The International Network for Bamboo and Rattan (INBAR) is an intergovernmental organization established in 1997 by Treaty. As of March 1998, INBAR's Establishment Agreement had been signed by 11 countries (Bangladesh, Canada, China, India Indonesia, Malaysia, Myanmar, Nepal, Peru, the Philippines and Tanzania).INBAR's mission is to improve the social, economic and environmental benefits of bamboo and rattan. INBAR supports and coordinates core programs in scientific research and technology generation, and sustainable development programs providing bamboo and rattan solutions for people and the environment. INBAR Programs link partners from the government, nongovernment, academic and corporate sectors with knowledge and technologies that directly improve the well-being of people in developing and developed countries.

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Natural Forest-based Bamboo Production-to-Consumption System: a Case Study from Central India

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FOREWORD

Bamboo is an extremely important resource in India. There are about 125 indigenous and exotic species growing in the country over an area of more than 10 million hectares – about 13% of the total forest area. For millions of people in the country, particularly in its rural areas, bamboo is a material that features ubiquitously in their daily lives. It is used in building shelters (houses, sheds, lean-tos), for storage and transportation (baskets, containers, bullock-carts, rafts), in subsistence activities (crafts, agriculture, fishing, hunting), and to earn extra cash income for tiding over times of need.

Despite its extensive use, bamboo in India is still a commodity that is harvested free from forests or homesteads. The concept of planting bamboo as a crop is yet to seep into the minds of the people. Consequently, large-scale, degenerative exploitation of this resource continues unabated. Those who make a living from bamboo is finding it harder each day to obtain the necessary raw material. Central India presents an example of this alarming trend.

In view of the importance of bamboo to Central India in aiding subsistence and improving livelihoods, INBAR commissioned two studies on this region under its Socio-economics and Policy Program. One of this, The Status of Bamboo and Bamboo Craft in Karjat, has already been published. This report provides a more general picture of the region, with emphasis on Madhya Pradesh, a major bamboo-growing state of India. We hope that this Working Paper, which looks at a production-to-consumption system that is based largely on natural forests, will contribute to improve our understanding of the socio-economics of bamboo.

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1 INTRODUCTION

Background

Bamboo plays an important role in India's culture and heritage, use of land resources and rural economy. There are 125 indigenous and exotic species of bamboo, consisting mainly of *Dendrocalamus strictus* and *Bambusa bambos,* falling under 23 genera in an area of lo.03 million hectares. This constitutes around 12.8% of the total area of forest cover in the country. Bamboo forms a major constituent of the deciduous and evergreen forests and spreads from tropical to temperate regions up to 4 000 m above sea level, except in Kashmir valley. Best of the bamboos are found in areas that have a temperature of 8-389°C, a minimum annual rainfall of 1 000 mm and a high atmospheric humidity. The annual production of bamboo in India is 3.2 million tons against the potential availability of about 4.6 million tons (Tewari 1992), with an average production of 0.33 ton per hectare. The yield varies considerably, depending upon the intensity of stocking and biotic interference, from 0.2 to 4 tons per hectare (Anonymous 1994). The yield is low when compared with some other Asian countries (for instance, China with 1.25 t/ha/y and Japan with 2.41 t/ha/y).

Importance of bamboo in India can be gauged from the fact that it is often referred to as the "poor man's timber", "green gold", "the cradle-to-coffin timber", etc. Because of its many uses – such as for agricultural implements, handicrafts and house construction, as food, fodder and medicine, and in small and large-scale industries – bamboo is in great demand throughout the country.

In the natural forest-based system, such as in Madhya Pradesh, bamboo is extracted in four-year cycles by the Forest Department, and collected and distributed through a chain of depots. The rates are fixed every year, depending on the costs incurred in extraction, transportation and handling, and the length and diameter of bamboo. The users have to register themselves with the Forest Department, by giving a nominal fee, for their bamboo requirements. At present, bamboo craft workers *(basodsf)* get up to 1 500 bamboo culms annually from Basod depots at the rate of Rs 60-260 per 100 culms. Bamboo is supplied to agricultural labourers and artisans from *Nistar* depots at the rate of Rs 120-226 per 100 culms. Each family is entitled for 250 bamboo culms. Consumer depots are meant to meet the requirements of betel vine growers *(pan-barejas),* fruit producers and incense stick *(agarbatti)* manufacturers. The rates chargeable from betel vine growers vary from Rs 230 to 235 per 100 culms. Fruit producers and incense stick manufacturers have to pay Rs 115 per 100 culms. Other consumers get bamboo from consumer depots at the rate of Rs 440-765 per 100 culms, depending on length. Each depot caters to the requirement of a selected number of nearby villagers. In some areas, where production is more than demand from local people, lease is given in favour of the paper pulp industry. Generally, the following categories of people are the beneficiaries of the natural bamboo forest-based production system:

1. Bamboo craft workers and artisans;
2. Betel vine cultivators;
3. Agriculturists;
4. Tribal people and forest dwellers;

5. Bamboo-based small-scale industries; and
6. Large-scale industries.

Bamboo craft workers are wholly dependent on bamboo for their livelihood. They are mostly landless and are in this trade since generations. They manufacture artifacts such as baskets, winnowing trays, mats, window blinds and small containers, and sell them in weekly markets in the villages or in adjoining townships.

Betel vine cultivators cultivate betel vines in specially made bamboo mat enclosures provided with interspersed long bamboo stakes for supporting the betel vine. In India, betel leaves are in great demand for paan chewing, a popular custom among a majority of the population.

In rural areas, the farmers use bamboo for scaffolding in house construction, fencing of farms and house compounds, and for stakes to support agricultural and plantation crops. Processed bamboo is a core component in many items of daily use in rural households – such as much (an improvised grain carrier that can be fitted on to a bullock cart), tatta (screen partition), jbadu (broomstick), supa (winnowing tray), parle (a decorative basket for carrying gift items in marriages), pankha (small fans), baskets for transporting grains, tree-guards, handles for agricultural and household implements, farm tools, utensils, etc.

In rural cottage industries, the main use is in making incense sticks, musical items like flutes, sports goods, walking sticks, toothpicks and match splints. There is great commercial potential in making value-added decorative items – such as furniture, lamp shades, bookshelves, toys and door mats – that have considerable market demand.

Paper and rayon grade pulp is manufactured by large-scale mills that use bamboo as the most important raw material.

In India, rural artisans face difficulty in obtaining sufficient and high-quality raw material at affordable rates. Of the estimated 3.2 million tons of bamboo harvested each year, as much as one-third is used by craft workers and bamboo-based industries. Yet, production, supply, processing and marketing systems are often constrained by lack of systematic organization, leading to low-quality goods and low returns. Experience has shown that conflicts often occur over the scarce resource in forests. This hinders the flow of raw material on a continuous basis and affects the regular employment and income of the communities engaged in bamboo-based occupation. Bamboo craft workers need greenbamboos for making high-quality articles. But unfortunately, the time gap between harvest and supply is so much that the bamboo received is often dry and that too not in the required quantity. Many times, the craft workers indulge in illegal felling or purchase bamboo at higher prices from collectors, who also extract bamboo from forests illicitly. Unsustainable harvest practices resulting from inadequate supply of raw material damage the growing bamboo stock.

Bamboo craft workers, other artisans and even the persons engaged in bamboo-based small-scale industries are not properly trained in manufacturing high-quality, high-value, finished products

Bamboo craftspeople and villagers are unable to expand their activities owing to monetary constraints since financial support from organizations like banks or other lending agencies are often not available on demand.

Although bamboo has immense potential in alleviating poverty by providing employment opportunities and additional income to people, the resource is not properly managed and used. Bamboo forests provide three types of employment – direct employment, self-employment and secondary employment through forest-based industries. It has bean estimated that 1 ha of bamboo forest with 500 clumps generates 384 workdays of unskilled labour and 47 workdays of skilled labour over a period of 30 years. In addition to direct employment, self-employment is generated in the form of transporting bamboo as head loads, grazing of cattle in bamboo forests, lopping for fodder, thatching, scaffolding, etc., and in bamboo-based cottage industries involved in basket making, mat weaving, tooth pick manufacture, incense stick manufacture, etc.

The present infrastructure with respect to secondary employment in the industry for bamboo processing, storage and manufacture of value-added products is inadequate in many respects and highly disorganized. There is urgent need for streamlining the production and marketing infrastructure for finished products that fetch lucrative prices, as well as for finding more prospective markets. At the same time, skills of present workforce have to be upgraded to make improved value-added finished products with better market potential.

Unless a sound technology base, an adequate marketing system and a responsive institutional framework are developed, any commercialization program of bamboo among the rural populace cannot be expected to succeed.

Objectives

So far, there is no knowledge of any socio-economic study carried out in the sector with a target group or a particular production-to-consumption system in focus. This case study was, therefore, initiated with the objectives mentioned below.

General objectives

1. Identify opportunities for developmental interventions in the bamboo sector in central India; and
2. Provide an empirical basis for the development of a conceptual model of bamboo production-to-consumption system.

Specific objectives

1. Describe the bamboo production-to-consumption system taking into consideration the flow of material and its cost/price, and to identify major stakeholders in the system and their interests and conflicts.
2. Identify groups within the system as potential targets for development interventions based on: poverty; the number of people involved (with gender analysis); degree of importance of bamboo to the group; importance of bamboo and bamboo crafts, particularly to the disadvantaged groups (women and children); importance of bamboo for bamboo craft workers (basods) and other poor communities; and other parameters.

3. Describe the decision-making environment of the target groups in terms of knowledge, resources and incentives, and examine relevant policies and issues such as credit facilities and land tenure.
4. Identify opportunities for change -within the system that would lead to sustainable development within the target groups. This includes:
   a. Description of the proposed system and changes required; and
   b. Identification of social, technical, economical, political and environmental constraints, and identification of appropriate interventions to overcome these constraints.
5. Recommend a course of action for INBAR client groups, namely:
   a. poor and disadvantaged people involved in the bamboo sector;
   b. donors and multilateral development banks;
   c. NGOs and community-based development groups;
   d. the government;
   e. researchers; and
   f. the private sector, including foreign investors.

This research project on the analysis of a natural forest-based bamboo production-to-consumption system was initiated in June 199 5 around three villages – Chhatarpur and Dumna in Jabalpur district and Bamhani in Mandla district – situated in the vicinity of bamboo-dominated forests.

Methodology

Areas around Chhatarpur, Dumna and Bamhani villages was selected for the study because of the occurrence of long stretches of natural bamboo forests in their immediate vicinity. Thus, the study involved all households in three clusters/blocks, each with five villages (Table 1). The study examined various aspects such as the collection and utilization of bamboo, socio-economic status of bamboo workers, infrastructure and facilities available, demographic information, land use pattern, and marketing system. For the purpose of this study, the dwellers in these villages were categorized as bamboo craft workers, betel vine cultivators, agriculturists and labourers.

Table 1: Names of villages in the blocks/clusters studied

Chhatarpur block	Dumna block	Bamhani block
1. Dharampura	I.Dumna*	1. Bamhani
2. Deonagar	2. Amanala*	2. Kamta *
3. Deori	3. Sundarpur*	3. Kapotbahra*
4. Khajri	4. Umaria*	4. Tilai*
5. Badkheri*	5. Piparia *	5. Chhapri*

Note: + villages close to bamboo forest.

The study of these villages was done with the help of semi-structured questionnaires covering socio-economic aspects, participatory rural appraisal (PRA) and rapid rural appraisal (RRA) methods, and door-to-door survey. The data thus collected were tabulated and interpreted. In addition to above, a vegetation survey was also conducted in bamboo-dominated forests around Chhatarpur, Dumna and Bamhani. Density, frequency and abundance of bamboo and tree species were calculated as per the method suggested by Mishra (1389).

The study area comprising two blocks lying in Jabalpur district – Chhatarpur and Dumna – is about 15-45 km from Jabalpur City in the North-East direction (Fig. 1). The annual rainfall in the area is 1 358 m and the mean annual temperature is 24.98'C (Totey and Gupta 1993). The third block, Bamhani, is about 150 km from Jabalpur City towards east and lies in Mandla district (Fig. 1); about 40-50 km south of Mandla township near the Kanha National Park. Annual precipitation in averages 1 302 mm and the mean annual temperature is 24.36'C.

Fig. 1: The state of Madhya Pradesh (Districts, under which the study areas, are shaded)

All villages in Dumna and Bamhani blocks, except Bamhani town, are close to bamboo forest. However, in Chhatarpur block only Badkheri village is close to the forest (Table 1). Approximate distances of surveyed villages in the three blocks from bamboo depots are presented in Table 2.

Table 2: Approximate distances of surveyed villages from bamboo depots

Village	Block	Nearest depot	Distance from depot
Deonagar	Chhatarpur	Budagarh	3km
Dharampura	Chhatarpur	Budagarh	8km
Khajri	Chhatarpur	Budagarh	12 km
Deori	Chhatarpur	Panagar	2 km
Badkheri	Chhatarpur	Budagarh	10 km
Dumna	Dumna	Panagar	18 km
Amanala	Dumna	Panagar	15 km
Sundarpur	Dumna	Panagar	13 km
Umaria	Dumna	Panagar	15 km
Piparia	Dumna	Panagar	10 km
Bamhani	Bamhani	Bamhani	2km
Kamta	Bamhani	Bamhani	8km
Kapotbahra	Bamhani	Bamhani	12 km
Tilai	Bamhani	Bamhani	10 km
Chhapri	Bamhani	Bamhani	12 km

Geographical area

Table 3 gives information on the total geographical area of the villages in the three blocks. Out of three blocks, Bamhani block covers maximum area (2 363.08 ha), Chhatarpur block the minimum (1379.80 ha) and Dumna block falls in between (1747.90 ha). [Nere ater the term "block" will be used only when there is a need to distinguish a village and a block of the same name- for example, Dumna village and Dumna block.

Table 3: Geographical area of the villages studied

Chhatarpur block		Dumna block		Bamhani block	
Village	Area (ha)	Village	Area (ha).	Village	Area (ha)
Deonagar	301.52	Dumna	319.00	Bamhani	87.73
Dharampura	209.07	Amanala	222.29	Kamta	232.10
Deori	460.82	Sundarpur	450.02	Kapotbahra	196.50
Khajri	223.19	Umaria	339.60	Tilai	523.75
Badkheri	185.20	Piparia	416.99	Chhapri	533.00

Source: National Information Centre, Madhya Pradesh State Unit, Jabalpur and Mandla.

2 GENERAL STATUS OF VILLAGE RESIDENTS

Population and literacy

Socio-economic survey of the villages of Chhatarpur and Dumna involved a total of 961 and 1 329 households covering a population of 5 599 and 6 839, respectively. On an average there are 192.2 households and 1 119.8 persons (Table 4) per village in Chhatarpur and 265.8 households and 1 367.8 persons (Table 4) per village in Dumna. Population in the two blocks is about 53% male and 46% female.

Table 4: Demographic features of the study areas

Village	House-holds	Population			Literacy			Illite-rates	Female-male ratio (females/ 1000 males)
		Male	Female	Total	Male	Female	Total		
CHWTARPUR BLOCK									
Dharampura	147	482	415	8 9 7	308	143	451	446	861
Deonagar	212	672	516	1188	4 3 4	193	627	561	768
Deori	324	961	854	1 815	689	476	1 165	650	888
Khajri	117	436	360	796	234	151	385	411	825
Badkheri	161	472	431	903	264	108	372	529	912
Total	961	3 023	2 576	5599	1929	1 071	3000	2 599	852
Average	192.2	604.7	515.2	1 119.8	385.8	214.2	600'0	519.8	851
		(54%)	(46%)	(100%)			(53.6%)	(46.4%)	
DUMNA BLOCK									
Dumna	44	118	98	216	55	18	73	143	830
Amanala	57	139	102	241	78	5 3	131	130	734
Sundarpur	313	1 029	962	1991	593	322	915	1076	935
Umaria	192	655	519	1 174	433	268	701	473	792
Piparia	723	1 691	1 526	3 217	1 017	810	1 827	1390	902
Total	1 329	3 632	3 207	6 839	2 176	1 471	3 647	3 192	883
Average	265.8	726.4	641.4	1 367.8	435.2	294.2	729.4	638.4	839
		(53.1%)	(46.9%)	(100%)			(53.3%)	(46.7%)	
BAMHANI BLOCK									
Bamhani	1596	4 619	4368	8 987	3499	2 497	5996,	2991	946
Kamta	48	155	163	318	73	58	131	187	1 051
Kapotbahra	37	105	98	203	56	37	93	110	934
Tilai	302	858	842	1 700	454	310	764	936	981
Chhapri	97	304	294	598	113	65	178	4 2 0	967
Total	2 080	6 041	5 765	11 806	4 195	2967	7 162	4644	954
Average	416.0	1 208.2	1 153.0	2 361.2	839.0	593.4	1 432.4	928.8	976
		(51.2%)	(48.8%)	(100%)			(60.7%)	(39.3%)	

Demographic features of Bamhani are a little different. As can be seen in Table 4, Bamhani is highly populated with much more households than other two blocks. The five villages of Bamhani consist of a total 2 080 households with a population of 11806. On an average, there are 416 households and 2 361.2 persons per village. The population consists of about 51% male and 49% female.

As can be seen from Table 4, there is 53.58% literacy in Chhatarpur, 53.32% in Dumna and 60.66% in Bamhani. The overall literacy in Bamhani block is higher because of the extremely high literacy (66.72%) in Bamhani town, which is more influenced by urban activities. Otherwise it is very low, being a tribal area, varying from 29.77% to 45.81% (an average of 41.36%). Literacy was higher among adult males in all three blocks: 73.16%, 66.01% and 71.33% in Chhatarpur, Dumna and Bamhani, respectively. But among children less than 12 years old, literacy data for the three blocks vary widely. In Chhatarpur, literacy was far more in female (52.7%) than in male children (38.6%), while in Dumna both male and female children had more or less similar levels of literacy (about 45.7%). But in Bamhani, literacy was more in male (64.2%) than in female children (48.5%)..

Live stock population

Live stock is an indication of prosperity of a village and Table 5 reveals Bamhani block to be better verage live stock population in Bamhani is 533.8, compared with 338.0 in Dumna and 286.8 in Chhatarpur. Cows dominate livestock in all villages studied, followed by bullocks.

Table 5: Livestock population in the study area

Village	Number of livestock					
	Cows	Buffaloes	Goats	Bullocks	Poultry	Total
CHHATARPUR						
Dharampura	123	23	26	52	29	253
Deonagar	149	19	29	79	13	289
Deori	68	57	21	83	34	263
Khairi	199	32	69	110	35	445
Badkheri	81	33	17	45	8	184
Total	620	164	162	369	119	1 434
Average	124.0	32.8	32.4	73.8	23.8	286.8
DUMNA						
Dumna	39	11	17	19	0	86
Amanala	83	62	13	39	0	197
Sundarpur	265	124	61	85	0	535
Umaria	117	44	29	53	12	255

Village	Number of livestock					
	Cows	Buffaloes	Goats	Bullocks	Poultry	Total
Piparia	274	132	73	91	47	617
Total	778	373	193	287	59	1690
Average	155.6	74.6	38 .6	57.4	11.8	338.0
BAMHANI						
Bamhani	456	228	280	292	29	1 285
Kamta	44	21	6	50	5	126
Kapotbahra	131	70	7	37	2	247
Tilai	239	135	94	I98	32	698
Chhapri	107	39	9	132	26	313
Total	977	493	396	709	94	2669
Average	195.4	986 .	79.2	141.8	18.8	533.8

Occupation pattern

Table 6 presents the occupation pattern in the study area. In Chhatarpur and Dumna, 28.3% and 18.4% of the households consist of farmers and 33.5% and 50.3% consist of labourers, respectively. In Bamhani, the percentages of farmers and labourers are 32.6 and 50.1, respectively. In other words, in Dumna and Bamhani, half the population is labourers while in Chhatarpur it is one-third. The number of craft workers in Dumna is a little less than double that in Bamhani, but half that of Chhatarpur (4.7% of households in Chhatarpur, 2.3% in Dumna and 1.5% in Bamhani). Less than 10% of households are engaged in business – 8.9% families in Chhatarpur, 9.8% in Dumna and 7.2% in Bamhani.

Out of the 15 villages, only three (Dharampura, Deonagar and Bamhani) have cultivation of betel vines. On an average, 33% families in Dharampura are involved in the activity (it is interesting to note that there is no craft worker family in this village). In Bamhani village, betel vine cultivation is almost negligible, with only 0.14% of the families engaged in this activity.

Table 6: Occupation pattern of families in the study area

Village	Farming	Labour	Service	Craft	Bidi* making	Business	Betel vine growing	Others**	Total
CHHATARPUR									
Dharampura	37	24	13	0	11	3	52	7	147
Deonagar	49	87	9	4	29	23	0	1	212
Deori	81	123	41	14	17	45	0	3	324

Village	Farming	Labour	Service	Craft	Bidi making	Business	Betel vine growing	Others*	Total
Khajri	41	19	10	26	7	12	0	2	117
Badkheri	54	69	16	1	13	3	0	5	161
Total	272	322	89	45	77	86	52	18	961
Percentage	28.3	33.5	92	47	81	89	54	19	100
Average	54.4	64.4	17.8	90	15.4	17.2	10.4	36	192.2
DUMNA									
Dumna	8	19	11	2	0	2	0	2	44
Amanala	17	28	6	4	0	1	0	1	57
Sundarpur	68	171	39	6	4	17	0	8	313
Umaria	39	68	44	5	0	23	0	13	192
Piparia	112	383	91	14.	0	87	0	36	723
Total	244	669	191	31	4	130	0	60	1329
Percentage	18.4	50.3	14.4	23	0.3	98	0	45	100
Average	48.8	133.8	38.2	62	08	26.0	0	12.0	265.8
BAMHANI									
Bamhani	497	798	126	6	0	139	3	27	1596
Kamta	16	30	0	1	0	0	0	1	48
Kapotbahra	20	12	2	3	0	0	0	0	37
Tilai	113	151	11	10	0	9	0	8	302
Chhapri	27	51	4	11	0	2	0	2	97
Total	673	1042	143	31	0	150	3	38	2 080
.Percentage	32.4	50.1	69	15	0	72	0.1	1.8	100
Average	134.6	208.4	28.6	62	0	30.0	0.6	76	416.0

Notes:
l Bidiis an Indian cigarette made of tobacco rolled in dried young leaves of Diospyros mel-anoxylon .Tendu).
* Barber, washerman, etc.

Income pattern

Income pattern of villages (annual income of family heads, total income of family and per capita income of villagers) is also an indicator of prosperity and economic development of villagers. Income patterns of the villages studied have been calculated to assess the living standard of villagers (Table 7). It has been found that the total annual income from all sources in Chhatarpur is R.s 12 413 946 with a per household annual income of Rs 12 918 (961 households) and a per capita income of Rs 2 217. The average annual income per village is Rs 2 482 789 and a per capita income Rs 2 144. The highest per capita income of households in Chhatarpur block is in Deori (Rs 2 567) and the lowest in Badkheri (Rs 1 893).

Table 7: Income pattern of residents in the study area

Village	Annual income		Sources of other income			Total family income	Per capita income
	Family head	Total family	Land on lease	House rent	Live-stock		
CHHATARPUR							
Dharampura	1044 540	1961738			15768	1977506	2 205
Deonagar	1 459 166	2 527132	-	16 416	5 769	2 549 344	2 146
Deori	3 920 018	4 551247	-	24085	83 106	4 658438	2 567
Khajri	818 298	1477944		3 120	38 208	1519 272	1909
Badkheri	1 180886	1703314		1320	4752	1 709386	1893
Total	8422908	12 221375	-	44941	147 630	12413946	
Average	1684 582	2 444 275	-	8988	29 526	2482789	2 144
DUMNA							
Dumna	441956	513724	-	-	5 867	519 591	2406
Amanala	783 180	1114920		-	1440	1116 360	4 632
Sundarpur	2 642614	3906910	8943	7920	35650	3959 423	1 987
Umaria	3 016 265	4 128151	-	7560	15 360	4 151 071	3 536
Piparia	7 986 258	10385 894	25 457	89920	64 800	10 566 071	3 284
Total	14 870 273	20049599	34400	105400	123117	20312 516	
Average	2974055	'4009910	6880	21080	24 623	4 062 503	3 169
BAMHANI							
Bamhani	15 781 248	24 897 600	- 957600		820799	26675 999	2968
Kamta	299 917	503 040		960	7020	511020	1607
Kapotbahra	305 250	418400			24 120	442 520	2180
Tilai	2 561 509	3 451127	-	11400	100980	3 563 507	2096
Chhapri	579672	1136064			3504	1139568	1906
Total	19 527 596	30406 231	- 969960		956423	32332614	
Average	3905 519	6 081 246	- 193992		191 284	6466 522	2151

NOTES:

Total family = Total income of family head and other family members

Total income of family = Income of family plus income from other sources.

The total annual income from all sources in Dumna is Rs 20 312 516, with a per household annual income of Rs 15 284 (1 329 households). The average annual income per village in Dumna is Rs 4 062 503, with an average per capita income of Rs 3 169. The highest per capita income in Dumna is in Amanala (Rs 4 632) and lowest in Sundarpur (Rs 1 987).

The total annual income from all sources in Bamhani is Rs 32 332 614, with a per household annual income of Rs 15 544 (2 080 households). The average annual income per village is Rs 6 466 522, with average per capita income of Rs 2 151. The highest per capita income of villagers is in Bamhani village (Rs 2 968) and lowest in Kamta (Rs. 1 607).

Thus, it can be seen that Dumna is way ahead of Chhatarpur and Bamhani in terms of income: the per capita income in Dumna is about 47% more than the other two blocks.

Agricultural and irrigation facilities

Availability of agricultural and irrigation facilities indicates the level of modernization and development of agriculture (Table 8). The socio-economic status of the 15 villages on the basis of irrigation facilities and agricultural implements is definitely not low. The availability of ploughs and threshers is maximum in Bamhani block, while Chhatarpur block has the maximum number of tractors. Irrigation wells and pump sets are found more in Dumna than other two blocks.

Table 8: Availability of agricultural and irrigation facilities in the study area

Village	Agricultural facilities				Irrigation facilities	
	Ploughs	Barns/sheds	Tractors	Others*	Wells	Pump sets
CHHATARPUR						
Dharampura	22	19	1	0	4	2
Deonagar	41	39	1	0	10	10
Deori	71	67	3	9	7	2
Khajri	40	35	0	11	8	4
Badkheri	35	35	0	0	6	2
Total	209	195	5	20	35	20
Average	41.8	39	1	4	7	4
DUMNA						
Dumna	5	5	0	0	3	1
Amanala	17	23	1	1	5	3
Sundarpur	61	71	1	4	14	7
Umaria	22	27	0	2	9	5
Piparia	74	81	2	7	17	12
Total	179	207	4	14	48	28
Average	35.8	41.4	0.8	2.8	9.6	56
BAMHANI						
Bamhani	595	549	3	17	12	15

Village	Agricultural facilities				Irrigation facilities	
	Ploughs	Barns/sheds	Tractors	Others*	Wells	Pump sets
Kamta	32	27	0	2	2	1
Kapotbahra	13	12	0	0	1	0
Tilai	173	151	0	10	3	2
chhapri	51	48	0	3	2	0
Total	864	787	3	32	20	18
Average	172.8	157.4	0.6.	64 .	40 .	36 .

Note:* Thresher, sprinkler, etc.

Land and house distribution pattern

Land and house distribution pattern for all three blocks are presented in Table 9. Information obtained using PRA and RRA techniques indicate that the so&-economic status of people in the three blocks somewhat differ. Villages in Bamhani and Chhatarpur are better in terms of land and house distribution than those in Dumna. More than 66% households in Bamhani and 53% in Chhatarpur are iandholders while landholding families are only 28.6% in Dumna. There are more mud houses in Chhatarpur (86.2%) than Bamhani (79.2%) or Dumna (78.3%). However, the number of brick houses in Dumna area is more than in either of the other two blocks.

Table 9: Land and house distribution pattern in the study area

Village	Land-holding households	Landless households	Total cultivated area (ha)	No. of mud houses	No. of brick houses	No. of other types of houses	Total no. of houses
CHI-WTARPUR							
Dharanipura	81 (55.1)%	66 (44.%)	131.24	135 (91.8%)	7 (4.8%)	5 (3.4%)	147
Deonagar	108 (50.9%)	104 (49.1%)	218.44	192 (906%)	9 (4.2%)	11 (5.2%)	212
Deori	149 (46.0%)	175 (54.0%)	187.52	248 (76.5%)	41 (12.7%)	35 (10.896)	324
Khajri	84 (71.8%)	33 (28.2%)	156.22	101 (86.3%)	9 (7.7%)	7 (6.0%)	117
Badkheri	89 (55.3%)	72 (44.7%)	129.86	152 (94.3%)	3 (1.9%)	6 (3.8%)	161
Total	511 (53.2%)	450 (46.8%)	823.28	828 (86 2%)	69 (7.2%)	64 (6.6%)	961
Average	102.2	90.0	164.66	165.6	13.8	12.8	192.2
DUMNA							
Dumna	13 (29.6%)	31 (70.4%)	28.63	42 (95.5%)	0 (0.0%)	2 (4.5%)	44

Village	Land-holding households	Landless households	Total cultivated area (ha)	No. of mud houses	No. of brick houses	No. of other types of houses	Total no. of houses
VAmaraala	22 (38.6%)	3 5 (61.4%)	165.30	48 (84.2%)	4 (7.0%)	5 (8.8%)	5 7
Sundarpur	95 (30.4%)	218 (69.6%)	233.35	286 (91.4%)	9 mm	18 (5.7%)	313
Umaria	46 (24.0%)	146 (76.0%)	152.53	173 (90.1%)	7 (3.7%)	12 (6.2%)	192
Piparia	204 (28.2%)	519 (71.8%)	258.36	492 (68.1%)	87 (12.0%)	144 (19.9%)	723
Total	380 (28.6%)	949 (71.4%)	838.17	1041 (78.3%)	107 (8.1%)	181 (13.6%)	1 329
Average	76	189.8	167.63	208.2	21.4	36.2	265.8
BAMHANI							
Bamhani	1 041 (65.2%)	555 (34.8%)	362.97	1 187 (74.4%)	137 (8.6%)	272 (17.0%)	1 596
Kamta	3 6 (75.0%)	1 2 (25.0%)	90.89	47 (97.9%)	0 (0.0%)	1 (2.1%)	48
Kapotbahra	19 (51.4%)	18 (48.6%)	51.79	37 (100.096)	0 (0.0%)	0 (0.0%)	37
Tilai	229 (75.8%)	73 (24.2%)	307.17	284 (940%)	3 (1.0%)	15 (5.0%)	302
Chhapri	60 (61.3%)	37 (38.1%)	208.55	93 (95.9%)	1 (1.0%)	3 (3.1%)	97
Total	1 385 (66.6%)	695 (33.4%)	1 021.37	1648 (79.2%)	141 (6.8%)	291 (14.0%)	2 080
Average	277.0	139.0	204.27	329.6	28.2	58.2	416

Land use pattern

The land use pattern of the villages in the study area is presented in Table 10. The table shows the total area under Chhatarpur (1379.80 ha), Dumna (1747.90 ha) and Bamhani (2363.08 ha) with average an area of 275.96 ha, 349.58 ha and 472.62 ha, respectively, per village. Total area under cultivation in these blocks is 823.28 ha, 838.17 ha and 1 021.37 ha with per household land under cultivation 0.86 ha, 0.63 ha and 0.49 ha, respectively. Thus, Chhatarpur commands better position when area under cultivation per household is concerned. Average cultivated area under Kharif crops (crops cultivated during monsoon season) is more in Bamhani but average cultivated area under Rabi crops (crops grown during winter) is more in Dumna, which also has more irrigated area. Thirty-six percent of total village area of Bamhani and sixteen percent of total village area in both the blocks of Jabaipur region are wasteland. Bamhani village (307.36 ha) in Bamhani Block, Deori village (69.66 ha) in Chhatarpur block and Piparia village (81.66 ha) in Dumna block have maximum wastelands.

Table 10: Land use pattern of the areas studied
Area (in hectares)

Villages	Total area of village	Total cultivated area	Cultivated area under		Irrigated area under		Other village land	Waste land
			Kharif	Rabi	Kharif	Rabi		
CHHATARPUR								
Dharampura	209.07	131.24	130.83	131.66	11.36	12.25	41.08	36.75
Deonagar	301.52	218.44	205.77	231.12	42.27	65.29	28.35	54.73
Deori	460.82	187.52	173.61	191.42	24.30	28.75	203.64	69.66
Khajri	223.19	156.22	151.13	161.32	19.40	21.25	28.22	38.75
Badkheri	185.20	129.86	113.64	146.09	32.20	36.75	29.67	25.67
DUMNA								
Dumna	319.00	28.63	37.70	19.56	16.96	9.90	243.92	46.45
Amanala	222.29	165.30	142.50	188.10	28.50	19.20	18.89	38.10
Sundarpur	450.02	233.35	182.56	284.15	40.83	72.33	162.97	53.70
Umaria	339.60	152.53	102.19	202.87	48.26	84.45	129.77	57.30
Piparia	416.99	258.36	190.95	325.77	68.74	107.37	72.16	81.66
BAMHANI								
Bamhani	877.73	362.97	399.00	326.95	76.75	59.60	207.40	307.36
Kamta	232.10	90.89	90.01	91.77	10.50	10.50	86.06	57.15
Kapotbahra	196.50	51.79	67.52	36.07	--		88.75	55.96
Tilai	523.75	307.17	324.71	289.64	48.35	41.2;	70.78	145.80
Chhapri	533.00	208.55	155.20	261.90	05.50	05.50	35.50	288.95

NOTES:
Total cultivated area (Kharif area + Rabi area) + 2

Cropping pattern

Chhatarpur

The two crops rice and soybean are usually grown during Kharif season, though the major crop for all the villages is only rice. Soybean is grown only in two villages – Dharampura and Deonagar – and the average yield is 869.13 kg / ha. Rice crop shows inconsistent yields that vary from 353.64 kg / ha. in Khajri to 630.56 kg / ha in Dharampura

Total area under crops is 861.61 ha, which is 86.63 ha more than Kharif season as shown in Table 10. The major crops grown during Rabi season are wheat, gram, lentil and mustard. Vegetables like potato and tomato are also grown in these villages. Wheat and gram crops are grown in all villages and cover maximum cropped area. More than two-third of area is covered by wheat crop in Chhatarpur. Gram, the second major crop, occupies 13.30% of the total area.

Dumna

Main Kharif crops are rice and soybean. The yield of rice is very low and varies from 229 to 413.60 kg/ha. Soybean, grown in four villages out of five, cover&even times more area than in Chhatarpur. However, total area under rice in Dumna is less than that in Chhatarpur (427.26 ha against 740.03 ha).

Major Rabi crops are same as in Chhatarpur. Along with wheat and gram, the other crops grown are pulses like lentil and Arhar (Cajanus cajan). The total area under Rabi crops is 1 020.45 ha, which is 364.53 ha more than Kharif crops. Similar trend has been observed in Chhatarpur. Average yield of wheat is 591.12 kg/ha. Gram is the second largest crop.

Bamhani

Main Kharif crops are rice and vegetables, but vegetables are grown only in two villages – Bamhani and Tilai. Average yield of vegetables is 564.06 kg/ha. Rice crop yield varies from 311.12 kg/ha in Talai to 877.91 kg/ha in Bamhani.

Total area under Rabi crops is 1 006.33 ha and the major crops are wheat, kodon-kutki (lesser millets) and gram. Lentil, batari (peas) and sugar-cane are also grown in these villages. Wheat, which is grown in all villages, covers the maximum cropped area (497.38 ha). Lesser millets, the second major crop, occupy 320.44 ha of the total area.

3 KNOWLEDGE OF BAMBOO PLANTING AND PROPAGATION

Although bamboo has been of immense utility to villagers in their daily life routine, many of them are not knowledgeable about its planting and propagation. Efforts were, therefore, made to find out the level of awareness in this respect.

Knowledge of bamboo planting

The knowledge level among residents regarding bamboo planting and propagation is presented in Table 11. About 82% of the households in Chhatarpur, 69% in Dumna and 75% in Bamhani are ignorant about bamboo planting and propagation. In general, residents of Dumna are more familiar with bamboo planting and propagation techniques than the other two blocks.

Table 11: Awareness among households about bamboo planting and propagation (average percentage)

Study area	Aware of	Not aware of
Chhatarpur	18.02	81.98
Dumna	31.64	68.36
Bamhani	25.00	75.00

Interest in planting bamboo

Table 12 presents information about the level of interest in planting bamboo. Only about 14% households in Chhatarpur, 18% in Dumna and 40% in Bamhani are interested in planting bamboo on bunds (embankments) of agricultural fields. **A** survey made during PRA/RRA revealed that 81% households in Bamhani, about 70% in Chhatarpur and 30% in Dumna favour the bamboo planting on wastelands. All the households in Kapotbahra village in Bamhani favour of planting bamboo on wastelands, while 85% in Dharampura village in Chhatarpur are against it.

Table 12: Level of interest among households in planting bamboo (average percentage)

Study area	On bunds of agr. fields		On wastelands		On village commons	
	Interested	Not interested	Interested	Not interested	Interested	Not interested
Chhatarpur	13.61	86.39	29.53	70.47	22.12	77.88
Dumna	18.03	81.97	29.40	70.60	25.59	74.41
Bamhani	40.00	60.00	81.00	19.00	21.70	78.30

As far as planting bamboo on village/panchayat (common) land is concerned, all the three blocks show almost similar trend. About 78% households in Chhatarpur and Bamhani, and 75% in Dumna are against using village/panchayat land for bamboo plantation.

The main activity of the people in the study area is farming of agricultural crops: about 18-32% of the population (Table 5) is involved in this activity, assisted by a group or class of labourers who form 33-50% of the total population. The ignorance of people about bamboo plantation and propagation could be because bamboo is not an agricultural crop. About 68-82% of the households do not know about bamboo planting and propagation (Table 11). They are, however, aware of the negative aspects of bamboo, such as it spreads fast causing accumulation of litter and throwing shade, both of which reduce the yield of agricultural crops. This is probably the reason why only 13-40% of households are interested in growing bamboo on agricultural bunds, while 70-81% (Table 12) seem to be enthusiastic to plant bamboo on wastelands, which offers a new area for income generation.

About 16% of the total land in Chhatarpur and Dumna and 36% in Bamhani (Table 10) are categorized as wasteland. Only 30% people in Dumna are interested in utilizing wasteland for bamboo growing as against 70% in Chhatarpur and 81% in Bamhani. One reason for this could be the higher degree of involvement of people of Dumna in service and business – 24% as against 18% in Chhatarpur and 13% in Bamhani (Table 5). It is possible that people of this block, being closer to Jabalpur City, are anticipating the development of infrastructure for renting to outside people engaged in nearby factories and new establishments. As more number of people in Dumna (9.71%) live in rented houses than Chhatarpur (3.33%) and Bamhani (5.72%), they would be more inclined to consider this possibility. A majority wants to retain Panchayat land as resting yard and grazing field for cattle (Table 14), and this could be the reason why 74-78% of the people do not want bamboo plantation on village commons.

4 BAMBOO DEMAND AND SUPPLY

Bamboo stands in the study area

A survey was done to find out the richness of bamboo and some other tree species in Chhatarpur, Dumna and Bamhani forests. The main data are given in Table 13.

Table 13: Natural bamboo stands in the study area

Block	Number of culms per clump	Diameter of culms (cm)	Expansion of clump (cm)	Density of bamboo (clumps/ha)
Chhatarpur	5-80	5-18	30-325	414.06
Dumna	5-75	4-12	25-275	632.66
Bamhani	5-55	4-18	50-450	240.00

Bamboo forests of Chhatarpur, Dumna and Bamhani can be categorized as dense and pure bamboo forest since it contains more than 125 mature and well-developed clumps per hectare (Verma and Bahadur 1980).

There are about 39 tree species that exists in association with bamboo in Chhatarpur, 41 in Dumna and 28 in Bamhani. These include Lagerstroemia parviflora, Anogeissus latifolia, Diospyros melanoxylon, Cassia spinarium, Bucbanania lanzan, Xylia xylocarpa and Tectona grandis.

Vegetation data collected from these forests suggest that bamboo occurs abundantly in these areas. If these bamboo forests are managed properly it can adequately meet the local bamboo demand.

Annual requirement of bamboo

Annual requirement of bamboo for agricultural and household purpose per village/block is presented in Table 14. More than 95% of bamboo in the three blocks are used ,for household purpose. Need of bamboo for agricultural purpose is more in Bamhani area than Chhatarpur and Dumna. Consumption of bamboo in Bamhani is of the order of 251 231 bamboo culms per year and is 3.32 times and 1.42 times more than Chhatarpur and Dumna, respectively. On the basis of average consumption per household, Dumna needs 132.64 bamboos as against 120.78 in Bamhani and 78.58 in Chhatarpur.

Apart from the above uses, bamboo is also used for making separate cattle pens (called *badas).* Bamboo culms of 4-5 cm diameter and 1.50-l .75 m length are used for making these pens. Assuming a cattle population of 6 per shed (2 bulls, 2 cows, 1 buffalo and 1 goat), it is estimated that Chhatarpur would require 300-375 culms to build the pens (1 434 cattle, 240 pens), Dumna 350-400 culms (90 cattle, 280 pens) and Bamhani 500-560 culms (2 669 cattle, 445 pens). After that 30-50 culms would be required per pen each year for their repair and

Table 14: Annual requirement of bamboo (number of culms)

Villages	Purpose			Total
	House	Agriculture	Raw material	
CHHATARPUR				
Dharampura	10 910	-	-	10 910
Deonagar	8 085			8 085
Deori	19 390	100		19 490
Khajri	21760	375		22 135
Badkheri	14 900			14 900
Total	75 045	475	-	75 510
Average per village	15 009	95	-	15 102
Average per household	78.1	0.5		78.6
DUMNA				
Dumna	5 418	-	-	5 418
Amanala	11799	-		11 799
Sundarpur	61 082	4 742	-	65 824
Umaria	25 517	2 291	-	27 808
Piparia	64 714	458	225	65 397
Total	168 530	7 491	225	176 246
Average per village	33 706	1 498	51	35 249
Average per household	126.8	5.6	0.2	132.6
BAMHANI				
Bamhani	92 340	39 275	28 450	160 065
Kamta	3 626	148		3 774
Kapotbahra	1 942	-	-	1 942
Tilai	56 234	2 083	560	58 877
Chhapri	19 447	7 126	-	26 573
Total	173 589	48 632	29 010	251 231
Average per village	34 718	9 726	5802	50 246
Average per household	83.5	23.4	13.9	120.8

maintenance. Table 15 presents projected total annual requirements of bamboo for constructing and maintaining cattle pens in the study area.

Table 15: Requirement of bamboo (no. of culms) for the construction and maintenance of cattle pens in the study area

Block	No. of pens per block	Requirement of bamboo/pen		Requirement of bamboo/block	
		Construction	Maintenance+	Construction	Maintenance*
Chhatarpur	240	300-375	30-50	72 000-90 000	7 20042 000
Dumna	280	350-400	30-50	98 000412 000	8 400-14 000
Bamhani	445	500-560	30-50	222 500-249 200	13 350-22 250
Average				130 833-150 400	96 50-16 083

NOTE: + Requirement per year

In general, higher number of households indicates more population, more domesticated animals, and consequently a higher demand for bamboos. Similarly, a large geographical area of a village may indicate a large population. These assumptions were found to be true to a large extent in the study area. Positive correlation could be found between geographical area and population, number of households and population, population and livestock, and population and demand for bamboo. It is expected that the spread of literacy among rural folks may bring a change in bamboo utilization.

Collection and buying of bamboo

Villagers in the study area collect bamboos for their daily household requirement from various sources such as forest, depots and open markets. Villagers residing near bamboo forest collect bamboos directly from forest through illegal ways, though some of them buy bamboo from depots or markets at the prevailing rates.

Table 16 shows the percentage of households collecting bamboo from different sources. It is clear from this table that about 61.92% house holds in Bamhani, 35.01% in Dumna and 26.85% in Chhatarpur collect bamboo from fore& directly through illegal means.

About 22-29% of the households collect bamboo from depots and a very small group of about 5-15% from markets. About 79% of households in Kapotbahra and 74% households in Dumna are engaged in illegal collection of bamboo. About half the households in Piparia do not collect bamboo at all.

Bamboos are sold at various rates varying from Rs 0.50 to Rs 8.00 per bamboo culm depending on its length, diameter and availability. However, in majority of cases, they are sold at the rate of Rs 3.00 per culm (about 52% of households in Chhatarpur and 59% in Dumna). Only about 10% of households in Chhatarpur and Dumna get bamboo at Rs 1.00 per culm.

Table 16: Percentage of households collecting bamboo from different sources

Village	Source of Bamboo collection			
	Forest	Market	Depots	No collection
CHHATARPUR				
Dharampura	28.37	13.43	19.40	38.80
Deonagar	18.18	19.69	45.45	16.68
Deori	24.25	12.50	15.75	47.50
Khajri	31.69	14.23	36.49	17.59
Badkheri	31.78	15.94	27.54	24.65
Average	26.85	15.16	28.92	29.04
DUMNA				
Dumna	74.08	0.00	7.40	18.52
Amanala	38.31	7.65	32.77	21.27
Sundarpur	34.85	16.60	31.88	16.67
Umaria	19.36	17.74	40.32	22.58
Piparia	8.45	11.27	30.98	49.30
Average	35.01	10.65	28.61	25.67
BAMHANI				
Bamhani	35.15	17.80	33.60	13.45
Kamta	72.60	-	19.80	7.60
Kapotbahra	79.35	-	11.50	9.15
Tilai	65.00	3.45	20.68	10.87
Chhapri	57.50		26.57	15.93
Average	61.92	425	22.43	11.40

5 DISTRIBUTION CHANNELS, USERS AND PRICES

Distribution of bamboo

Forest in Madhya Pradesh is spread over an area of 15 541 100 ha, out of which bamboo forest covers an area of 2 226 113 ha or 14.32% (Fig. 1) of the total (Anonymous 1996). There are other estimates that put the extent of bamboo, for example, at 2 377 000 or 15.29% (Dixit 1989) and 2 436 949 or 15.68% (Ashutosh et al. 1996).

Madhya Pradesh was once considered rich in bamboo resources. However, by 1985-86 most districts and forest divisions had lost much of their bamboo forests. Most areas of western and northern Madhya Pradesh, as well as the districts of Sagar, Damoh, Narsinghpur, Mandla, Jabalpur, Shahdol, Bhopal, Raigarh, Raisen and Chhindwara, do not have bamboo forests. Bamboo-bearing areas of Betul, Harda, Kawardha, Umaria, Hoshangabad and Bilaspur have reduced to a great extent. As it stands today, about 55% of the total productive bamboo forests of the state (approx. 8 595 km^2) have died out after gregarious flowering. Bamboo forests of significance are now concentrated only in Balaghat, Bastar, Bilaspur (part), Hoshangabad, Harda, Kanker and Raipur (part) divisions of Madhya Pradesh (Prasad 1989).

In Jabalpur region, bamboo forest is spread over an area of about 30 000 ha. The ban imposed on bamboo felling after the gregarious flowering in 1985 has helped the regeneration of a good bamboo forest around Chhatarpur and Dumna. Bamboo occurs abundantly here with a density of 414 and 632 clumps/ha, respectively. The number of culms per clump varies from 5 to 80 cm and 5 to 75 cm, and the culm diameter from 5 to 18 cm and 4 to 12 cm, respectively. The clump expansion is 30-325cm and 25-275 cm in Chhatarpur and Dumna forests, respectively.

Areas of Mandla forest studied (Bamhani block) are somewhat poor with 240 culms/ha density, 5-55 culms per clump, 4-18 cm culm diameter and 50-450 cm clump expansion. Bamboo forest is spread in an area of 70 000 ha in West Mandla; 30 000 ha in Dindori; 20 000 ha in Kanha and only 15 000 ha in East Mandla. Balaghat, adjoining Mandla and Jabalpur, has a dense bamboo forest spread over an area of 125 000 ha in the north and 45 000 ha in the south.

Bamboo distribution channels

Till 1991, Jabalpur used to get bamboo from Mandla and Balaghat, where there was no ban on bamboo felling. The bamboo thus obtained was distributed to different users through forest depots. After 1994, however, the scenario seems to have changed a great deal. As per the information bulletin of the Forest Department of Mandla (Nistar Patrika, 1991~95), Mandla itself is obtaining bamboo from Balaghat because of local scarcity. Hence, Balaghat is the only source now for Jabalpur for getting bamboo.

Bamboo users and types of depots

Forest Department has a distribution system under which it supplies bamboos to different types of users through its chain of depots. The users can be categorized as follows:

a) Nistars (right holders) – Population living in and around the forests are supplied with bamboos for their bona fide domestic requirement at concession rates. A family gets up to 250 bamboo culms per year at the cost of Rs 0.25 (royalty) + extraction cost under this arrangement + forest development surcharge.b) Basods(bamboo craft workers) - Basods are traditional bamboo craft workers who earn their livelihood by making articles such as baskets, mat, containers, hand-fans from bamboo and selling them in local markets. A registered basod family is entitled to get 1 500 bamboos per year from Forest Department depots at the rate of Rs 0.60-0.75 + extraction cost + forest development surcharge. Forest Department ensures that the bamboo given to basods is utilized only by them. For this purpose bamboos given to basods are split from the top.

c) ***Pan bareja*** (betel vine growers) – Growing betel vines requires shade and support to the plants for which bamboo is widely used. After satisfying nistars and basods and depending upon availability, each pan bareja family gets a maximum of 1000 culms a year at the rate of Rs 1.50 + cost of extraction + forest development surcharge + sales tax.

d) Other consumers – Other villagers who do not fall into the above-mentioned categories can purchase bamboo from forest department depots. One person can get a maximum of 50 culms in a year. Retail price of bamboo under this category for 1994-95 was:

Length (m)	4.60	5.50	6.50	7.30
Price (Rs)	7.70	9 65	11.70	13.75

The Forest Department has established a number of depots throughout the forest division with details of the jurisdiction and information such as the number of villages attached to a depot, in-charge of a depot, sale day and type of material available in each depot, etc. There are thus three types of depots: Nistar Depot, Basod Depot and Consumer Depot.

There are many other consumers of bamboo, such as business persons, building contractors, fruit growers, incense stick (Agarbatti) manufacturers and manufacturersof frames for bidi storage, etc. Those who consume more than 500 bamboo culms of 3.70 m length and above have to register with the Forest Department by paying the following registration fee:

Business persons	Rs200
Building contractors	Rs 150
Basods	**Rs 5**
Pan barejas and others	Rs5

Fruit growers, incense stick manufacturers and manufacturers of frame for bidi storage can buy at a time 5 notional tons of bamboo, of length varying from 1 to 2 m, on providing a certificate from either the Block Development Officer or Assistant Director of Industries. The cost of such bamboo is Rs 1 115 per notional ton. One notional ton corresponds to 2 400 running metres.

Bamboo prices fixed by-Forest Department

The summary of sale price of bamboo fixed by the forest department during 1994-95 is given in Table 17.

Table 17: Prices of bamboo fixed by the FOES Department

Bamboo users	Price (Rs per 100 culms)			
	Depot 40 km away from bamboo coupe	Depot 41-200 km away from bamboo coupe	Depot 201-400 km away from bamboo coupe	Depot more than 400 km away from bamboo coupe
JABALPUR				
1. For rural folks through nistar depots	120	180	200	220
2. For craft workers				
(a) First 500 cuhns	60	195	235	250
(b) Next 1000 culms	75	210	250	260
3. For betel vine cultivators	230	285	325	335
4. For fruit growers/ incense stick manufacturers	1 115 per notional ton			
5. For other consumers (from consumer depots)	440/100 cuhns of 3.70 m 58O/OO culms of 4.60 m 670/100cuLms of 5.50 m 765/100 culms of 6.50-m			
MANDLA				
1. For ruralfolks through nistar depots	186 *			
2. For craft workers				
(a) First 500 culms	60	1613		
(b) Next 1000 culms	75	176 3		
3. For betel vine cultivators	311			
4. For fruit growers/ incense stick manufacturers	1 115 per notional ton			
5. For other consumers (from consumer depots)	280/100 culms of 2.50 m 342/100 culms of 3.10 m 420/100 cuhns of 3.70 m 562/l00 culms of 4.60 m 652/100 culms of 5.50 m 745/100 culms of 6.50 m			

1. In addition to above rates, right holders (nistars) and craft workers (basods) will be charged 2% **forest development surcharge. Others will have to pay, in addition to this, a sale tax.**

2. For distribution to *nistars,* **bamboo is procured from Balaghat. The transportation expenses are charged to customers.**

3. From depots more than 40 km away from bamboo coupe.

6 STATUS OF BAMBOO CRAFT WORKERS (BASODS)

Bamboo craft workers (basods) are well-versed with the inherited art of making various articles from bamboo. Both men and women are equally involved in making or weaving articles at home. Dendrocalamus strictus, the green bamboo, is the preferred raw material.

Demographic features

Demographic features of basod families of Chhatarpur, Dumna and Bamhani are presented in Table 18. There are no basods in Dharampura village in Chhatarpur block; all other villages studied have basods. Total number of basod households in Chhatarpur, Dumna and Bamhani are 45,31 and 31, respectively. Khajri in Chhatarpur, Piparia in Dumna and Chhapri in Bamhani have the highest basod populations, and Badkheri in Chhatarpur, Dumna in Dumna block and Kamta in Bamhani have the lowest.

Although some of the villages show more female population, in general females are less in number. The highest female population (986) per 1000 males was in Bamhani and the lowest (848) in Dumna.

Table 18: Demographic features of bamboo craft workers in the area studied

Village	House-holds	Population			Literacy			Illiterates	Female-male ratio (females/ 1000 males)
		Male	Female	Total	Male	Female	Total		
CHHATARPUR									
Dharampura	0	0	0	0	0	0	0	0	0
Deonagar	4	9	14	23	2	3	5	18	1 555
Deori	14	50	34	84	24	11	35	49	680
Kha jri	26	61	57	118	31	24	55	63	934
Badkheri	1	3	4	7	2	2	4	3	1333
Total	45	123	109	232	59	40	99	133	
Average	9	24.6	21.8	46.4	11.8	8.0	19.8	26.6	300
DUMNA									
Dumna	2	9	11	20	4	5	9	11	1 222
Amanala	4	11	11	22	5	4	9	13	1000
Sundarpur	6	19	17	36	7	0	7	29	895
Umaria	5	27	23	50	18	9	27	23	852
Piparia	14	79	61	140	56	30	86	54	772
Total	31	145	123	268	90	48	138	130	
Average	62	29	24.6	53 6	18	96	27.6	26.0	948

Village	House-holds	Population			Literacy			Illiterates	Female-male ratio (females/ 1000 males)
		Male	Female	Total	Male	Female	Total		
BAMHANI									
Bamhani	6	11	15	26	9	7	16	10	1364
Kamta	1	2	3	5	2	1	3	2	1500
Kapotbahra	3	12	11	23	4	0	4	19	917
Tilai	10	24	19	43	9	4	13	30	792
chhapri	11	23	23	46	12	4	16	30	1000
Total	31	72	71	143	36	16	52	91	
Average	6.2	14.4	14.2	28.6	7.2	3.2	10.4	18.2	1 115
Total of three blocks	107	340	303	643	185	104	289	354	
Average per block	36.6	113.3	101	214.3	61.66	31.66	96.33	118	967
Average per village	7.1	22.6	20.2	42.8	12.33	693	19.26	23.6	987

The average literacy among basods in Chhatarpur, Dumna and Bamhani are 42.7%, 51.9% and 36.4%, respectively. The comparatively high literacy rate in Dumna applies to both males and females.

Income pattern

Income pattern of bamboo artisans (basods) is presented in Table 19. Average annual income of artisan families of Chhatarpur is the highest (Rs 95 698) and that in Bamhani is the lowest (Rs 47 541). However, the average annual per capita income is the highest in Bamhani (Rs 2 268), followed by Dumna (Rs 2 058) and Chhatarpur (Rs 1987).

Table 19: Income pattern of basod families (Rs per annum)

Villages	Annual income		
	Family head	Total family	Per capita income
CHHATARPUR			
Dharampura	-		-
Deonagar	21840	38640	1680
Deori	73 206	192 500	2 292
Khajri	135 096	233 350	i 977
Badkheri	6500	14 000	2ooo
Total	236 642	478 490	-
Average	47 328	95 698	1 987

Villages	Annual income		
	Familyhead	Total family	Per capita income
DUMNA			
Dumna	22 800	30 000	1500
Amanala-	22 200	37 800	1 718
Sundarpur	28 800	52 800	1 467
Umaria	50 400	111000	2 220
Piparia	137 760	231 840	1 656
Total	261960	463 440	--
Average	52 392	92 688	2 058
BAMHANI			
Bamhani	53 200	90 318	3 474
Kamta	6000	9 450	1 890
Kapotbahra	17 280	40 595	I 765
Tilai	68400	91 200	2 121
Chhapri	57 945	96 140	2 090
Total	202 825	237 703	--
Average	40 565	47 541	2 268
Total for three blocks	701427	I 179 633	
Average per block	233 809	393 211	
Averageper village	41 261	78 642	

Bamboo collection

It is interesting to note that only a small fraction (10-40%) of the bamboo collection is done through legal means – that is, from basod depots. The major portion (60-90%) is illegally harvested from forests. Although bamboo is collected throughout the year, majority collectior takes place in summer months, followed closely by winter. Collection during monsoon (rainy; season was observed only in Dumna.

It has been observed that the price of bamboo has been raised by 25-50% each year. After 1993-94, there was a sudden rise (Table 20). In general, prices were higher in Chhatarpur than in Dumna and Bamhani (Fig. 2).

Table 20: Bamboo prices during 1990-95

Block	1990	1991	1992	1993	1994	1995
Chhatarpur	100	125	150	200	300	350
Dumna	75	100	135	198	243	300
Bamhani	85	125	165	200	250	285

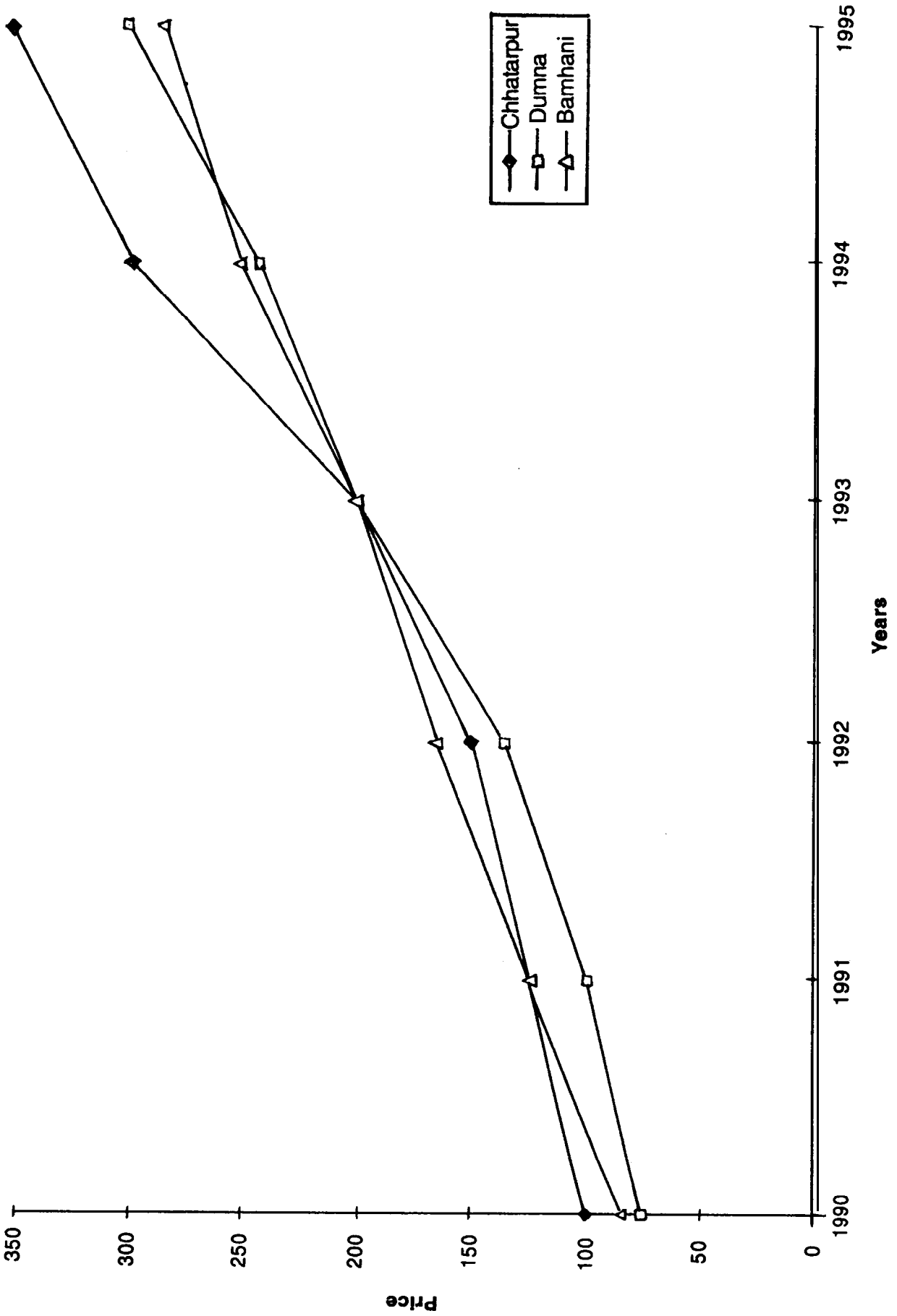


Fig. 2: Trends in bamboo prices (in Rs per 100 culms)

Bamboo products and marketing

A wide variety of baskets (addha, zabua, toknа) and containers (chunka, cbunki, toknі) get sold round the year. Some other products – such as fan (pankba), gift basket (tipara) and container for betel leaves (machla) are seasonal.

The craft workers (basod) themselves sell most bamboo articles, either in nearby towns/cities or surrounding villages. They have to often traverse long distances of 20-40 km. Seventy five to ninety percent of artisans of the study area sell their articles door to door. In general, artisans carry their materials on head or bicycle. Occasionally, three-wheeler or four-wheeler is hired to transport the material, paying Rs 15-30 per trip. There is a very small group of artisans (10-25% who prefer to sell their material to agents. Although marketing and sale patterns vary from village to village, the main structure remains the same. In Dumna and Bamhani, town markets are more important since appreciable quantities of articles are consumed in these markets. Intermediaries seem to play crucial role in Dumna and Bamhani as they handle 25% and 27% of the sales, respectively.

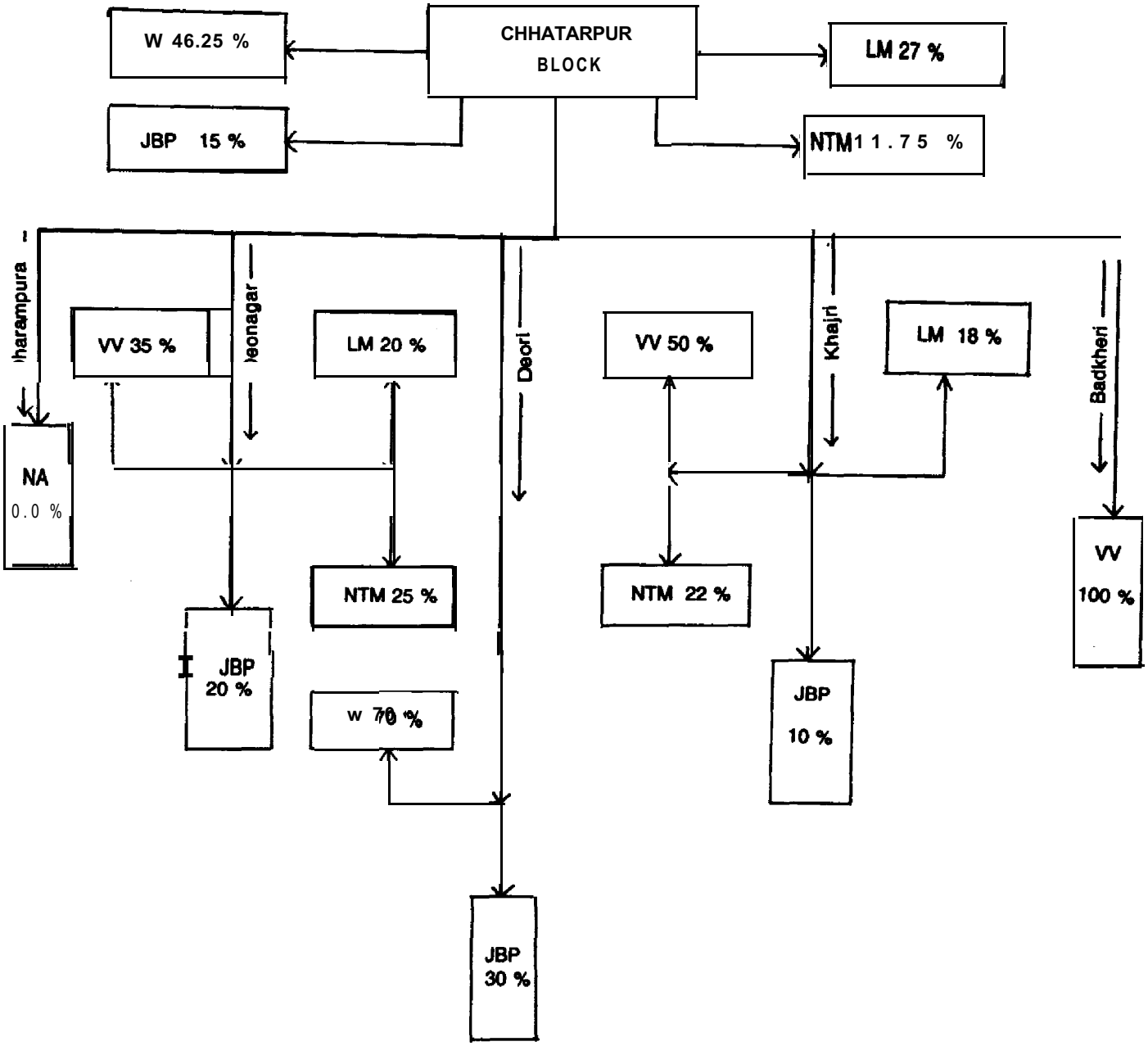
In Chhatarpur, 46% of the articles are marketed in the villages during door-to-door visit of artisans. About 40% articles go to the local markets (held once in a week) and town markets (at' places like Deori & Panagar) (Fig. 3 and Table 21). Only a very small sale of 9% goes through agents/brokers (Fig. 4).

In Dumna, 38% of the commodities are marketed in the villages (Fig. 5 and Table 21). The main sale channel consists of individual contacts through which 75% commodities are sold, while the rest are sold through intermediaries (Fig. 6).

In Bamhani, only 28% of articles are consumed in the villages (Fig 7 and Table 21) and only 6% articles are sent to the Mandla city market, which is far away from the studied area. The majority of sale is through individual contacts And about 27% articles are sold through intermediaries (Fig. 8 and Table 21).

Table 21: Marketing of products through various channels

Blocks	Village visits	Local markets	Town markets	Jabalpur or Mandla city
Chhatarpur	46.25	27.00	11.75	15.00
Dumna	38.00	22.00	24.00	18.00
Bamhani	28.24	28.02	37.80	5.94

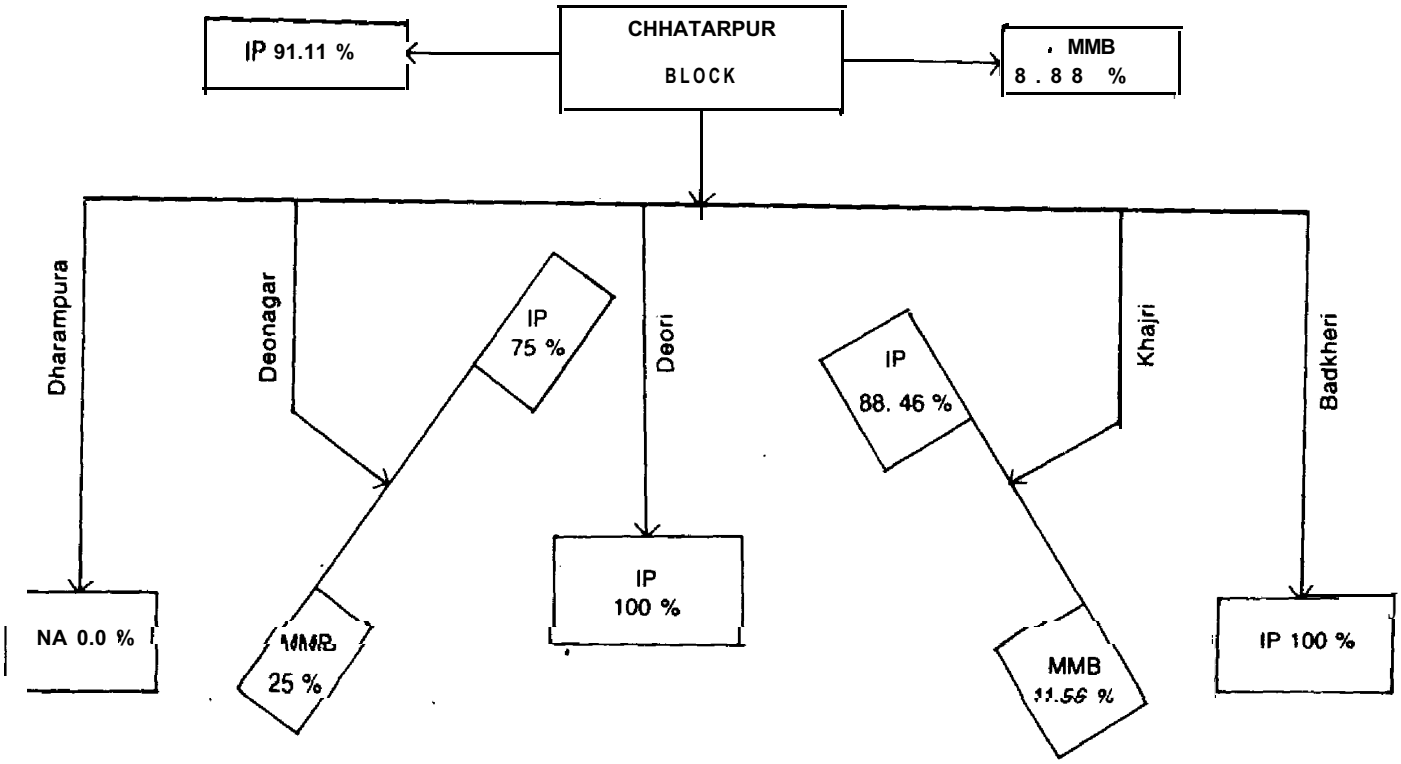


VV : Wage to village

VV : Village to village
LM : Local market (or village market .i.q. one day in a week).
NTM : Nearest town market (like Deori, Badhagarh, Panagar, Sihora).
JBP : Jabalpur city.
NA : Not applicable for particular village

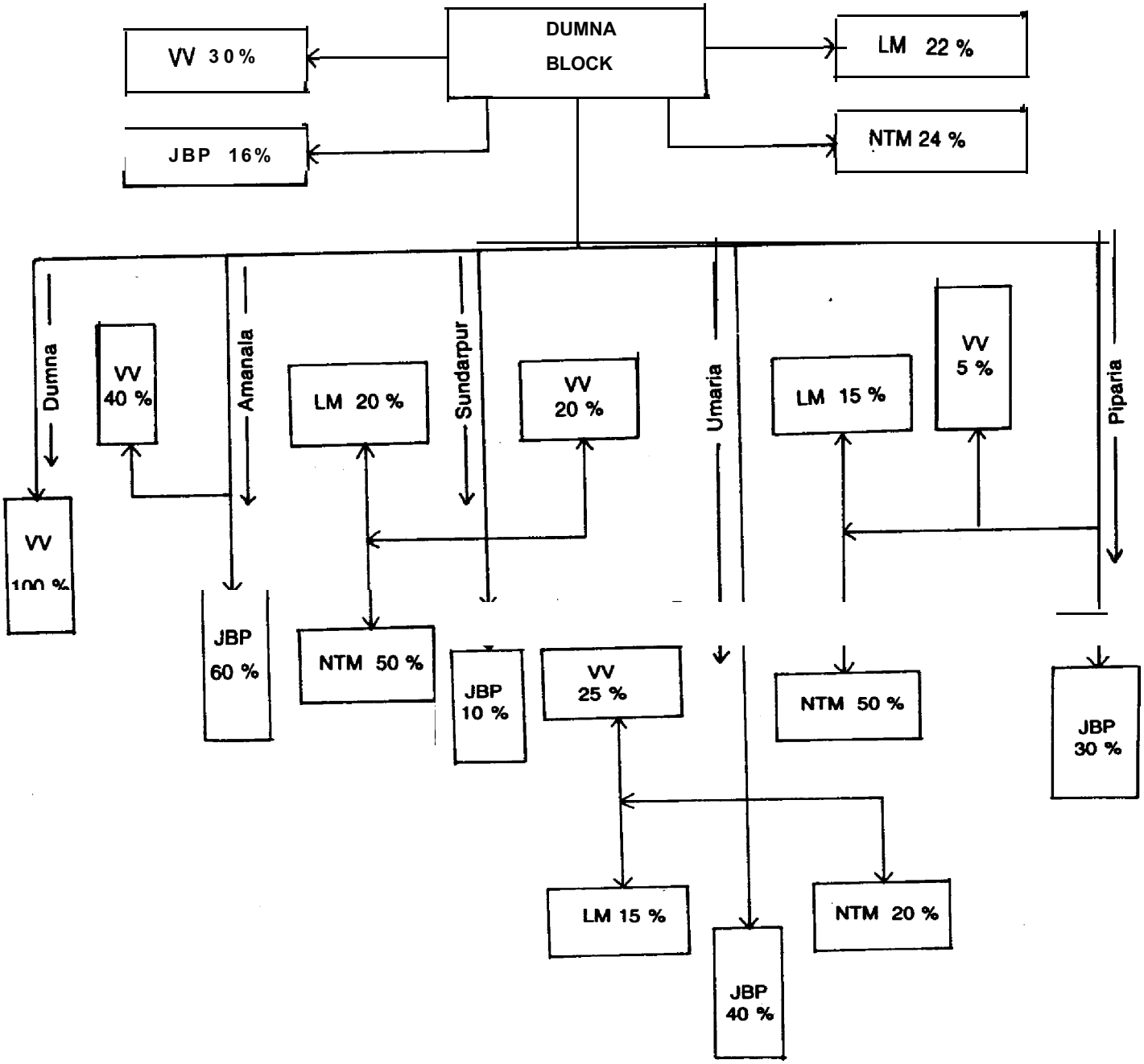
Fig. 3:

Fig. 3: Marketifig channels in Chhatarpur



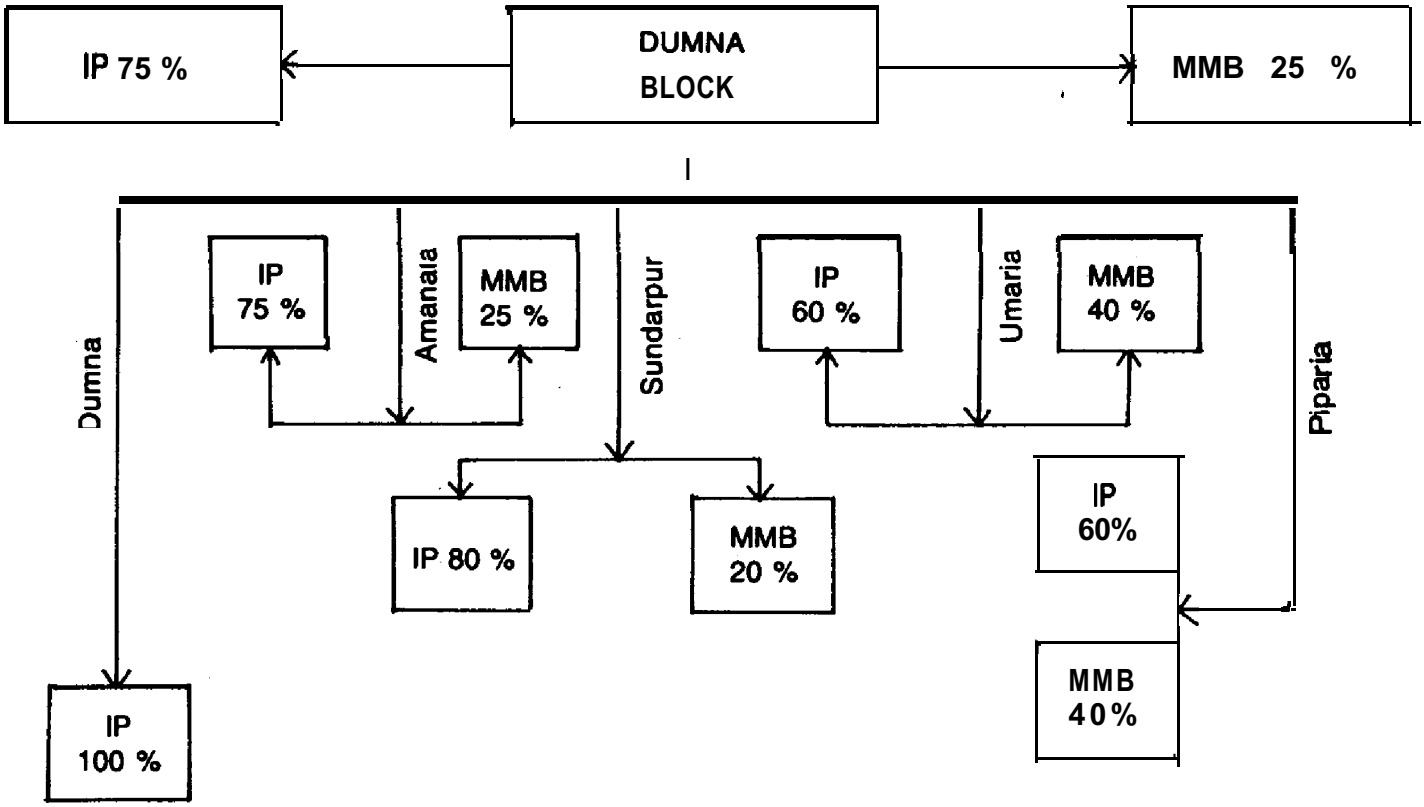
NA : Not applicable for particular village
IP : Individual purchaser
MMB : Agent or broker

Fig. 4: Sale channels in Chhatarpur



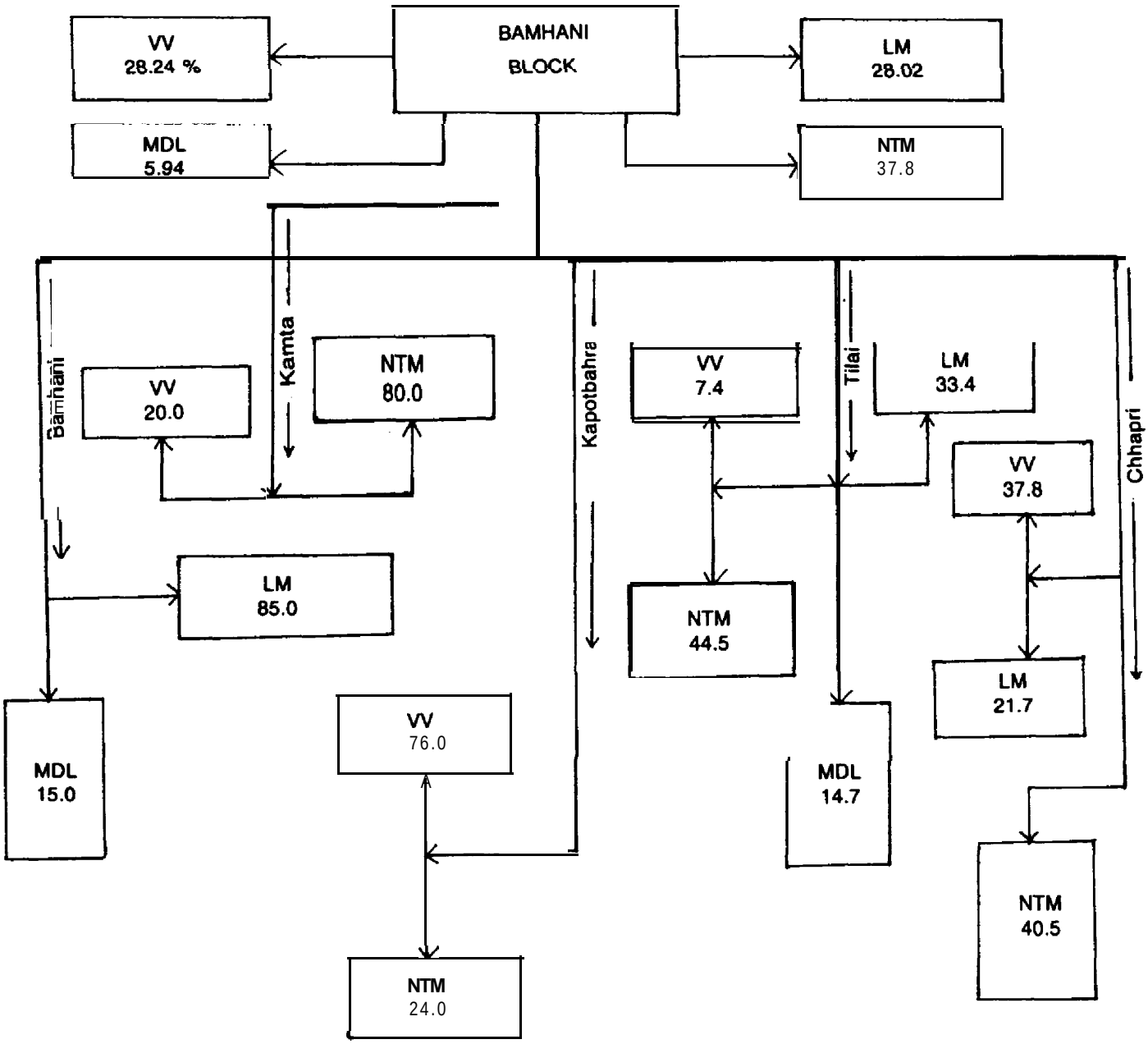
VV : Village to village
LM Local market (or .village market i.e. one day in a week).
NTM Nearest town market (like Khamaria, Piparia, Sonpur).
JBP Jabalpur city.
NA Not applicable for particular village

Fig. 5: Marketing channels in Dumna



IP : Indiviual purchaser
MMB : Agent or broker

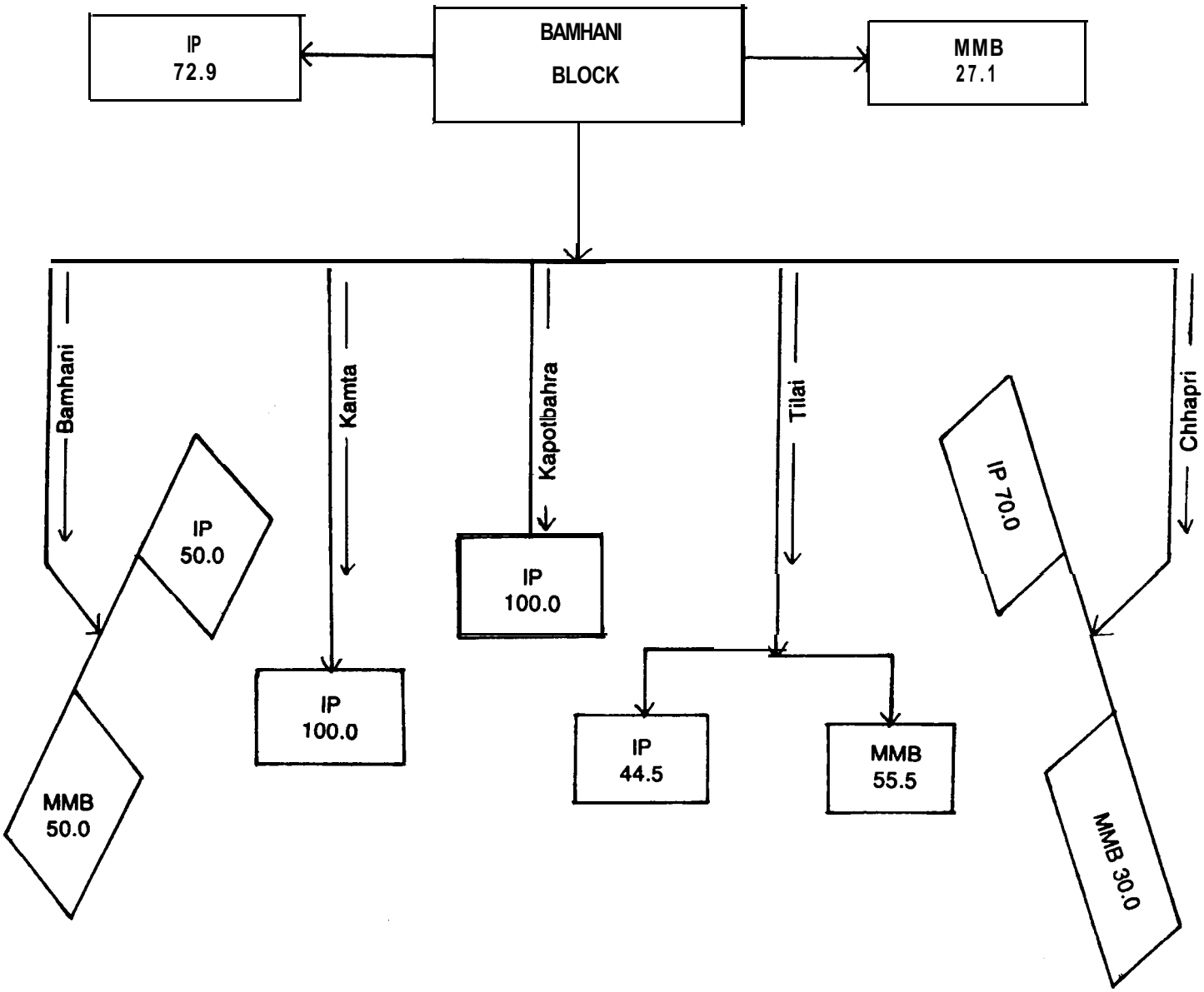
Fig. 6: Sale channels in Dumna



where,

VV : Village to village.
LM : Local market.
NTM : Nearest town market
MDL : Mandla city

Fig. 7: Marketing channels in Bamhani



where,

IP : Individual Purchaser
MMB : Agent or Broker

Fig. 8: Sale channels in Bamhani

Production inputs and economics

Artisans require green and long (4 m) bamboo for making various articles. Almost all members of his family assist him in the production. Each article fetches him different price that depends upon the skill and time required to make the product, and the cost of bamboo (on an average, a bamboo culm costs Rs 3.35).

About 11-15 culms are required for the preparation of a mat, while only up to one-third of a culm is needed for making a fan, hat or betel leaf container. The time required to manufacture a product varies from 0.1 (fan) to 3.0-3.5 (mat) workdays.

Table 22 gives the requirement of bamboo for manufacturing different items, workdays required for completing the product, selling price of each item and net average profit per workday and for each item.

Craft workers (basods) of Chhatarpur and Dumna utilize 3.4 and 3.6 bamboos, respectively, per workday for making various articles. Artisans of Bamhani, however, utilize only 1.75 bamboos per workday, because they mainly make decorative items for which more time is needed than that of normal items. On an average basis, an artisan utilizes 2.5-3 bamboos per workday.

Net profit per workday (selling price of the article minus cost of bamboo required to manufacture the same article within a time limit expressed in terms of workday), varies from Rs 3.30 to Rs. 78.80.

Table 22: Inputs for and economics of different products

Product	No. of culms required *	Workdays required	Cost of bamboo (Rs)	Selling price (Rs)	Net profit per workday (Rs)	Net profit per piece (Rs)
CHHATARPUR						
Basket (12 kg)	2.0	0.3	12.00	67	17.6	5.3
Basket(9 kg)	17	0.18	7.20	5.10	8.60	1.60
Container (Douri)	12	03	11.00	4.00	23.20	7.00
Winnower	0.7	02	5.60	2.30	16.30	3.30
Fan	0.3	0.0l	3.00	1.00	20.00	2.00
Mat (3x2 m)	11.5	3.0	70.00	38.50	10.50	31.50
Partition mat (Tatta)	5.0	1.9	23.50	16.70	3.50	6.80
DUMNA						
Basket (12 kg)	2.0	0.28	10.00	6.70	11.70	3.30
Basket(9 kg)	15	0.15	5.90	5.00	6.00	090
Container (Douri)	0.8	0.25	10.03	2.70	30.04	7.60
Winnower	0.6	0.18	8.80	2.00	37.70	6.80
Fan	03	0.12	4.70	1.00	30.80	3.70
Mat (3x2 m)	11.0	28	72.50	36.80	12.70	35.70
Partition mat (Tatta)	5.0	17	25.00	16.70	--	--

Product	No. of culms required *	Workdays required	Cost of bamboo (Rs)	Selling price (Rs)	Net profit per workday (Rs)	Net profit per piece (Rs)
BAMHANI						
Basket(12 kg)	21	0.4	12.00	7.03	12.41	4.96
Basket (9 kg)	18	0.25	9.00	6.03	11.88	2.97
Container (Douri)	1.0	0.5	20.00	3.35	33.34	16.65
Winnower	0.8	0.4	10.00	2.68	18.30	7.32
Fan	04	0.1	4.70	1.34	41.60	4.16
Mat (3x2 m)	15.0	3.5	80.00	50.25	8.50	29.75
Partition mat(Tatta)	3.5	2.0	35.00	11.22	11.89	23.78

NOTES:

*** Each culm is 4 m in length and costs Rs 3.35**

Net profit per workday = (selling price – cost of raw material) / workdays

An average basod family makes in a year (200 workdays) articles that fetch Rs 7 120. Of this, Rs 3 283 is spent on raw materials. Hence, the actual earnings per year is only Rs 3 837 or a daily earning of Rs 19.18, which is extremely low.

It has been estimated that the 45 basod households in Chhatarpur require 43 400 bamboo culms annually for manufacturing craft items. About 51800 culms are required by the 31 basod households in Dumna and 29 000 culms by the 31 households of Bamhani. The total requirement of the 107 households thus comes to 124 200 bamboo culms.

Assuming that 1 500 bamboo culms are made available regularly to each artisan family through basod depots, the Forest Department has to distribute about 160 500 culms (67 500 + 46 500 + 46 500) annually among the 107 basod households in the study area.

However, this target is never met because of the non-availability of bamboo. The average capacity of a basod depot in these three blocks varies from 8 000 to 12 000 bamboo culms. Moreover,- some of the depots – such as Jabalpur depot and Kundam depot – are far away from the study area. As of 1994-95, the basod depots in the study area had the following capacities (number of culms):

Jabalpur depot	40 000
Panagar depot	8 000
Budhagar depot	10 000
Kundam depot	10 000
Bamhani depot	7 000
Nainpur depot	12 000
Chiraidongari depot	5 000
TOTAL	92 000

Thus, there would be a capacity shortfall of 68 500 culms, if enough bamboo were to be available for supply. The total capacity of the 24 basod depots spread over the seven ranges of Jabalpur territorial forest division is only 285 500 bamboo culms, and the total capacity of 14 basod depots spread in six ranges of West Mandla territorial forest division is only 100 000 culms. It may be noted here that, as indicated in the information bulletin (1994-45) of Manila Forest Division, these depots also cater to the need of other consumers.

7 STATUS OF BETEL VINE GROWERS (*PAN BAREJAS*)

Betel vine cultivation is common only in three villages – Dharampura, Deonagar (of Chhatarpur block) and Bamhani (of Bamhani block) – out of the 15 studied. Betel vine growers require huge quantities of bamboo for supporting betel vines, and for roofing and enclosing betel vine gardens.

Demographic features

Out of the 147 households in Dharampura village, 68 (36%) are engaged in cultivation of betel leaves; in Deonagar it is two out of 212 (0.9%) and in Bamhani three out of 1 596 (0.2%) households.

Demographic features of these villages are presented in Table 23. The survey found 413 betel vine growers in Dharampura, 15 in Deonagar and 34 in Bamhani.

Table 23: Demographic features of betel vine growers

Village	House-holds	Population			Literacy			Illiterates	Female-male ratio (females/ 1000 males)
		Male	Female	Total	Male	Female	Total		
Dharampura	68	209	204	413	162	142	304	109	976
Deonagar	2	9	6	15	5	2	7	8	667
Bamhani	3	17	17	34	11	9	20	14	1000
Total	73	235	227	462	178	153	331	131	

Income pattern

The income pattern of betel vine growers is given in Table 24. Per capita income is the highest in Bamhani village (Rs 3 152) and the lowest in Dharampura (Rs 2 868).

Table **24:** Income pattern of betel vine growers (*pan barejas)*

Village	Annual income (Rs)		
	Family head	Total family	Per capita income (Rs)
Dharampura	816 774	1184368	2868
Deonagar	28 750	44 175	2 945
Bamhani	70 128	107 152	2 870

Requirement of bamboo

Betel vine growers require huge amount of bamboo stakes to support betel vine/climbers. As bamboo is in short supply, they are forced to use substitutes, such as sturdy branches of *Ipomea* sp.

In 1995, the 68 *pan barejas* households in Dharampura bought 42 400 bamboo culms for Rs 75 804 (at the rate of Rs 1.20 and Rs 2.54 per piece) to erect their betel vines. Of the 68 households, 16 buy bamboo from consumer depot while the rest procure it from other sources.

As per the commitment of the Forest Department, each betel vine grower is entitled to an annual quota of 1000 culms. However, only 100-150 culms'have been made available in 1995 and that too for only 16 households.

There are 1840 betel vine beds (*paties*) covering an area of about 8 ha in Dharampura, and 40 beds on 0.2 ha in Deonagar. In Bamhani town about 40-45 beds are managed for betel growing in an area of about 0.20-0.25 ha. Bamboo is used for erecting shade, boundary, tying of mats (tattas) for protection of betel vines from wind, and for supporting betel vine climbers. One bed of about 6 m^2 requires an average of 300 bamboos and for 40 beds, the total requirement of bamboo is 12 000. Growing betel vine on 1 840 beds has been reported to require more than 1 million culms over two years, costing about Rs 4 million (at Rs 4 per culm). During the PRA/RRA survey, betel vine growers from both Dharampura and Deonagar reported losses (up to 31% of the investment in Dharampura, but only 6.5% in Deonagar where the scale of cultivation was about 2% that of Dharampura). Major cost involved in the business, as reported by the growers, was the purchase of bamboos culms, baskets and mats: about 49% of the cost in Deonagar and a substantive 94% of the total cost in Dharampura.

There might be an element of exaggeration involved in these reports, particularly the one from Dharampura where the losses reported are too high to absorb in the business. It is therefore obvious that either substitutes were used for bamboo and/or culms were obtained at much lesser costs. Nevertheless, the point is that bamboo is not available in sufficient quantities and at reasonable prices. In order to make the business of betel growing profitable the following measures need to be adopted:

1. Easy availability of bamboos, especially in the month of January;
2. Bamboo sale on all days;
3. Availability of bamboos at cheaper rates and that too from depots;
4. Making available crop insurance facilities; and
5. Encouraging cooperative societies for giving loan facilities.

8 USE OF BAMBOO FOR PAPER AND RAYON

Half of the current annual production of bamboo in India is consumed by paper and rayon industries. Paper manufacturing is now a high-profit industry in the country and has great potential for growth. The steady increase in the demand of paper and rayon industries has resulted in over-exploitation and rapid depletion of natural bamboo stands. The projected demand for forest-based raw materials for the paper industry alone is expected to reach 7.53 million tons (MT) by the year 2000. Based on the present production, a shortage of 4.32 MT is expected by the year 2000 (Anonymous 1995).

There are 310 paper mills in the country, 16 of which are located in Madhya Pradesh (Mishra and Mishra 1996). The major units producing paper from bamboo are the National Newsprint and Paper (Nepa) Mills at Nepanagar, Hoshangabad, and Orient Paper Mills at Amlai, Shahdol.

The Nepa Mills has a capacity to produce 80 000 tons of paper annually from about 120 000 tons of bamboo. About 70% of this requirement is met from Balaghat sector (mainly Balaghat, Chhindawara and Seoni circles) and the remaining from Hoshangabad sector (mainly Betul, Hoshangabad and Khandawa circles). As per an agreement, drawn in 1985 and valid till 1997, the Government of Madhya Pradesh has to supply 80 000 notional tons (1 notional ton = 0.8 ton = 1 sale unit) of bamboo per year to Nepa Mills. The mill pays the Forest Department a royalty, forest development tax (2%) and sale tax (4%) for the bamboo it receives. Over the 10-year period from 1985-86 to 1994-95, the mill has paid about Rs 610.5 million to the Department for approximately 606 460 tons of bamboo. Over this period, the price of bamboo has varied from Rs 541 to Rs 1185 (Fig. 9) per sale unit (0.8 ton).

The landed cost of bamboo, including handling and transportation costs, varies from Rs 2 600 to 2 800 per ton. The Forest Department has not been able to supply the requisite quantity of bamboo to the Nepa Mills as per the agreement, forcing the mill to procure bamboo from various sources in, for example, Assam and West Bengal. The short falls were about 51, 102 and 381 tons (64, 127 and 476 sale units), respectively, in 1992-93, 1993-94 and 1994-95.

Orient Paper Mills requires about 140 000 tons of bamboo per year to produce 85 000 tons of paper. Although the mill has an agreement with the government for 100 000 tons of bamboo per year, the Forest Department is unable to meet the commitment because of the non-availability of bamboo. The Department is able to supply only 70-80% of the requirement, mainly from areas iike Shahdol, Balaghat, Bastar, Mandla and ,Surguja.

From 1985-86 to 1994-95, Orient has paid to the Forest Department approximately Rs 741.3 million for 725 300 tons of bamboo. During this period, the price per sale unit (0.8 t) varied from Rs 583.44 to Rs 1 277.20 (Fig. 10). At present, the landing cost (including handling and transportation charges) per ton works out to Rs 2 200.

To meet its requirements, Orient Paper Mills procures bamboo from other sources at much higher prices – 30 000 to 40 000 tons from Assam at the rate of Rs 3 000/t, 15 000 to 20 000 tons from Uttar Pradesh at the rate of Rs 3 000/t, and 15 000 to 20 000 tons from Bihar/Maharashtra at the rate of Rs 2 500/t (rate includes transportation charges and taxes).

The other important raw material is eucalyptus, as mixed pulping – bamboo (60%) and eucalyptus (40%) – is used for making paper. In 1994-95, the Orient Paper Mills consumed 113 356 tons of bamboo and 65 016 tons of eucalyptus to manufacture 66 602 tons of paper.

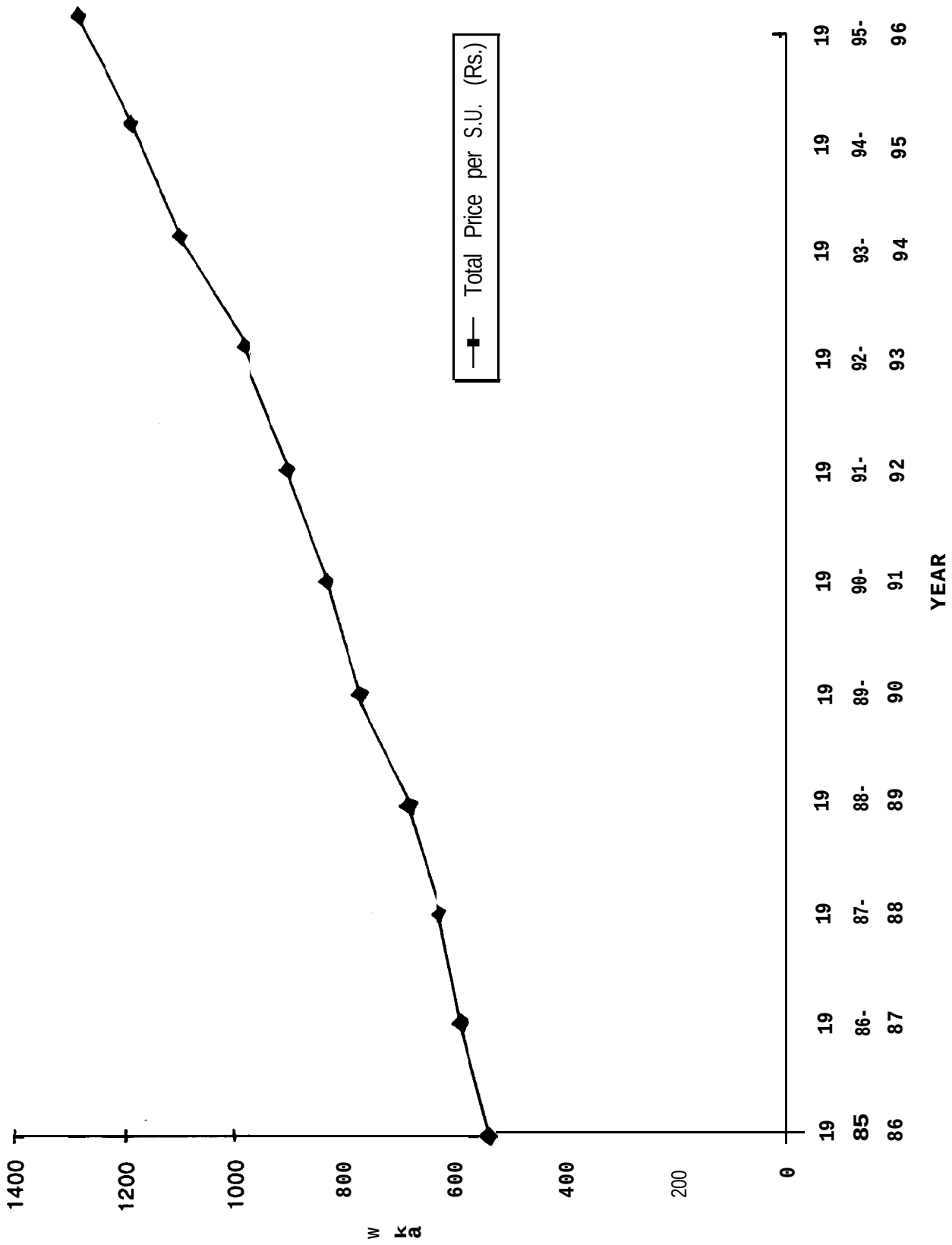


Fig. 9: Price (inclusive of all taxes) of bamboo per sale unit (0.8 t) - Nepa Mills

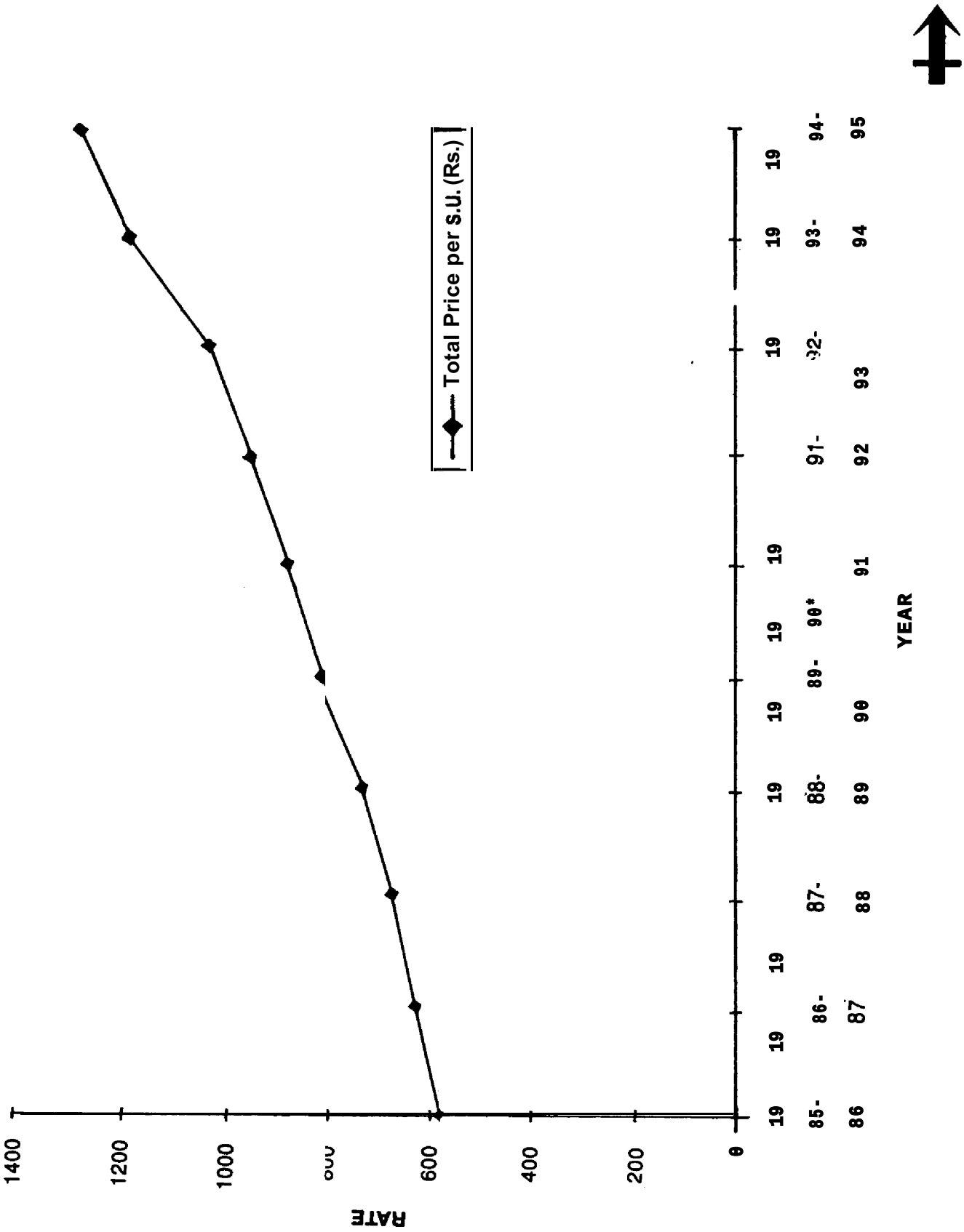


Fig. 10: Price (inclusive of all taxes) of bamboo per sale unit (0.8 t) - Orient Paper Mills

9 BAMBOO MANAGEMENT

Although bamboo management has been going on for nearly 100 years, the silvicultufai system under which it is managed has not been specifically named. Bamboo felling is done selectively so that the production of new culms takes place continually (Prakash and Khanna 1983). Culm Selection System, the name Krishna Swamy (1957) suggested for the process, was used by Khanduri for the first time in 1978.

Bamboos are worked generally on felling (cutting) cycles of 3 or 4 years, and of these two the 4-year cycle is generally adopted in Madhya Pradesh. The felling rules, though they vary from state to state, include the following points.

1. Prohibition of cutting of culms up to two years old.
2. Retention of some older bamboos for support of immature culms; the minimum number of culms, both new and old, is fixed according to quality class.
3. Prohibition on digging of rhizomes.
4. Regulation of the height at which bamboo should be cut. The minimum height at which the bamboo may be cut is generally 15 cm from ground, with the condition that at least one node should be left. The maximum height is 45 cm in Madhya Pradesh.
5. Insistence on cutting with a sharp instrument so that the stump does not split.
6. In case of flowering, the bamboo should be cut only after the seeds have been shed.

The period of working varies slightly from state to state. In Madhya Pradesh, it is from November to end of March.

Seedlings, which result from seeds of sporadic flowering, produce new clumps. Blank spaces, if any, are filled by planting nursery-raised seedlings in polybags. Bamboo clump keeps on producing culms through the development of rhizome. In case of gregarious flowering, when all the clumps in the area die, regeneration starts from the seed shed, provided they are protected from rodents before germination and from cattle after germination.

In fully developed clumps, bamboo does not require weeding and clearing the way tree species require. But weeding and tending of clumps have to be done to facilitate growth of new culms. In areas where seedlings appear as a result of flowering or gap planting, three weedings are done in the first year and two in the second year.

Bamboo management in Madhya Pradesh

The bamboo (Dendrocahmus strictus) forests are first categorized into the following three treatment types (areas less than 5 ha are not separated as distinct treatment type):

Type I: Well-stocked and well-grown bamboo forests of :

(a) 1st quality (culm height of 9 m and above)

(b) 2nd quality (culm height of 6-9 m); and

(c) 3rd quality (culm height up to 6 m).

Type II: Well-stocked bamboo forests, but malformed from heavy lopping, congestion and/or burning.

Type III: Bamboo forests with very sparse stocking of bamboo clumps.

Marking of culms for reservation

In each clump to be worked, culms to be reserved against felling are given a distinguishing paint mark at breast height. The number of culms so reserved in a clump is written on one of the reserved culms, above the distinguishing paint mark. Other data written include the serial number of the clump and the number of culms marked for felling.

Rules applicable to all treatment types

The felling rules cited earlier are applicable to all treatment types. Besides those, other norms observed in Madhya Pradesh include:

1. All cutting debris shall be removed at least 1 m away from the periphery of each worked clump.
2. Bamboo cutting will not be done in the period from 1 July to 15 October.
3. When flowering is sporadic, all flowered clumps within the coupe under working have will be clear-felled after they have shed seeds.
4. In the event of gregarious flowering, all clumps that have flowered, irrespective of their location, will be clear felled after they have shed their seed.
5. Lopping of bamboo either for feeding livestock or otherwise is strictly prohibited.
6. As far as possible:
   (a) Bamboo felling should be completed by the end of March.
   (b) Bamboo should be rigidly protected from fire and in no case forest fire should be allowed to occur in bamboo forests during the year of working and the year following it.
   (c) No grazing is to be permitted during the rains in bamboo forests that have been worked in the previous open season.
7. Clumps having only the minimum prescribed number of culms or less will not be commercially exploited. Only broken, dead, dry, badly damaged or over-mature bamboo will be felled in such clumps.
8. A clump will be distinguished as an independent clump when its periphery is easily discernible from the adjacent ones. Where such a distinction is not possible two clumps within 1 m distance will be regarded as one.
9. The minimum number of culms to be retained in each clump is fixed, on the basis of quality class, as follows:

   1st quality : 20 culms
   2nd quality :15culms
   3rd quality : 10 culms

However, the total number of 1-2 year old culms and older culms in the clump should not be less than the total number of culms of up to 1 year of age.

While reserving culms in a clump, it should be ensured that they are well-spaced and preferably at the periphery. Younger culms get preference over older ones.

Rules applicable to individual treatment types

TYPE I:

1. Cultural operations will be carried out in clumps having less than the prescribed number of culms.
2. Commercial felling will be done in those clumps that have more than the prescribed minimum number of culms.

TYPE II:

1. There will be no commercial felling in any clump.
2. Cultural operations will be carried out, including:
   (a) Felling of all dead, over-mature, burnt, broken and badly damaged bamboos.
   (b) Maintaining the size of the clump by, if needed, retaining broken or cut bamboo having a length of 2.5 m or more.
   (c) Adhering strictly to the minimum number of culms per clump prescribed for various quality classes.
3. Congested bamboo clumps shall be clear-felled by forming segments. The maximum number of segments, in which a congested clump may be worked fully, will be three and, in each working, not more than one segment will be cut. When three segments are formed, the middle one will be in the shape of a triangle, with its apex at the periphery and base formed by one-third of the periphery. This segment should be felled at the first working. In subsequent cycles, side segments should be felled one by one.

TYPE III:

1. Only cultural operations will be done in the clumps available.
2. Plantations of suitable bamboo species will be established to augment the potential of bamboo in this type forest. The minimum area to be planted annually will be one-third of the total area under this type.
3. Tending and cultural operations in the areas planted with bamboos will be done as per standard practice.

10 BAMBOO AND CENTRAL INDIA

The bamboo areas could be classified roughly into four categories (Verma and Bahadur 1980):

1. Dense or pure – Forest having more than 125 mature and well developed clumps per hectare;
2. Predominated – Areas having 50-125 mature clumps per hectare;
3. Space – Areas having 25-50 clumps per hectare; and
4. Poor and scattered – Areas having less than 25 clumps per hectare.

About 60% of bamboo forests lying in the Central region of India belong to the categories 3 and 4.

The bamboo-bearing forest areas of the States of Madhya Pradesh, Maharashtra and Orissa lying in the central region of India, reports Tewari (1992), have the total potential to supply of 1.59 million tons of bamboo per year (Table 25).

Table 25: Bamboo-bearing areas in the central region of India

State	Forest area (ha)	Bamboo-bearing forest area (ha)	Bamboo-bearing forest area (%)	SUPPIY potential (tons/year)
Madhya Pradesh	15 541 400	2 226 113	14.32	800 000
Maharashtra	6 387 400	997000	18.61	300000
Orissa	5 718 300	1 550 000	27.10	490000
Total	27 647 100	4 773 113	17.26	1 590 000

The quantity of bamboo harvested from natural forests in the central region of India during the last **14** years is given in Table **26.**

Table 26: Quantity of bamboo harvested (in tons) in the central region of India

Year	Madhya Pradesh	Orissa	Maharashtra
1980-81	337 900	332 089	145 000
1981-82	289 124	287 789	-
1982-83	280 064	281 199	162 650
1983-84	237 378	251205	467 542
1984-85	336 283	370 161	467968
1985-86	349 000	274 799	138 300
1986-87	325 216	204 285	21 809
1987-88	362 629	248 715	-

Year	Madhya Pradesh	Orissa	Maharashtra
1988-89	330 6%	260955	-
1989-90	280 552	265650	-
1990-91	259707	251965	246 141
1991-92	229 716	236940	239 416
1992-93	245 346	289 465	211019
1993-94	229 657	241360	

It can be seen from Tables 24 and 24 that the actual production is far less than the potential. It may also be noted that in these areas the respective Forest Departments are under contractual agreement to supply bamboo to paper industries. The bamboo demand of the paper industries in these states are: Madhya Pradesh, 190 000 tons; Maharashtra, 265 000 tons; and Orissa, 240 000 tons (pers. comm Mishra, Y., Ashutosh, S. and Vighwakarma, P., Tropical Forest Research Institute, Jabalpur). The demand for bamboo for paper-making will only increase with time. The projected demands are given in Table 27.

Table 27: Projected demand for bamboo for paper-making (in tons)

State	Years		
	2ooo	2005	2010
MadhyaPradesh	260 000	290 000	280 000
Maharashtra	290 000	290 000	295 000
Orissa	260 000	275 000	275 000

It seems that many paper and rayon mills are willing to establish bamboo plantations on their own, provided land is allotted by the government. Bamboo from these plantations will be used exclusively by the mills. However, many modalities need to be worked out before such a program can be realized.

Employment generation

Bamboo forests provide three types of employment: direct employment, self-employment, and secondary employment based on forest industries.

Direct employment is provided in the form of managerial, technical, research, planning and executive jobs. It has been estimated that one hectare of bamboo plantation with 500 clumps wil generate 383.9 workdays for unskilled labour and 47.3 work days for supervisory and skilled labour over a period of 30 years. Table 28 based on Tewari (1992) gives year-wise details of employment generated.

Table 28: Employment generation for unskilled, skilled and supervisory labour

No.	Year	Unskilled labour (workdays/ha)	Skilled/supervisory labour (workdays/ha)
1.	Year of formation	140.3	12.0
2.	2nd year	40.7	2.6
3.	3rd year	6.3	1.5
4.	4th year	26.3	-
5.	7th year	67.0	-
6.	Annual maintenance 4th year onwards upto 29th year	3.3	31.2
	Total	383.9	47.3

It has also been estimated that 17 workdays will be required to harvest, extract and transport one air-dry ton of bamboo. The estimated potential yield of bamboos in India is 3.6 million tons and therefore, the estimated potential employment generation in harvesting and related work is 61.2 million workdays. Plantation activity will further generate large number of employment.

Self-employment is generated when individuals are employed in a. production process whose output or benefit is wholly or partly consumed by them. Transportation of bamboo by head-load, grazing of cattle in bamboo forests, availing of rights and concessions related to bamboo harvest/utilization, etc. are some of the activities that give self-employment to the people. Cottage industries based on bamboo, and paper, pulp, paperboard and rayon industries provide secondary employment to the people.

Forest Departments of almost all states has definite policy to supply bamboos to the rural population living around forests to meet their bona fide requirements. Pant (1979) suggested that harvesting of 1 ton of bamboo requires 7.5 workdays (quoted by Prasad and Bhatnagar 1989). If the bamboo production of 1992-93 in Madhya Pradesh, Maharashtra and Orissa is taken as 245 346, 211 019 and 289 465 tons, respectively, the employment that this activity generated in those states would be 1.84, 1.58 and 2.17 million workdays, respectively. That is, nearly 6 million workdays of employment in one year in just three states.

11 BAMBOO PRODUCTION-TO-CONSUMPTION SYSTEM

Understanding of the bamboo production-to-consumption system facilitates the identification of constraints and opportunities in the development of the resource and in the designing appropriate interventions. To make this exercise comprehensive, information generated during this study was pooled with data available in government records and information derived from interviews of officials of forest department and paper industry. The generalized picture thus obtained for the state of Madhya Pradesh is presented below.

Bamboo production

Bamboo in Madhya Pradesh largely comes from natural forests, and also from plantations raised by the Forest Department and the Forest Development Corporation. Other sources – such as small plantations raised by farmers and bamboo grown on field embankments and homesteads – augment the production by about 4%. The bamboo production-to-consumption continuum is shown in Figure 11.

Natural forests

Bamboo occurs in natural forests mostly as an understorey in association with other tree species, in decreasing extent of association, in teak forests, mixed forests and sal forests. In recent years, bamboo production has been showing a downward trend. The main reasons for this are gregarious flowering, and biotic interference in the form of indiscriminate felling and suppression of regeneration through increased grazing. The productivity of natural bamboo forests is highly variable and ranges from 0.1 to 0.9 ton/ha/year. According to Tewari (1992), the annual yield of bamboo in Madhya Pradesh is 1.235 tons/ha in moist areas and 0.618 ton/ha in dry areas. About 44% of the total production of bamboo in the state come from natural forests.

Forests in Madhya Pradesh is spread over an area of 15 541 400 ha, out of which bamboo forest covers an area 2 436 949 ha – natural bamboo in 1510 000 ha and plantation bamboo in 926 949 ha.

Bamboo plantations

Plantations are raised by the Forest Department, Forest Development Corporation (formed in 1975, individuals and industries. About 51% of the total bamboo production in the state come from plantations raised by the state Forest Department and Forest Development Corporation, and about 1% from plantations of private individuals and industries. The area under bamboo plantation is 926 949 ha.

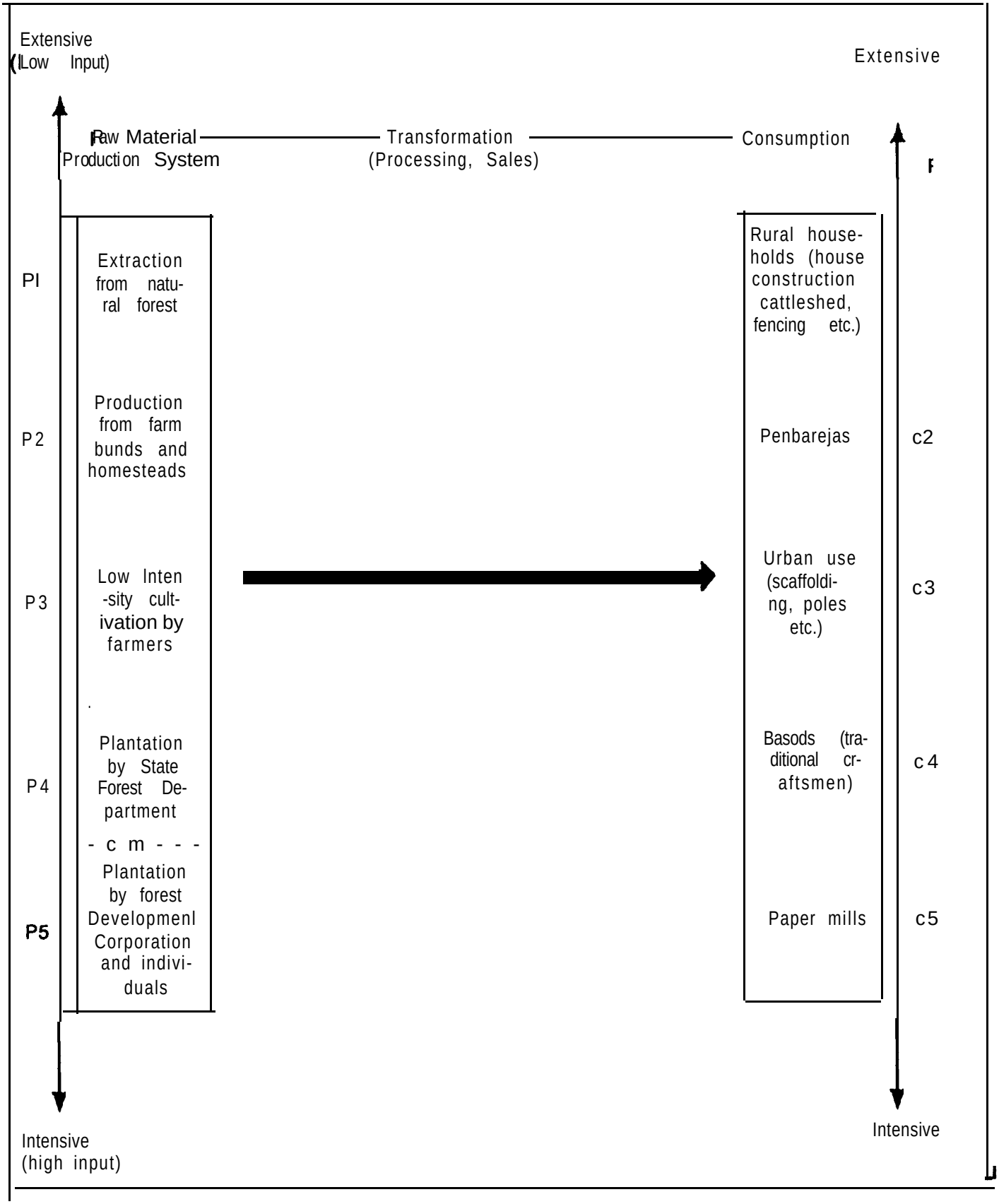


Fig. 11: Bamboo production-to-consumption system in Madhya Pradesh

Rural bamboo

Villagers raise bamboo clumps on field embankments (bunds) to meet their day-today requirement of repairing house and cattle shed, fencing, etc. In some villages (such as in Sarguja district), people retain some bamboo clumps as security to be used in times of need.

From the survey data of about 30 villages from different parts of the State, it has been found that the number of clumps/household ranges between 0.1 to 0.4, the average being 0.15. About 14 000 tons of bamboo is produced in this manner, accounting for approximately 4% of the total production in the State (per-s. comm. Subhash Ashutosh, IFS).

Bamboo consumption

Consumption of bamboo in the State can be categorized under three heads: commercial bamboo, industrial 'bamboo and bamboo used by villagers.

Commercial bamboo

Commercial bamboo is bamboo meant to be sold in the market for uses other than as raw material for pulp and paper industries. Quality-wise, it is superior to industrial bamboo and fetches higher revenue (per ton) to the Forest Department. Commercial bamboo comes to the market through traders who buy it from the Dorest Department depots through open auctions. Although major supply of commercial bamboo comes through this route, bamboo produced by farmers augment it. Production of commercial bamboo in 1994-95 was 176 617 notional tons, with the average of 22 years being 106 044.3 notional tons (Table 28).

Forest Department's distribution system, as discussed in Chapter 5, is inadequate to meet the demand because of the short production of commercial quality bamboo. On the basis of 22 years bamboo production data, only 34.66% of bamboo produced from natural forest are of commercial quality (Table 29). Demand-supply situation varies from place to place. Supply may depend on the availability of bamboo in the forest and restrictions imposed upon felling bamboo. Consequently, regional variation in price occurs. Price of bamboo in open market is, in general, higher than that in Forest Department depots.

Table 29: Commercial and industrial bamboo production in Madhya Pradesh

Year	Bamboo production (in notional ton)		
	Commercial	Industrial	Total
1973-74	25 961.54	87 206.06	113 167.60
1974-75	24 553.97	346 668.30	371 222.27
1975-76	42 421.56	283 970.18	326 391.74
1976-77	83 421.70	308 758.28	392 179.98
1977-78	82 183.01	276 852.75	359 035.76
1978-79	106 391.00	294 230.00	400 621.00
1979-80	101 089.39	260 660.00	361 74939
1988-81	111 300.00	226 600.00	337 900.00
1982-83	99 141.00	180 923.00	280 064.00

Year	Bamboo production (in notional ton)		
	Commercial	Industrial	Total
1983-84	77 157.00	160 221.00	237 378.00
1984-85	138 512.00	197 771.00	336 283.00
1985-86	138 000.00	211 000.00	349 000.00
1986-87	107 216.00	218 000.00	325 216.00
1987-88	128 629.00	234 000.00	362 629.00
1988-89	107 841.00	222 813.00	330 654.00
1989-90	193 771.00	115 524.00	309 295.00
1990-91	161 498.00	98 209.00	259 707.00
1991-92	96 150.00	133 566.00	229 716.00
1992-93	93 064.00	152 278.00	245 342.00
1993-94	140 770.00	88 887.00	229 657.00
1994-95	176 617.00	107 526.00	284 143.00
Total	2 332 974.20	4 397 501.50	6 730 475.70
Average	106 044.30	199 886.40	305 930.70

Industrial bamboo

Production of industrial bamboo in the State was 107 526 notional tons in 1994-95, with an average of 199 886.4 notional tons over 22 years. It can be seen from Table 28 that the production of industrial bamboo was more than twice that of commercial bamboo till 1989-90 when it suddenly dropped to almost half that of commercial bamboo. It recovered a little in 1991-92 and 1992-93, but thereafter the production of industrial bamboo has remained far less than that of commercial bamboo.

Industrial bamboo is supplied to papers mills located in the state under long-term agreements. The main beneficiaries are the Nepa Mills, which is a government undertaking, and the Orient Paper Mills, which is a private sector company. Details are given in Chapter 8.

Bamboo used by villagers

Forest department has a distribution system under which bamboos are supplied to different types of users through its chain of depots. The details of this distribution system are given in Chapter 5.

Economic analysis of bamboo production-to-consumption system

To have an idea of the economics of bamboo production-to-consumption system three systems of production need to be considered:

(a) Natural forest-based production;

(b) Village-based (on farm embankments and homesteads) production; and

(c) Plantation-based production.

Natural forest-based production

costs

C_1 Rent of Land: Cost of land (fixed by the government) is Rs 10 000 per ha with the assumption that 25% of productivity of land is in the form of bamboo harvest and the rent @10% would be Rs 25O/ha/year.

C_2 Administration: Salary of staff, establishment, travel, etc. is Rs 22/ha/year.

C_3 Fire protection and tending: Rs ll/ha/year.

C_4 Harvesting: Rs 123/ha/year.

C Total cost: C, + C, + C, + C, = Rs 406/ha/year.

Revenue

1. Yield: Taken on aggregate basis, average yield of bamboo from natural forests in the state is 0.30 t/ha/year on an average, 25% of which is of commercial quality and the rest industrial quality.
2. Price of commercial bamboo: Rs 3 500/t
   Price of industrial bamboo: Rs 1 300/t
3. Revenue = R = Rs 462/ha/year.

Net benefit = R – C = Rs 56/ha/year.
Cost benefit ratio = R / C = 1.14

Village-based production

Almost every household in villages can grow at least 5 clumps on their land at negligible cost. Rural bamboo from villages comes mostly from such lands.

Cost (for 5 plants/clump)

1st year of establishment, including cost of seedlings = Rs 24.58

2nd year onwards – tending = Rs 1.80

8th year onwards – harvesting = Rs 22.50

Income

From 8th year onwards = Rs 187.50

Cost-benefit ratio = 6.449 -(at 8% discount rate)

Net present value (NPV) = Rs 909.54 (8%); Rs 482.06 (12%)

Internal Rate of Return (IRR) = 43.22%

Plantation-based prduction

cost

1. Rent of land= Rs 1 000/year/ha
2. Administration = R!s 198/year
3. Plantation

1st year, establishment tending = Rs 4 24 9.00

2nd year, maintenance – Rs 824.00

3rd & 4th year, maintenance – Rs 484.00

5th year, maintenance (including soil working) = Rs 1 145.00

6th to 32nd year, security and fire protection = Rs 135.00

Harvesting (including transportation up to depot) = Rs 350/t

Cost-benefit ratio = 1.678

Net present value (NPV) = Rs 16 734.52 (8%); Rs 4 014.01 (12%)

Internal Rate of Return (IRR) = 14.51%

Results of economic analysis of these three production systems are summarized in Table 30.

Table 30 : Economics of three bamboo production systems

Parameter	Natural forest-based	Village-based	Plantation-based
NPV 8% (Rs)	648.87	909.54	16 734.52
12% (Rs)	456.77	482.06	4014.01
IRR (%)	Not available	43.22	14.51
B/C ratio	1.14	6.45	1.68

It is evident from Table 30 that there is further scope for improving/expanding all the three bamboo production systems.

Chaturvedi (1986) worked out the economics of bamboo plantation in Uttar Pradesh (Tewari 1992). Initial costs were estimated for a plot of 100 ha in which planting was done at 6 x 6 m spacing. Calculations were based on the assumption that the culm production would start in the 5th year and flowering will set in the 22nd year of planting. The Internal rate of return (IRR) worked out to be 23% and benefit/cost ratio 1.794 at 14.5% rate of discount. In a similar study, Tewari tested the economic parameters of a 1 ha bamboo plantation in Madhya Pradesh. He found the benefit/cost ratio as 1.85, net present value (NPV) as Rs 2 465/haand internal rate of return (IRR) as 18% at 14% discount rate (Tewari 1992).

Scope for improvement/expansion

Improving or expanding the bamboo production-to-consumption system will open up tremendous possibilities of generating more employment opportunities and bettering the welfare of rural people through sustainable utilization of bamboo. As noted earlier, taking the bamboo production in Madhya Pradesh, Maharashtra and Orissa as 745 830 tons, harvesting alone

generated about 6 million workdays in direct employment in those states. This leaves plenty of scope also for self-employment and secondary employment.

In the existing framework, development in the following directions appears appropriate.

1. At present, only the artisan (basod) community utilizes bamboo for making articles of daily use or decorative value. There is a great potential for enlarging this sector. In addition to catering to the needs of rural population, there is need for improving quality of products to make them attractive to urban populace export markets. Expanding markets will generate more employment for artisans and others involved in bamboo craft. Another outcome will be a higher demand for commercial quality bamboo, creating opportunities for farmers to grow bamboo as part of their agribusiness, and giving a further boost to employment.

2. There is already a gap between demand and supply of the main raw material for paper mills – bamboo. As the trend indicates, the gap is likely to widen in the future. This scenario can be seen as an opportunity for extending agro- and farm-forestry practices to include bamboo cultivation. Once the availability of raw material is assured, more paper mills might come up,, creating more employment opportunities, besides the multiplier effect.

3. With the development of agro- and farm-forestry practices and models wherein barren wastelands could be put to use, more bamboo production could be expected. This will go a long way in satisfying the bamboo demand of betel vine growers and bamboo craft workers, whose business could be strengthened and expanded.

Limitations

While developing bamboo production-to-consumption systems for creating more opportunities, one should also be aware of the constraints in terms of technology, information, resource availability and policymaking. The constraint analysis matrix in Table 31 attempts to identify these and suggest interventions.

Table 31: Constraint analysis matrix for bamboo production-to-consumption system

Constraint	Need	Intervention
Technology and Information	Nursery technology, planting techniques, tending and harvesting.	Standardization for evagro-climatic zones (with reference to wastelands also) and developing extension packages.
	Agro-forestry and farm forestry models.	Research and extension.
	Technology for value addition, durability and quality improvement.	Product research and extension.
	Market information.	Market research and information dissemination.
	Training on traditional skills and improved methods of making bamboo articles.	Establishing training centres.
Resources	Availability of sufficient quantity of viable seeds, seedlings, offsets.	Establishment of seed and offset banks, and nurseries by Forest Department.
	Investment capital.	Easy loan facilityfrom banks.
Policy	Rationalization of the price fixed for raw material supply to paper mills.	Price determination should be based on incentive production system.
	Incentives.	Subsidy in the form of low priced planting materials; subsidy for reclaiming wasteland for bamboo cultivation; subsidy for bamboo processing machines.
	Assured sale of bamboo snd bamboo priducts.	Cooperativemarketing; institutional arrangement to promote export.

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