Mini Paper Units Based on Agricultural Residues—A Case Study For Madhya Pradesh

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The idea of mini paper and straw board units seems to have taken root firmly in the country. There is actually a scramble for obtaining letters of intent for such units. For the State of Madhya Pradesh, there are as many as 65 applications, involving a proposed outlay of Rs. 3600 million. Even if one third proposals materialize, there would be, in the coming few years, at least 22 new units of varying capacities in the State.

The paper and straw board units could play a vital role in the national context, and lead to the tapping of the vast agricultural resources for pulp and paper manufacture.

The paper sets out to appraise the agricultural data of the State and to suggest a methodology for calculating the potential availability of agricultural residues for pulping. It appears that very little work has been done in the country in this direction.

The cattle population of the State and the fodder requirements for it have been taken into consideration, and after making due allowance for this item, the surplus available potential of agricultural residues has been worked out for the purpose of broad sectoral planning. A safety factor of 20 percent for availability of agricultural residues only, for the time being, has been applied.

It has been shown that it should be possible to sustain an annual production target of 330,000 tonnes of paper and board from agricultural residues. Taking the additional possibility of producing 800,000 tonnes of pulp, board and newsprint from forest raw materials, the State of Madhya Pradesh could contribute 30 per cent to the projected demand targets for 1988-89 for the country, and thus assume a leading position in this field.

Introduction

It is a heartening sign,and a good augury that a complete session of one of the IPPTA Seminars is being devoted to the subject of mini paper units and agricultural residues. There seems to be no doubt that this Seminar will help focus public attention on this vital topic and establish its importance in the national context.

In an article which was published in the Economic Times[1], the author had pointed out that the idea of mini paper and straw boards units with capacities ranging from 5 to 20 tonnes per day, had taken root firmly. It was the 'in' thing to talk and plan for such mini units. It would not be wrong to say that they have come to stay, and have now a definite place under the sun.

The above article was followed by a study brought out by the Madhya Pradesh Audyogik Vikas Nigam Ltd[2], in which ten locations each for mini paper and straw board units were examined with reference to power situation, river flows, and other available infrastructural facilities. This study was received well, and it succeeded in arousing a keen interest among industrialists for setting up such units in Madhya Pradesh.

Mention could also be made of another separate study brought out by the author on the Bamboo and hardwood potential of

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Madhya Pradesh, and the scope of setting up pulp, paper and newsprint units in the State[3].

The result of all these efforts was that investment prospects in the State began to be realized as never before, and there was a scramble for obtaining letters of intent for setting up paper units of varying capacities in the State. This freshly aroused interest could be judged by the fact that as many as 65 parties have either obtained letters of intent or applied for them. Of these, 22 parties have actually received letters of intent, 21 parties have their cases pending with Government of India, and 22 parties have their cases under consideration of the State Govt. The total investment on these proposed projects would be of the order of Rs. 3600 million. Even if it is granted that only 33 percent proposals may eventually materialize, then too the prospects for the future would be quite bright. In the coming years, on the above assumption, there would then be at least 22 new units, and by the same rule of three, there would be an investment of Rs. 1200 million on setting them up. Actually, the investment prospects may be in the neighbourhood of Rs. 2000 million, when it is considered at least two rayon grade pulp units and one or two large-sized paper units may come up.

The above is an extremely hopeful and promising situation. It should now be for the State Government, financial institutions and machinery manufactures to create favourable conditions for sustaining the interest of prospective entrepreneurs, and helping them translate this blue-print into concrete action. When this comes about, the State of Madhya Pradesh with its central and strategic location, promising situation of surplus power, perennial river flows, and abundant availability of raw materials, both from forestry and agricuitural sources, could acquire a commanding position in the pulp, paper and newsprint industry, and play a significant role in meeting the growing requirements of these products, as well as in providing for exports too.

In this paper the available agricultural data has been examined in order to assess the potential availability of some agricultural residues (which could be used as raw materials in the pulp, paper and newsprint industry). In making this appraisal due allowance has been made for the requirements of the cattle population. There would be considerable scope for improving the quality of data and the determination of more realistic norms and methodology. Nevertheless, this study would suffice to show that there is an adequate surplus of agricultural potential for this industry, in Madhya Pradesh.

Agricultural Residues—Early History And Development

D.C. Tapadar[4] has dealt exhaustively with the early history and development of agricultural residues for the manufacture of paper and board.

As regards paddy straw, Le Cacheux[5] has pointed out that excellent printing and writing paper is at present made from paddy straw in different parts of the world. For example, two mills in Taiwan are producing high grade printing and writing paper from paddy straw (with 80 per cent rice straw soda pulp, and 20 per cent sulphate wood pulp). Two other mills are working with the same raw materials in Indonesia, as well as one mill in Thailand for making writing and printing paper, More recently, a paddy straw integrated mill producing writing and printing paper (80 tonnes per day) was established in Egypt near Alexandria. The furnish of materials was: 50–60% paddy straw, 20–30% sulphate wood pulp, and 20% waste paper. The requirement of straw per tonne of paper has been indicated Le Cacheux as 3 tonnes. (ibid.)

Sugarcane bagasse was tried in France as a raw material for newsprint as early as 1844. It was successfully used for making pulp and paper in Peru in the year 1939. As many as 40 mills were established in the next 25 years based on bagasse alone or in admixture with other raw materials.

In the Asian Newsprint Study (1971) of F.A.O.[6] it has been estimated that all the sugar mills in India are crushing annually between 35 and 40 million tonnes of moisture-free bagasse a year. However, more than 200 sugar mills of the country use practically all of the bagasse as fuel for generating process steam and

release electrical energy. The release of bagasse in exchange for alternative fuels is not easy in India, because coal, the principal fuel, would involve bulky and costly transportation.

The yield of sugar from sugarcane is generally taken as 8% and that of bagasse (bone dry) as 14%. Pith content in bagasse is 28%.

By way of example the Asian Newsprint Study has shown that if the crushing capacity in a sugar mill is 3500 tonnes per day, the quantity of sugarcane crushed in 160 days would be 550,000 tonnes. The yield of 50% moisture would be 150,000 tonnes, and that of bone dry bagasse 75,000 tonnes. The yield of pulp (bone dry) would be 40,500 tonnes.

A 50,000 tonnes per year newsprint mill would require 45,000 tonnes of bagasse pulp (10% moisture) which is a chemi-mechanical pulp with a yield of 80–85% after allowing for depithing. Most mills have a rated crushing capacity of 1500-2000 tonnes per day.

A continuous pulping plant based on Pomilio process was started at Rohtas Industries, Bihar in early forties. A newsprint project of 45,000 tonnes per year capacity based on bagasse is being contemplated at Sangli in Southern Maharashtra.

As for other agricultural residues, Tapadar[4] has pointed out that stalks of soya bean and cotton have already been used as substitute for straw in making straw board. Jute sticks and Mesta (Kenaf) are being successfully used in India for making paper and board since 1961. Hemp and Flax stalks can also be used readily, so also corn stalks which are similar to bagasse, both in structure and composition.

Agricultural Residues As Raw Materials And their Technology

Biswas[7] is surprised that in an agricultural country like India, the pulping of agricultural bye-products and residuces has not been uedertaken in a big way, except bagase and jute sticks. According to Guha and Pant[8], straw and agricultural bye-products are suitable as sources of pulp.

The main reason, according to Biswas[7], for the above state of affairs was the cheap and abundant availability of Bamboo. Till sometime back the agricultural residues were generally costlier than Bamboo, Now with the mounting shortage of Bamboo supplies and rapidly rising royalty rates, as well as felling and transporation charges (very often involving long leads), attention is again veering towards agricultural residues.

According to some people the use of agricultural residues is not feasible on a large scale as some of them like paddy and wheat straws are first of all used as stock feed for cattle, and secondly, the collection and transportation of the seasonal bulky products of agriculture and their storage present many problems. An opposite view is advocated by some others, and notably by Sen[9] who point out that unlike raw materials from forest-based wood, the suppoly of which is likely to decrease with population increase, the supply of agricultural residues is likely to increase with population. According to these sources, the agricultural residues would be a safer bet. Even after allowing for a sizeable proportion of wheat and paddy straw for bovine feeding, there would be a good deal available for pulping. More than its technological feasibility, the economic and strategic significance of this idea as a lever for enriching the rural economy and ensuring balanced regional growth deserves to receive more attention than it has so far done from planners and industrialists.

In addition to wheat and paddy straw, large quantities of other agricultural bye-products and residues would be available for pulping. To illustrate, the stalks or stems of the oil seed crops and pulses can be used as a source of pulp. The use of bast fibre-free jute sticks, sunn hemp, and Mesta could be another source. So also stems of the cotton plant, hemp and reeds of *Arundo donax* could be another source.

Not much work seems to have been done in the country on surveying the potential availability of agricultural residues for pulping. Tapadar[4], in his paper referred to earlier, has, however, put forward some general esti-

mates for some products based on agricultural statistics. This good work could surely be intensified and improved upon in order to have reliable data for sound planning purposes. It is in this spirit that the topic has been dealt with in this paper.

The composition and fibre dimensions of some agricultural residues are given below:

Material	Composition		Fibre dimensions		
	Lignin %	Hemi-Cellulose %	Cross and Bevan Cellulose %	Av. length mm.	Av. dia. mic.
1.	2.	3.	4.	5.	6.
Cotton	—	2.0	92-97	18	20
True hemp	5.2	5.5	79.3	22	30
Jute	11.7	18.1	74.9	2.0	22
Sabai grass	22.0	23.9	45.5	2.08	9
Munj grass	20.5	23.7	58.2	2.06	15
Bagasse	21.0	26.6	54.9	1.38	18
Paddy straw	25.5	21.0	53.5	1.13	16
Wheat straw	21.5	23.5	51.5	1.10	12
Jute sticks	21.4	18.8	57.6	0.79	29
Bamboo (*Dendrocalamus strictus*)	27.8	15.1	59.9	1.65	12

Source : D C. Tapadar, "Prospects of Manufacture of Paper and Board From Agricultural Residues. IPPTA , 9, 4 : 340 (1972)

Technology

Ernst and Clark[10], have stressed that development of improved processing techniques could offset some of the economic disadvantages of agricultural residues such as collection, transport and storage. They have pointed out that fine paper, pulps with good strength characteristics have been prepared by alkaline pulping of straws. Higher yields with somewhat lower strength characteristics were subsquently realised by a neutral sulphite process. The mechano-chemical produces quality pulps at atmospheric pressure in greater yields than by any chemical process. The advantages of the mechano-chemical process are that equipment is less costly and cooking cycles are shorter. But there are disadvantages too, i.e. higher power requirements, and greater amount of chemicals to bleach pulps to an acceptable brightness.

It has been shown that pulping of straws is best done in Hydrapulpers or Dynopulpers Yields of screened pulp from wheat straw rauge from 51-56%, depending on pressure and alkali concentration. The corresponding figures of yield of pulp from bagasse range from 61-66%. Increased pressure and higher temperature of cooking give reduced yields, but the advantages are that pulps contain less lignin and so bleach requirements are less.

Biswas[7] has suggested that agricultural residues should preferably be pulped, bleached and beaten separately and then mixed with pulp produced from conventional raw materials such as conifers, Bamboo and hardwoods.

Mishra[11], has emphasized that modified processes and machines would be required for agricultural residues. By way of example he has pointed out that jute sticks require specially designed stock preparation and paper making equipments. The bulky nature of agricultural residues proves uneconomical in batch digester system of pulping. These materials can be best cooked in continuous digesters.

Tapadar[4] has drawn attention to the commendable break through in the recovery of chemicals, according to which small or medium sized paper mills can now use Bamboo, wood and agricultural residues without losing the chemicals in washing out the spent liquor after the pulping operation. According to him loc. cit. a continuous digester capable of pulping 25 tonnes of agricultural residues is in an advanced stage of development.

Aggrawala[12], has made a forceful plea for the use of agricultural residues in the pulp and paper industry. He has, however, suggested that for using these fibres, there would be a need for some blending pulp of better quality from primary materials to be mixed with pulps obtained

from secondary fibres and setting up of some big sized mother pulp mills, each of capacity of 100,000 tonnes per year is necessary. One such mother pulp mill may give 400,000 tonnes of paper annually with secondary fibres from agricultural residues and waste paper, etc. Besides, the setting up of such mother pulp mills will give a fillip to the installation of 25/30 tonnes per day paper plants all over the country.

Westoby[13], has stated that it would be wrong to contend that there would be no scope for small scale operations in mills of 5-20 tonnes per day-capacity. Even in the industrialized countries, small mills often comprise 80% of the total number, though accounting only for 10-25% of the total output of paper and board. These include mills making speciality papers, such as cigarette, electrical and currency papers, etc. which are almost universally produced in small units. But they include many more mills (usually non-integrated mills) making straw board, tissues and other grades of paper and board for local consumption.

Assessment of Potential Agricultural Residues in Madhya Pradesh

No systematic study seems to have been done so far to estimate the potential of agricultural residues for paper and board manufacture. In this paper, therefore, an attempt has been made to utilize available agricultural data, and some of the prevalent norms of straw yields, etc, to work out the total potential of agrricultural residues.

The endeavour in this paper is only to develop a methodology for obtaining reasonably dependable estimates for broad sectoral planning purposes. This would be far better than having no estimates or applying adhoc or thumb rule factors. Once some merit is seen in this methodology, then efforts could be made to improve survey techniques,and to raise the precision of data on the basis of well-designed investigations and research.

A map of Madhya Pradesh has been appended with this study. It shows a broad regional distribution of area under different agricultural crops.

A statement of area distribution has also been appended. Some of the relevant informations pertaining to areas and yields is given below.—

It would be seen that the production in Madhya Pradesh of rice, wheat and maize is 8-9%, of Jawar 23-50%, of linseed 37% of cotton 6.18% and of Mesta 2.7 % of the total production in India.

Grain and Fodder Ratios :

These ratios which have been collected from books on agricultural statistics, and through discussions with agricultural experts are given below.

Wheat local	1:2	(Grain to Fodder)
Paddy local	1:2	—do—
Paddy high yielding Variety	1:1.5	—do—
Wheat high yielding Variety	1:1.5	—do—
Maize	1:2	—do—
Jawar	1:4	—do—
Bajra	1:3	—do—
Arhar	1:1	—do—

Estimation of Annual Potential of Agricultural Residues :

Applying the ratios of grain to

Agricultural Statistics For Madhya Pradesh

Item	Area in 000 Hect.	Production in 000 tonnes	Production per hect.	Percentage of all India production.
Rice	4578	3082	730 Kg.	8.03
Jowar	2227	1514	778 ,,	23.50
Bajra	224	128	633 ,,	3.37
Maize	624	579	984 ,,	9.33
Wheat	3277	2369	700 ,,	9.54
Mesta	17	24	—	2.07
Cotton	684	—	—	6.18
Sunn hemp	18	44	—	—
Sugarcane	59	143	2621 Kg.	1.13
Linseed	665	—	—	37.36

fodder, it should be possible to work out the total annual potential of pulpable agricultural residues. The calculations are shown below :

Paddy straw :

Actual production of rice in the State is nearly 3.1 million tonnes. Taking a ratio of 1:2, the potential of paddy straw would be 6.2 million tonnes, which in round figures could be taken as 6 million tonnes.

Wheat straw :

Actual production of wheat in the State is nearly 2.4 million tonnes. Taking a ratio of 1 : 2, the potential of wheat straw would be 4.8 million tonnes, which in round figures could be taken as 5 million tonnes.

Maize.

The production of maize in the State is nearly 6 million tonnes. Taking a ratio of 1 : 2, the potential of fodder would be 1.2 million tonns, which in round figures could be taken as 1 million tonnes. If pith content is taken as 33%, then the potential of maize fibre would be 0.7 million tonnes.

Jowar

The production of jowar in the State is nearly 1.5 million tonnes. Taking the ratio as 1 : 4, the potential of jowar fodder would be 6 millions tonnes. Taking the pith content as 33%, then the fibre content would be 4 million tonnes.

Total potential of paddy and wheat Straw, Maize and Jowar fibre :

Adding up the above figures, the total annual potential of straw and fibre of the above products comes to 13.7 million tonnes. Bajra has been left out, as its contribution would be negligible.

Allowance for animal feed :

The cattle population of the state consist mainly of

Cows	26 million	(in round figures)
Buffaloes	6 ,,	—do—

(one buffaloe to be taken as equal to 2 cows), beside bulls and bullocks.

The requirement of fodder for these animals on the assumption that 2/3 animal population is fed on grass in forests, and villages, and that the annual requirement of fodder per animal for the remaining 1/3rd would be 1 tonne, comes to 12 million tonnes.

Thus there would be a surplus potential of 15.7–12=3.7 million tonnes.

Other Agricultural Risdues :

The area under some other agricultural crops is:—

Mesta	17,000	hectares
Cotton	684,000	,,
Sunn hemp	18,000	,,
Linseed	665,000	,,
Total :	1, 384,000	,,

Even taking a modest figure of one tonne of agricultural residues per hectare from these crops, the potential of pulpable material from these crops comes to nearly 1.4 million tonnes.

Gross Potential And Allowance For Economic Availability :

The gross annual available potential of all agricultural residues after allowing for cattle feed comes to 3.5 + 1.4=5.1 million tonnes.

Even assuming that due to uneconomic leads, etc. only 20% of the above potential would be available for utilisation in mini paper units, the safe available annual potential could be taken as one million tonnes.

Taking a liberal factor of 3 tonnes of agricultural reisdues per tonne of paper, it would be seen that an annual production capacity of 330,000 tonnes of paper and board could safely be sustained from agricultural residues.

Economics Of Mini Units And Their Place In the National Economy

By sheer numbers, the mini paper units are today stronger than the larger integrated paper mills. There are 45 small paper mills on the list of D. G. T. D. as against 19 large integrated mills. The existing small mills have an annual capacity of about 150,000 tonnes which is roughly about 15 per cent of the total installed capacity for paper and boards.

These days there is an acute shortage of capital for investment in new ventures. In spite of the large number of letters of intent issued, there has been an extremely tardy progress in the establishment of new units. In fact, one could notice a state of

stagnation in the industry, where production, instead of catching up with the demand situation is becoming less than that of previous years. This would not bode well for the future, and the stalemate needs to be remedied urgently.

One way of correcting the situation would be to encourage the setting up of a large number of mini paper and board units. As for investments,a mini paper unit would on an average, require an outlay of Rs. 3,000 per annual tonne of finished product, whereas for a large integrated unit the corresponding figure would be nearly Rs. 10,000--12000. The investment on a mini board unit would be Rs. 1500 per annual tonne of finished product.

The scale of investment has an important bearing on the determination of the factor of outlay for the creation of a unit job in the factory or in the field for collection of raw material. For instance in a large integrated paper and pulp mill the investment per factory worker is of the order of Rs. 350,000 whereas in a mini paper mill it will be Rs. 50,000. This gives a ratio of 7 to 1, and purely from the point of view of generation of employment opporties, the mini paper units would have a distinct advantage over large integrated units. A similar ratio would obtain in the case of generation of employment in the field for collection of raw material.

The above would be only one aspect in the complex process of taking investment decisions. The other factors, such as economy of scale would also have to be taken into consideration. All in all,it could be said that mini units could at best be taken on a complementary role in respect of large capacity units. They can not, and should not completely displace large units.

Mini units are of considerable socio-economic importance as they would secure the social objectives of prevention of concentration of ownership, and dispersal of industry leading to a situation of balanced regional development, and creation of employment opportunities. Besides, they may be the answer to the problem and difficulty of large capital availability for investment.

Mini units have the additional advantage of being within the reach of a large number of entrepreneurs, whereas large paper mills, by and large, have to remain restricted to a few large houses or the public sector.

Another strong point in favour of mini units is regarding the use of raw materials. These mills could be set up in many parts of the country since they will be essentially based on agricultural residues and waste paper. The use of waste paper could lead to a better recycling of paper. Surely, it should be possible to have a utilisation of at least 250,000 tonnes of waste paper, amounting nearly 20 percent of the projected production capacity in 1988-89 for paper and paper board etc.

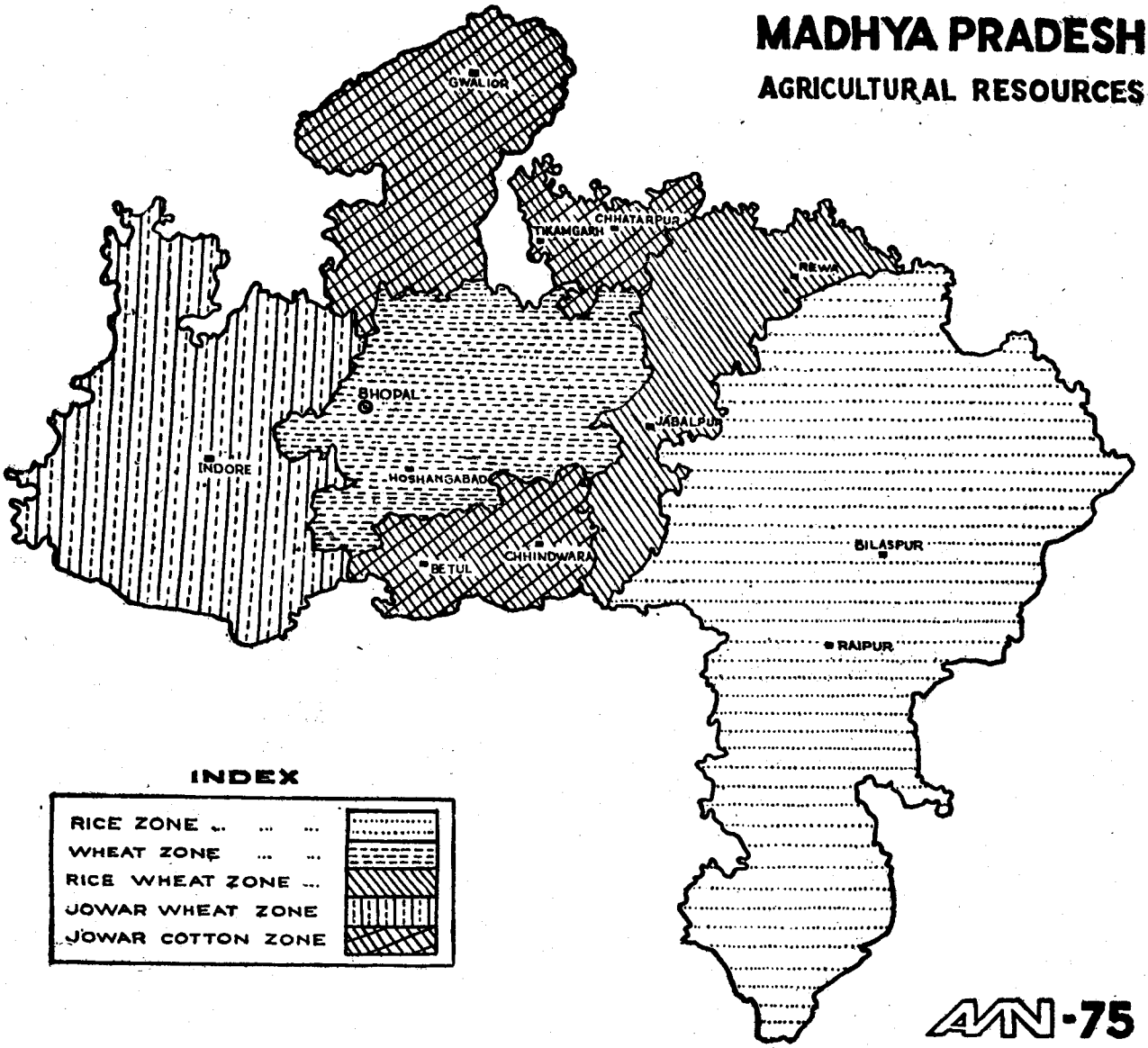
It would require little imagination to realize the contribution of mini units to the agrarian economy, by giving value to agricultural residues. To give an example, wheat straw for paper manufacture is selling at Rs. 12-20 per quintal. This would mean that a sizable income could accrue to farmers from the sale of this commodity.

To sum up,small scale operations have the following favourable aspects :

Utilisation of local fibrous raw material and reduced transportation charges, local sale with low distribution costs and ready adjustment to local market conditions, adaptation to limited water supply, fewer technical personnel and skilled labour needs; relatively small capital requirements, use of locally made machinery, geographical dispersal of employment opportunities, and maintenance of quality in spite of the small scale operations.

Conclusion

(i) There is at present an excellent climate for the establishment of mini paper and board units based on agricultural residues in Madhya Pradesh and for the whole country this will lead to economic value to agricultural residues, to enrich the rural economy and the agricultural sector will be an important source of raw material for the pulp, paper and newsprint industry, and will, to some extent relieve the forestry sector of the sole responsibility of supplying the raw material to the industry.


MADHYA PRADESH
AGRICULTURAL RESOURCES
GWALIOR
CHHATARPUR
TIKAMGARH
REWA
BHOPAL
JABALPUR
INDORE
HOSHANGABAD
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RAIPUR
INDEX
RICE ZONE
WHEAT ZONE
RICE WHEAT ZONE
JOWAR WHEAT ZONE
JOWAR COTTON ZONE
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Statement of area under different agricultural crops in Madhya Pradesh

District	Geographical area ooo ha.	Area under paddy ooo ha.	Area under wheat ooo ha.	Area under jowar ooo ha.	Area under Maize ooo ha.	Area under Bajra ooo ha.	Area under linseed ooo ha.	Area under sugar-cane ooo ha.	Area under cotton ooo ha.
1	2	3	4	5	6	7	8	9	10
Raipur	2123	762	11	1	1	—	63	1	—
Durg	1035	341	21	–	–	—	50	–	—
Rajnandgaon	911	240	19	–	3	—	62	–	—
Bastar	3918	443	3	6	27	—	5	1	—
Bilaspur	1972	636	28	2	11	—	48	2	—
Rajgarh	1297	345	4	–	9	—	—	2	—
Surguja	2199	294	10	5	37	—	4	1	1
Jabalpur	1012	130	160	18	7	—	19	1	—
Balaghat	922	223	15	1	4	—	36	4	—
Chhindwara	1185	21	65	88	18	—	1	3	9
Narsinhpur	513	16	42	23	—	1	2	1	—
Saoni	871	87	79	15	7	—	18	1	—
Mandla	1326	122	64	1	25	—	8	1	—
Sagar	1023	16	273	27	4	—	12	–	—
Damoh	729	50	123	18	2	—	17	–	—
Tikamgarh	503	29	72	36	1	—	2	1	—
Chatarpur	863	19	90	30	–	—	7	1	—
Panna	703	52	64	9	2	—	28	–	—
Rewa	629	100	109	19	1	2	45	–	—
Sidhi	1039	77	29	9	23	—	16	–	—
Satha	742	79	139	13	1	—	41	–	—
Shahdol	1386	199	46	7	24	—	15	–	—
Gwalior	522	20	78	36	–	3	6	4	—
Shivpuri	1017	12	90	63	24	4	8	3	—
Guna	1098	3	159	154	28	—	17	1	—
Datia	204	1	46	20	1	2	5	–	—
Morona	1169	4	89	36	–	80	7	2	—
Bhind	445	16	71	24	–	44	2	–	—
Indore	383	1	64	53	7	—	10	4	7
Ratlam	487	7	37	65	33	6	2	3	37
Ujjian	607	1	64	163	13	3	8	2	55
Mandsaur	1015	4	47	177	59	3	6	2	17
Dhar	821	31	76	84	51	10	11	1	57
Dewas	722	13	52	106	7	1	7	3	54
Jhabua	679	17	4	33	76	12	—	—	29
Khargone	134	30	33	184	29	48	1	1	124
Khandwa	1069	20	24	120	2	3	1	1	134
Bhopal	272	1	55	24	4	—	2	1	—
Sehore	622	6	115	63	4	—	11	4	115
Raisen	849	6	160	13	2	—	14	—	—
Vidisha	730	1	236	49	8	—	21	1	—
Betul	1008	30	61	85	15	—	1	3	3
Rajgarh	613	10	42	157	27	—	—	2	44
Shajapur	618	7	56	136	16	1	1	2	67
Hoshangabad	998	12	142	41	2	—	25	—	32
Non recorded	—	63	7	13	9	1	—	—	6
M. P. State	44.237	4578	3277	2227	624	224	665	59	684

Source : 'Agricultural Statistics', 1973 issued by Director of Agriculture, Madhya Pradesh
Note : Area figures by districts have been rounded and consequently the column totals need not be the same as given at the bottom.

If the rising cost of Bamboo is any index of the problems being faced by the industry, it would only point to the need for developing alternative raw material resources.

(ii) The recent decision of Government of India to permit the import of machinery for paper units upto a capacity of 30 tonnes per day would act as a fillip for the growth of mini units. This will enable entrepreneurs to obtain machinery at reasonably cheap prices, and above all, in a short time.

(iii) The machinery manufacturers in the country should also gear up their efforts and activities to cope with the rising demands. They should be able to cut down drastically the delivery schedules and scale down the high prices at present charged.

(iv) The financial institutions, both national and State level, such as Industrial Development Bank, Industrial Finance Corporation and ICICI, and State Financial Corporation and State Industrial Development Corporation should take stock of the situation and strengthen their organizations for rendering technical guidance and financial assistance to prospective entrepreneurs. The paper industry is now classified as a priority industry, and financial assistance for the setting up of mini paper units will be forthcoming from financial institutions.

(v) Even after allowing for the fodder requirments of the cattle population, and also for uneconomic loads, etc., the agricultural sector in Madhya Pradesh could safely provide enough raw material to sustain an annual production of 330,000 tonnes of paper and board. When this is added to the potential of 800,000 tonnes of pulp, paper and newsprint from the forestry sector, the total figure comes to 1.13 million tonnes, or 30 % of the projected production figures for the country for 1988-89. Thus, the State of Madhya Pradesh could assume a leading position in meeting the growing needs of the country for paper and board.

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