread of this industry. Research work done on all the aspects and modifications were made to various machines and equipment to improve the quality of the paper as per specifications. This has given respectability to this industry and has put it on a par with other small-scale industries. All the machinery and processes like digester, beaters and mixers have been mechanised. Only the lifting of the paper is done manually piece by piece in a very monotonous and time-consuming process. The progress of this industry since the year 1955-56 to 1973-74 has been

Table 4

Hand-made paper Industry- Some
selected indicators of progress.

	1955-56	1960-61	1965-66	1972-73	1973-74
1. Organisation (Nos.)					
(i) Regd. institutions	-	-	-	135	135
(ii) Co-operatives	66	108	149	44	44
Total	66	108	149	179	179
2. Production					
(i) Quantity (Tonnes)	661	1,248	1,960	3,551	3,348
(ii) Value (Rs. in crores)	0.18	0.24	0.39	0.96	0.95
3. Sales					
(i) Quantity (Tonnes)	N.A.	981	1,728	3,351	3,111
(ii) Value (Rs. in crores)	0.04	0.21	0.36	1.04	1.0
4. Employment (.000)					
(i) Full time	2	4	4	3	3
(ii) Part time	-	2	1	1	1
Total	2	6	5	4	4
5. Wages (Rs. in lakhs)					
	6	8	14	31	33

The technical process followed in hand-made paper industry is given in Appendix-1.

A scheme for setting ^{up} hand-made paper unit is given in Appendix II.

The Khadi & Village Industries Commission gives all technical and other help to those interested in implementing the scheme, almost on a turn-key basis. It also arranges for the training of workers and artisans and the goods manufactured according to their specifications are also marketed. Financial assistance from Banks is also available for setting up hand-made paper units.

An Appropriate Technology for Paper Making.

The major handicap in the economic viability of hand-made paper is the lifting operation. The pulp, after being prepared mechanically, is suspended in water in a tank from which a worker lifts individual sheets of paper on a special screen frame one by one. The productivity is very low. The cost of lifting is high and then high grammage paper is only possible and uniformity in quality depends on highly individualised skill. Diversification to common usage paper is technologically not possible.

The other handicap concerns the raw material for pulp-making. Waste paper and tailor cuttings and rags are now much more in demand by the medium-scale paper industry and their availability is uncertain and the cost is inflated to a level where even speciality paper manufactured by ^{the} hand-made paper industry is becoming gradually uneconomic. So, if the development effort made over the last three decades for hand-made paper industry which has created a rural employment potential, has to be sustained and kept up, further development and improvement

of the technology, i.e. devising an appropriate technology, will have to be done.

The Appropriate Technology Development Association in Lucknow has investigated this problem in depth, had discussions with various technologists and experts in this field and has reached the following conclusions:-

- 1) When all the other processes in handmade paper have been mechanised, why should the lifting be left to be done by hand? If this process can also be mechanised, then much diversification ^{manufacture of} into/low grammage paper specially for rural school exercise books, text books, typing, and other such general purposes can be undertaken. This requires development of a one-ton per day paper lifting machine. Already cylinder machines of a daily capacity of 2-3 tons are being manufactured for making duplex and triplex boards as well as packing boards. Earlier attempts to make low grammage paper from ^{type of} this/machine did not prove successful. Sri M.S. Parkhe, one of the pioneers of the small-scale industry in India, has now developed a FOURDRINIER paper lifting machine with a one ton per day capacity in his factory at Khopoli near Bombay. This prototype can be incorporated in the handmade paper industry and the low grammage paper for rural school exercise and text books could be manufactured. As a matter of fact, the introduction of this machine will be dramatic and

revolutionise the present rural handmade paper industry into a technically feasible and economically viable proposition to produce a large variety of daily usage paper on a competitive price compared to large scale paper.

- 2) The other problem is that of raw material. Any meaningful programme of paper manufacture on cottage scale can not depend solely on recycled waste. Moreover, long-fibre pulp is a necessity for manufacturing low grammage paper. Further, in order to keep the cost of a competitive agricultural waste pulp plant down, the pulp volume will have to be increased. The technology, of both these kinds of pulp making and the capacity and the capital investment required is beyond the capacity of the rural, small or cottage units. As stated earlier, the viable capacity of the agricultural waste pulp unit starts at 10 tons a day and goes upto 30 tons a day. If we standardise the rural paper units to a capacity of one ton a day, then an agricultural waste pulp unit will serve 30 - 100 small paper units. / rural (Only about 30% of the pulp will be used alongwith recycled and long-fibre pulp).

The problem with^a/high-fibred chemical pulping plant is yet more difficult. The capacity generally recommended for a plant nears 100 tons per day which requires more than 100 million rupees of investment. The Appropriate Technology Development Association has been investigating the possibility of scaling

down the size of the plant and has had some support in getting a long-fibred chemical pulping plant with a 30 to 50 tons capacity designed, if bleaching is not adopted.

The Appropriate Technology Development Association has, therefore, worked out the following organisational pattern for upgrading the present hand-made paper units:-

1. Set up a 30-50 tons capacity chemical long-fibred plant by development organisations, government institutions, and arrange distribution of the pulp to rural hand-made paper units. Such a plant can be at the State level. The pulp will be supplied to the small units.
2. ~~Set up a~~ regional pulping plant from agricultural wastes covering 2 to 3 districts to be owned and operated by local development agencies, both governmental or non-governmental. The pulp to be supplied to small units.
3. Set up a rural paper unit with a capacity of one ton with a complete recycling pulping plant on the pattern of the Khadi Commission but with a FOURRINIER type of mechanised paper-lifting unit as developed by Sri M.S.Parkhe of Paper & Pulp conversion Ltd. Khopoli. The paper will be manufactured with a suitable mixture of long fibre pulp obtained from ^{the} State Pulping Plant, Agricultural waste/^{short fibre} pulp & recycled pulp.

4. The hand-made paper units will also benefit by obtaining part of their pulp requirements from those State level and Regional level pulping plants. It is not the intention to completely convert the hand-made paper units to the mechanised lifting process. The hand-made paper section will be useful/³adjacent to the mechanised lifting units. The special quality paper which is best manufactured by the hand lifting process could be continued at a better economic level because of the supply of good and lower cost pulp.

Such an organisational pattern will increase the small scale paper production to a meaningful level and will meet the local paper requirement in rural areas and can generate employment potential in rural areas, improve their capital formation and economic condition.

APPENDIX I

TECHNICAL NOTES ON THE MANUFACTURE
OF HANDMADE PAPER AND BOARD.

The following sequence of processes is carried out in handmade paper manufacture:-

1. Rag-sorting, cutting and dusting;
2. Cooking(digestion);
3. Beating;
4. Lifting and couching;
5. Pressing and drying;
6. Tub sizing;
7. Calendaring;
8. Sorting and cutting.

These processes are described below:-

1. Rag sorting:

Rags are sorted thoroughly for removal of all impurities, i.e. all non-fibrous materials like bidi and cigarette ends, nails, buttons, wooden chips, etc. These are then cut into small pieces of approximately 1" x 1" size. The sorted and cut-to-size rags are then dusted through^a/dusting frame covered with 4 to 6 mesh wire.

2. Digesting:

The cooking or digestion of the rags is done with a mixture of 1% caustic soda and kept at boiling point for about 5 to 6 hours. They are washed thoroughly for removal of liquor and then taken to the beater.

3. Beating:

The beater is filled with the required quantity of water and the digested rags are added gradually till the right combination of water and rags is reached. One per cent bleaching powder is added to the beater. After allowing sufficient time for bleaching, ^{the} rags should be washed thoroughly by lowering the washing drum. Time required for pulping is about 6 to 8 hours where good hydration is desired. After that, Titanium dioxide or other fillers are added. For coloured paper, dyes are added, while for white paper, optical bleaching agent is added. After this, rosin soap and alum are added.

4. Lifting and couching:

From the beater, the pulp should be taken to storage vats near the lifting vat and mixed with a sufficient quantity of water to dilute it for uniform suspension and free it from clumps, knots, etc.

A certain quantity of diluted pulp is then lifted from vats on to a wire screen and the sheets are then covered by felt, one after the other.

5. Pressing and drying:

When a sufficient number of sheets have been formed, they are put under the press to remove the water. The sheets are then separated and, to avoid shrinkage, placed under absorbent boards and pressed again. The sheets are then hung to dry in bunches of 3 to 6 according to the thickness of the sheet.

6. Tub sizing:

When the paper is required to be strong and durable, tub sizing or surface sizing is done. The sized papers are again dried and cleaned with brush or cotton wadding to remove dirt specks etc.

7. Calendering.

The sheets are then placed alternately under metal plates to form a post and the post is then passed to and fro in between calender rolls to obtain the desired smoothness.

8. Sorting and cutting:

After calendering, sheets are carefully sorted and then cut to the required size with the help of a cutting machine. The cut sheets are then packed in rolls and despatched.

APPENDIX II

TENTATIVE SCHEME FOR HANDMADE PAPER UNIT

For handmade paper manufacturing unit:-

The unit is expected to produce bond paper, drawing paper, superior cards for invitations, greetings, etc. and such other superior varieties. Other varieties such as file boards, grey boards etc. can also be manufactured.

The scheme has been prepared taking into consideration the prevailing prices of various commodities. It is likely that there may be some variation in prices depending upon local conditions. Briefly, the financial requirements and working of the scheme is as follows: The scheme is for the production of 240 kg. of speciality paper per day or 72 metric tonnes per annum. The total cost of installation is Rs. 14 lakhs.

Financial requirements

A. Building

- i) Land about 3/4 to 1 acre
- ii) Pucca (brick and mortar) building, 3,200 sq. ft.
- iii) Kachcha (mud plaster) building, 2,000 sq. ft.
- iv) Water and power facilities (including construction of water storage tank)

Rs. 37,000.00

B. Machinery

- i) Vomitting type digester- 5' x 4'
- ii) Rag chopper 10" blade with motor 3 H.P.
- iii) Beater 24" x 30 roll size- 2 nos.
- iv) Electric motor for beaters of 20H.P 960 RPM slipring with oil immersed starter - 2 Nos.
- v) Lifting semi automatic vats 6 Nos.
- vi) Hydraulic press 40" x 50" plate size double ram with 5 H.P. motor

- 7. Screw press 36" x 42" or 35" x 45" plate size, for pressing of sized paper etc.)
- 8. Calender machine for paper glazing 12" x 36" roll size complete with accessories.)
- 9. Electric motor for calender machine 10 H.P. 960 RPM with starter)
- 10. Paper cutting machine 42" x 48" blade size.) Rs. 1,32,250.00
- 11. Small beater of 2 kg. capacity with 1/2 H.P. motor for experiments.)
- 12. Washing machine)
- 13. Add transport, taxes, ^{costs of} erection etc.)

C. Equipment

- 1. Chain pulley block with tripod 2 tons capacity)
- 2. Platform weighing balance 500 kg. capacity.)
- 3. Pulp storage tanks for lifting vats 6 nos.)
- 4. Washing cradles for pulp washing 2 nos.)
- 5. Press boards for paper lifting 24 nos.) Rs. 29,700.00
- 6. Zinc sheets for calender machine 4' x 3'- 40 nos.)
- 7. Woollen felts 400 nos.)
- 8. Complete set of tool box of carpentry fitting, pipe fitting tools etc.)
- 9. Small pan balance of 2 kg. capacity)
- 10. Towel horses for keeping felts. 6 nos.)
- 11. Sizing trays- 1 no.
- 12. Grinder- 1 no.
- 13. Duster, frame)

14. Spare parts of moulds etc.)	
15. Couching tables -6 units)	
16. Stools for vats, paper separation)	
17. Drying arrangement	
18. Other ^{miscellaneous} articles like Buckets)	
brushes, hardware stores etc.)	
Add. taxes, transport etc.)	
<u>D. Office equipment</u>	
1. Typewriter, cupboards, tables,)	
chairs, racks, clocks etc.)	
2. Storing arrangements for finished)	Rs. 15,000.00
paper, chemicals etc.)	
Total	
A. Building : Rs. 1,37,000.00	
B. Machinery : Rs. 1,32,250.00	
C. Equipment : Rs. 29,700.00	
D. Office equipment : Rs. 15,000.00	

	Rs. 3,33,950.00

or say R.3.14 lakhs.

Working of the scheme

At the outset, it may be pointed out that working the unit in ^a single shift alone will not be economical. In order to run the unit smoothly and economically, it should be necessary work in 2 shifts. The economics of working the unit in 2 shifts is as follows:

- a) Beater operation will be in 3 shifts.
- b) Lifting, pressing, paper separation, digestion (if necessary) in 2 shifts.
- c) Other processes in general shift.

A. Raw materials and Chemicals

1. New rags 90 tons - @ Rs. 1,700 per ton)
2. Caustic soda flakes 1% - 900 kg. @ Rs. 3.50 per kg.)
3. Bleaching powder 1% - 900 kg. @ Rs. 1.50 per kg.)
4. Titanium - dioxide 1% - 900 kg. @ Rs. 8.50 per kg.) **Rs. 2,03,500.00**
5. Rosin 1.5% - 1350 @ Rs. 3.00 per kg.)
6. Soda ash - 400 kg. @ Rs. 1.50 per kg.)
7. Alum (non ferric) 3% - 2,700 kg. @ Rs. 1.00 per kg.)
8. Glue flakes "Crocodile" brand 3% - 2,700 kg. @ Rs. 7.50 per kg.)
9. Tinopal or other suitable optical bleaching agent 50kg. @ Rs. 50/- per kg.)
10. Formaline 720 litres (700 kg. approx.) @ Rs. 2.50 per kg.)
11. Diaccol M-15-1/2% - 450 kg. @ Rs. 5/- per kg.)
12. Miscellaneous chemicals such as colours (dyes), soap, kerosene, Ultramarine blue etc.)

B. Labour

	<u>No. of persons</u>	<u>Remarks</u>
1. Rags sorting ...	6L	Gen. shift.
2. Rags dusting ...	4L	"
3. Rags cutting ...	2 2M	In shifts
4. Digester ...	2M	"
5. Beater man ...	4M	"
6. Beater Assistant .	4M	"
7. Vatman ...	1 2M	"
8. Couchman ...	1 2M	"
9. Press and wet paper separation. ...	8M	"

10. Paper drying ... 4L Gen. Shift)
 11. Paper sorting and Khurspi ... 6L ")
 12. Glue sizing ... 4L ")
 13. Calendering ... 2M ")
 14. Paper cutting and packing ... 1M ") **Rs. 1,63,020.00**
 15. Labour for miscellaneous work 5M In shift.)
 16. Chowkidar (night watchman) 4M ")
No. of working days in a year 300
 17. Carpenter-cum-mechanic 1)
 18. Helper 1)
- Add leave salary, provident fund, gratuity and other Labour benefits @ 30%

C. Other manufacturing expenses

1. Water charges)
2. Power charges) **Rs. 33,600.00**
3. Fuel (for cooking & drying))

D. Staff and other expenses

1. One manager)
2. Two Supervisors)
3. One Accountant-cum-Storekeeper)
4. One Clerk-cum-typist)
5. One messenger) **Rs. 31,410.00**

Add leave salary provident fund, gratuity E.S.I. scheme etc. @ 30%.

6. Telephone, taxes, insurance etc.)
 7. postage and stationer)
 8. Travelling expenses)
 9. Repairs and replacements:)
- E. Repairs and replacement) Rs. 10,000.00**

F. Depreciation

1. On pucca building)	
2. On kachcha building)	
3. On machinery	)	Rs. 22,650.00
4. On equipment)	
5. On office equipment and furniture)	

B. Interest

On capital expenses of Rs. 3,14,000.00	
On working capital (roughly equivalent to 4 months' requirements)	Rs. 1,00,000.00

	Rs. 4,14,000.00

Interest @ 9% of Rs. 4,14,000.00	Rs. 37,260.00

Summary of expenses

A. Raw materials and chemicals	.....	Rs. 2,03,500.00
B. Labour	.....	Rs. 1,63,020.00
C. Other manufacturing expenses	... ..	Rs. 33,600.00
D. Staff and other expenses	.....	Rs. 31,410.00
E. Repairs and replacements	.....	Rs. 10,000.00
F. Depreciation	.....	Rs. 22,650.00
G. Interest	.....	Rs. 37,260.00

		Rs. 5,01,440.00

Against this, the production of good quality finished bond/drawing/ superior card per day will be 240 kg. Therefore, production per year for 300 working days will be 240 x 300 = 72,000 kg. i.e. 72 metric tons. Actual cost of production will be Rs. 6.97 per kg. Taking into

consideration the discount to be paid to customers and profit margin, the selling price will be Rs. 25 per kg.

72,000 kg. x Rs. 25 = Rs. 5,94,000.00

Less 10% discount to be given to customers = Rs. 59,400.00

Rs. 5,34,600.00

Deduct expenses as shown above. = Rs. 5,01,400.00

Rs. 33,200.00

Net profit.

Note: 1- The financial implications shown in the scheme are based on costs prevailing in urban areas. However, the actual expenditure may come down at certain places due to local circumstances. Besides some items of equipment can be manufactured locally so as to bring down the cost.

The same holds for raw materials, chemicals etc. if special efforts are made to obtain them at a low rate. Economy and vigilance are the key factors for bringing down the cost of production to the minimum.

2. The sale price indicated above may be taken as an average. It may be ^a little higher in case ^{the} of thinner varieties and lower in case of thicker varieties.

3. The scheme is based on the prices prevailing in the year 1972. Since then the prices have fluctuated. As such, the scheme will have to be revised suitably. However, the basis will remain the same. With the increase in investment, production will have to be stepped up and that can be done by installing one or more ^{beaters} of appropriate capacity

and running the vats in 3 shifts.

In the same unit with the help of the same machinery and equipment the following varieties can also be manufactured.

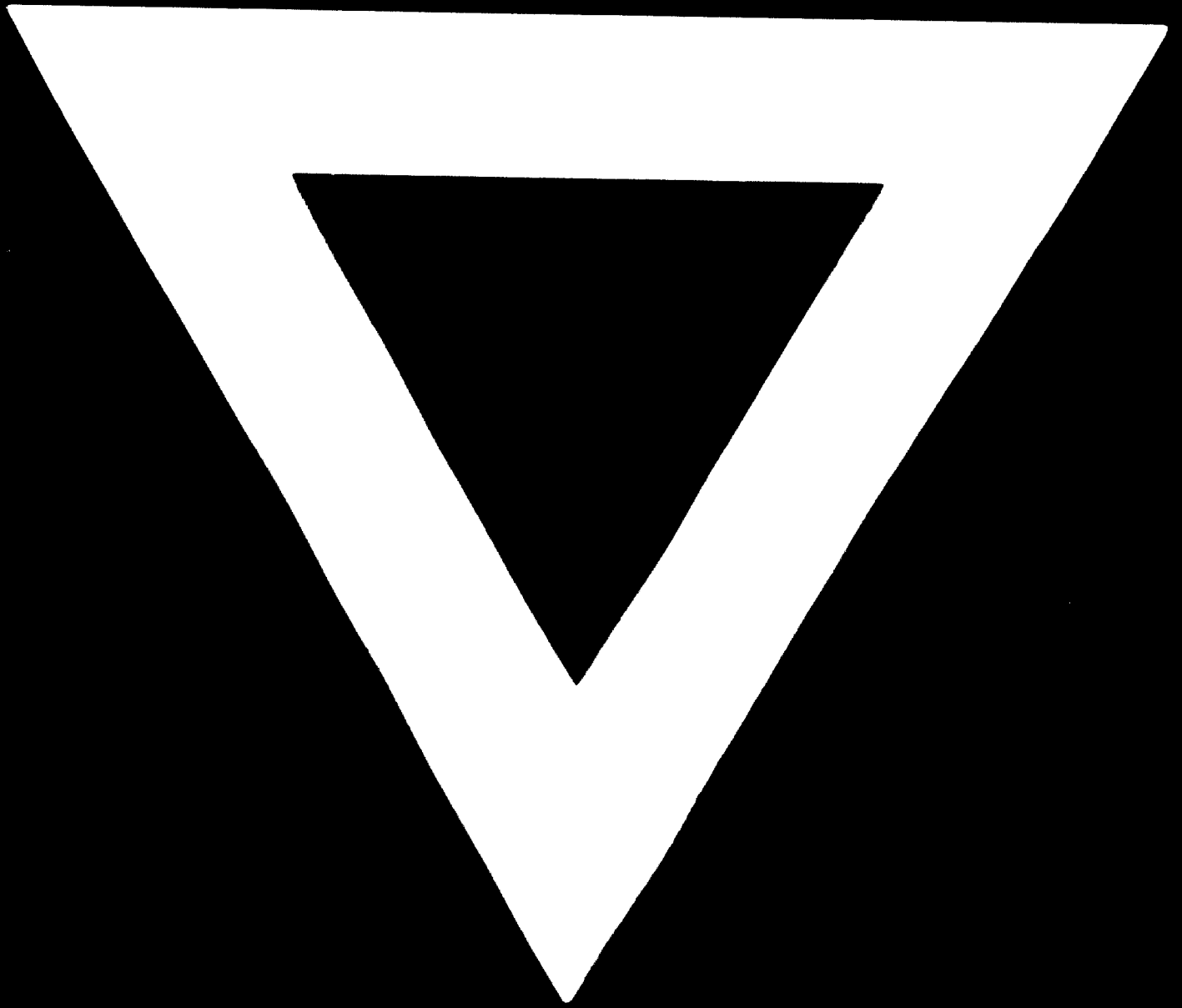
1. Filter paper
2. Electric insulation paper
3. Album paper
4. File boards
5. Straw boards
6. Grey boards
7. Blotting paper etc.

The processes and raw materials, chemicals, etc. may vary depending upon the type of raw material and quality of paper to be manufactured.

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B - 10



79. 11. 13