

Status of demand and supply of bamboo: A situational review of national scenario

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Abstract: India has the largest area under bamboo forest/plantations yet its domestic bamboo based industries are swinging in shortage of raw material availability. Around 66 per cent of bamboo resource (growing stock) of the country and 20 per cent of the world is grown in the North-eastern states. The aggregate production of bamboo in the country, both from government as well as private land, falls short by 50 per cent of what is actually required to meet the total annual demand of various bamboo based industries. Major consumers of bamboo in the country include construction sector, paper industry, handicrafts and small and cottage industries. Presently the largest consumer of bamboo in the country is construction sector with annual consumption of 3.4 million tones. Production of bamboo from private land is mostly utilized for domestic purposes. The bamboo economy of the country is still in nascent stage (4% of the global bamboo economy) and is likely to shoot up in near future owing to big programmes like National Bamboo Mission, National Mission on Bamboo Applications (NMBA), initiated by Government of India. The present paper discusses the national scenario of demand, supply, existing demand gap and possible strategies to be followed to bridge the gap and improve the bamboo resource of the country.

Keywords: Bamboo, demand, supply, plantations, marketing.

INTRODUCTION

The bamboo, known as 'green gold', is one of the most important forestry species having major contribution to the rural economy of India. There are 1,575 species of bamboo belonging to 111 genera reported from all over the world (Ohrnberger, 1999). Kumar and Ramesh (2001) have reported 99 species and 3 varieties belonging to 15 genera as native to India. International trade in bamboo is estimated to the tune of US\$ 10 billion and is expected to reach US\$ 20 billion by 2015. Indian share in the global bamboo market is only 4 per cent and is expected to touch the level of Rs. 26000 crores (US\$ 5.7 billions) by 2015 (Planning Commission, 2003). China's share in the world bamboo market is currently the highest at US\$ 5 billion. According to the

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estimates by National Mission on Bamboo Technology and Trade Development under the Planning Commission, Government of India, owing to the versatility of bamboo to be used as best alternative to wood material, the bamboo industrial sector has the potential to replace the projected import of timber to the tune of US\$ 6.7 billion by the year 2025. The Indian bamboo shoots industry has the potential to grow 25 per cent per annum and is expected to garner market worth US\$ 66.6 million. The future outlook for the domestic industry is encouraging and it is likely to witness a growth rate of 15-20 per cent in volume as well as in value trade. The industry is expected to grow by 15 per cent and earn about US\$ 5.7 billion by 2015. The Indian Government is keen to support the development of bamboo industry and aiming it to garner nearly 27 per cent of the global market by 2015.

In India, the total demand of various bamboo consuming sectors is estimated at 26.9 million tones. The estimated supply is only 13.48 million tones *i.e.* only half of the total demand. The major consumer of bamboo include pulp and paper industry, construction, cottage industry and handloom, food, fuel, fodder and medicine which jointly amounts to a value of annual trade of Rs. 2042 crore. Demand of bamboo for industrial use is met from state owned forests, while for non-industrial purposes it comes from private as well as state owned resources.

Keeping abreast of versatility of bamboo uses and its potential to build up the rural economy the Planning Commission, Government of India, launched big programme like NMBA (National Mission on Bamboo Application) and NBM (National Bamboo Mission) to popularize the bamboo as the best substitute of wood and improve the Indian representation in global bamboo market. The present paper gives a review of national scenario of bamboo sector by compiling information from the available literature on demand-supply and existing gap thereof, and possible strategies to be followed to bridge the gap and improve the bamboo resource base of the country.

BAMBOO RESOURCE AVAILABILITY IN THE COUNTRY

India has the largest bamboo resources of the world with 11.36 million ha bamboo area, constituting 16.8 per cent of the total forest area (67.71 million ha) of the country (Table 1). In India, last decade witnessed a gradual increase of 2.4 million ha area under bamboo resource from 8.96 million ha. Together, with China and Myanmar, India has 17.6 million hectares of bamboo reserves which constitutes 75 per cent of the world's bamboo forests (FSI, 2007; Lobovikov *et al.*, 2007). Of the total area under bamboo in the country, nearly 28 per cent is in the North-eastern states followed by Madhya Pradesh (20.3%), Maharashtra (9.9%), Orissa (8.7%), Andhra Pradesh (7.4%), Karnataka (5.5%) and the remaining 20.1 per cent in other states. Around 66 per cent of bamboo resource (growing stock) of the country and 20 per cent of the world are grown in the North-Eastern region (Rai and Chauhan, 1998) (Fig. 1).

The total assessed growing stock (green weight) for the inventorised area was 80.43

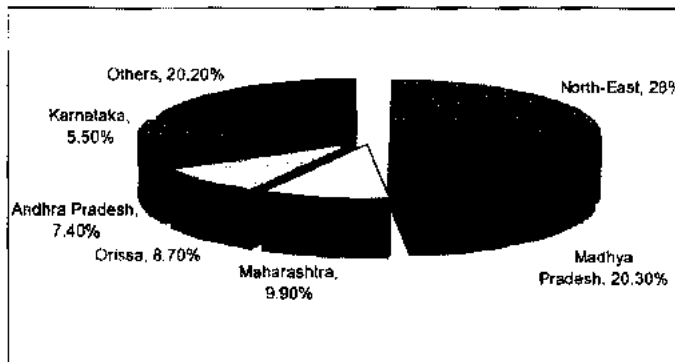
Table1. State wise bamboo resource of the country

States/Region	Area (km ²)	Growing stock (000 tones)
A. Northeast	30,510	54,533
1. Mizoram	9,210	10,890
2. Assam	8,213	13,405
3. Arunachal Pradesh	4,590	9,844
4. Manipur	3,692	11,470
5. Meghalaya	3,108	4,407
6. Tripura	939	860
7. Nagaland	758	3,657
B. Central, Eastern and Western India	46,362	22,225
1. Madhya Pradesh	18,124	9,365
2. Maharastra	8,893	3,796
3. Orissa	7,822	5,290
4. Andhra Pradesh	6,598	1,612
5. Karnataka	4,925	2,162
C. Others	12,703	3,670
Total	89,575	80,428

(Source: Rai and Chauhan, 1998)

million tones. Of this 67.3 per cent is by clump forming bamboos and 32.7 per cent by non-clump forming bamboos (Rai and Chauhan, 1998). The main states/UTs that contribute to the growing stock are Assam (16%), Manipur (14%), Mizoram (14%), Arunachal Pradesh (12%), Madhya Pradesh (12%), Orissa (7%), Meghalaya (6%) and Maharastra (5%) (Fig. 2).

Commercial growing stock, defines as part of the growing stock available for harvesting after one year, constitutes about 13 per cent of the total growing stock. Although, India has larger area of bamboo than China, yet its total and unit growing stock per ha are relatively lower 75 per cent and 30 per cent, respectively due to heterogeneity in species composition (Iobovikov *et al.*, 2007) (Fig. 3).

**Figure 1.** Details of area under bamboo in the country.

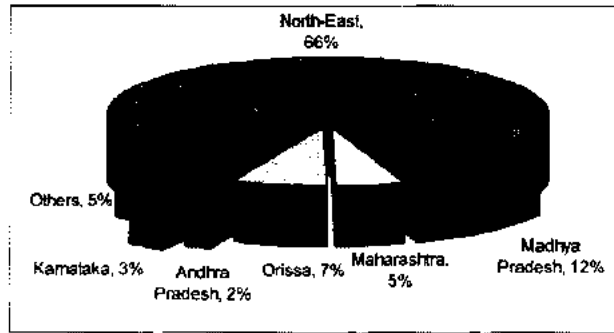


Figure 2. Details of growing stock of bamboo in different parts of the country.

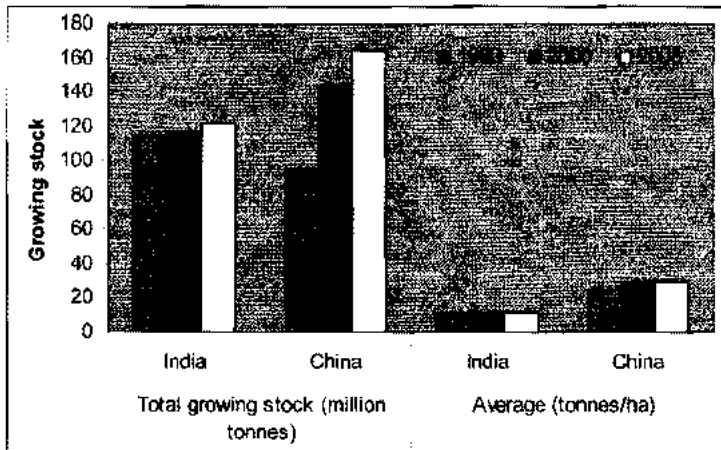


Figure 3. Growing stock of bamboo resource.

Nearly 3 million ha area constituting around 25 per cent of the total bamboo area is planted. Ownership pattern of the bamboo resources in the country revealed 16 per cent area as private and 84 per cent as government forest (FAO, 2006). The share of planted bamboo remained stable, while the total area of bamboo gradually increased (Fig.4).

Bamboo markets of the country

Bamboos are normally marketed either as commercial bamboos or as industrial bamboos. There exists no standard or generalized system of classification for industrial and commercial bamboos (Bhojvaid, 2005). The former are produced from live culms which are 2.5 m to 8 m in length and have 15 cm to 30 cm basal girth. The bamboo culms which are less than 2.5 m in length and have basal girth lower than 18 cm are generally used for industrial purposes. However, different systems of classification are followed in various regions of the country. For instances, in government markets of Northern India, bamboos of 2 m and 1 m length, are sold in the name of *bahi* and *sarava*, respectively, while in private markets the bamboos of different length are

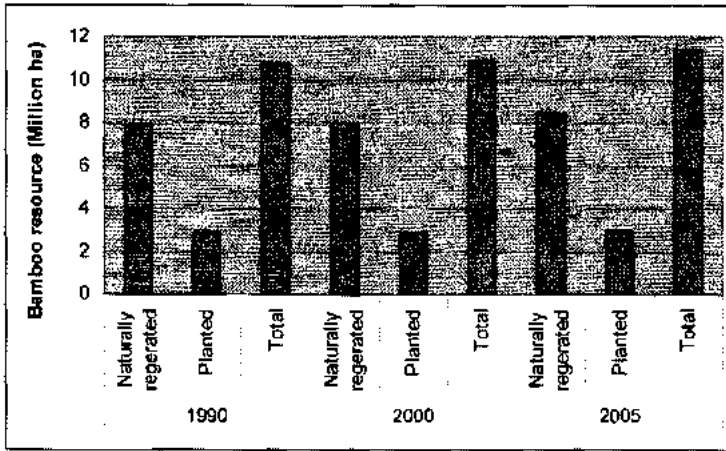


Figure 4. Characteristics of bamboo resource in India.

sold in the name of *kauri* (bundle of 20 bamboo culms). The price of commercial bamboo varies from Rs. 30 to Rs. 100 per culm (1 US\$ = Rs.50) depending upon its length, girth and rigidity. The price of industrial bamboo varies between Rs. 2000-3000 in various timber markets of the country (Timber/Bamboo Trade Bulletin, 2007). The major markets of the country and prices of bamboo prevailing in these markets are given in Table 2.

Price trend of bamboo

Although bamboo has always remained a preferred material by various consuming sectors, yet its price trend shows steady increase during the last six years. It can be

Table 2. Important bamboo market of the country and prevailing retail prices

S. No.	Name of market	Size of bamboo		Price/100 bamboos (Rs.)
		Length (cm)	Girth (cm)	
1.	Andhra Pradesh-Hyderabad	360-450	10-12	2600
2.	Assam-Guwahati	900-1100	18-30	2500-4000
3.	Chhattisgarh-Raipur	460	15-18	1480
4.	Gujrat-Ahemdabad	480	20-24	4000
5.	Jharkhand-Ranchi	300	5	3400-3500
6.	Karnataka- Bangalore	300-450	20-25	7500
7.	Kerala-Calicut	420	20	6000
8.	Madhya Pradesh-Jabalpur	460	15-18	1050
9.	Maharashtra-Nagpur	460	15-18	1200
10.	Rajasthan-Jaipur	360	20-24	3500
11.	Tamilnadu-Chennai	420	20	8000
12.	Uttarakhand-Dehradun	300-360	10-15	1000
13.	West Bengal-Kolkata	600	15-20	4548
14.	West Bengal-Siliguri	975-1000	15-25	3000

(Source: Timber/Bamboo Trade Bulletin, ICFRE, Dehradun, 2007)

attributed to poor quality and uncertainty in the availability. Results of price trends compiled from ICFRE, Timber Trade Bulletin revealed prominent fluctuation in few markets only, while in most of the markets the price of bamboo was observed to be increasing at decreasing rate (Fig. 5).

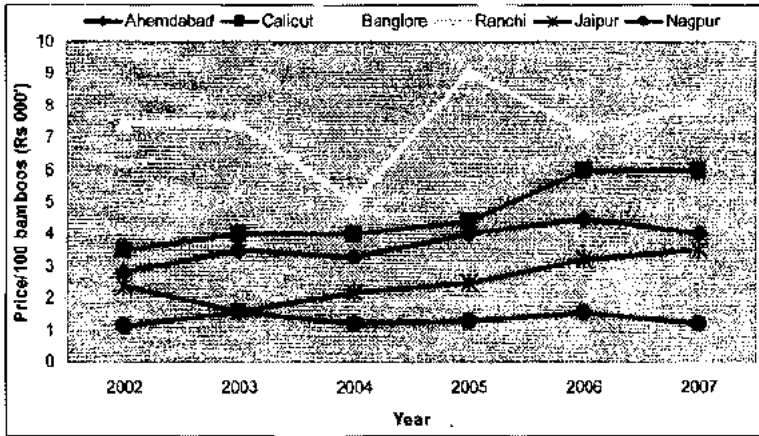


Figure 5. Price trend of bamboo during last six years.

Demand of bamboo and bamboo products

Bamboo provides a cost effective, safe and environmental friendly alternative to wood (Anon, 1976). The consumption of bamboo has increased considerably from 2.2 million tones in 1980 (Varmah and Bahadur, 1980) to 13.48 million tones in 2003 (Planning Commission, 2003) due to the rapid growth of bamboo based industries in the country (Fig. 6). There is huge gap between the current demand (26.9 million tones) and supply status (13.48 million tones). The low supply is attributed to a number of reasons like low level uses, poor productivity (4 tones/ha/year), location of industries away

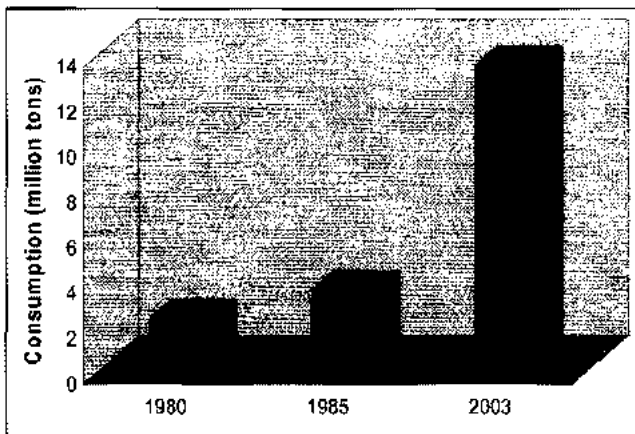


Figure 6. Trend of bamboo consumption.

from the bamboo growing areas, high transportation costs, wastage of quality material, lack of technology for use of inferior bamboo and unmatched use of species, etc.

Presently the largest consumer of bamboo in the country is construction sector (3.4 million tonnes). Sizeable quantity of bamboo is also used by small and cottage industries (3.32 million tonnes), handicrafts (2.55 million tonnes). Of this total supply, only 2.5 million tone is consumed by the pulp and paper industry in a year. Nearly one million tone of bamboo is used by ice-cream, kites and crackers industries and also for other miscellaneous items such as *lathis* and fishing rods. Bamboo shoot industry is estimated with lowest consumption of bamboo (8200 tonnes).

There are 666 units of pulp and paper industries distributed all over the country (TEDDY, 2005). These industries are operating at their 41 per cent capacity and using only 2.5 million tonnes of bamboo (Tewari, 1992). Industries are running at low level because of poor availability of raw material. The pattern of consumption of raw material in these industries includes waste paper (28%), bagasse and agriculture residue (32.3%) and wood (39.3%). Presently, the proportion of bamboo used is only 20 per cent of wood however, if available round the year industry can use bamboo as wood substitute due to its suitability, low cost and role in production of good quality paper. With one per cent rise in per capita income demand for paper increases by 1.5 per cent. With India's per capita income on rise, per capita paper consumption is expected to increase from 4.15 kg in 2002-04 to 8 kg by 2010 and 8.75 kg by 2015 requiring additional supply of bamboo which would be three times to its present consumption (Bihani, 2001; Bhati and Jha, 2006).

Based on the reported consumption of industries engaged in the production of paneled product, Ganapathy (1997) projected the wood raw material requirement by the panel industry for the year 2000, 2005 and 2010 at 2.41, 3.17 and 3.93 million m³, respectively. These estimates were made by assuming 80 per cent capacity utilization. Even taking into account the 30 per cent market penetration by bamboo-based wood substitutes by 2010, there will be a requirement for around 300 manufacturing units of 200 boards (8' x 4' x 12 mm) per day capacity.

Besides this, demand of bamboo is also increasing for new generation products *viz.* laminates, flooring, boards and ply, truck bodies, railway coach, activated carbon, etc. and medicinal products as bamboo has been identified to have medicinal value to cure kidney disorder, asthma and cancer ailments (Fig. 7).

Supply of bamboo

Out of the total growing stock of 80.42 million tonnes only 13.48 million tonnes could be made available to various industrial and commercial users, indicating that so far, we could explore only small portion of our vast bamboo resource. About 28 per cent

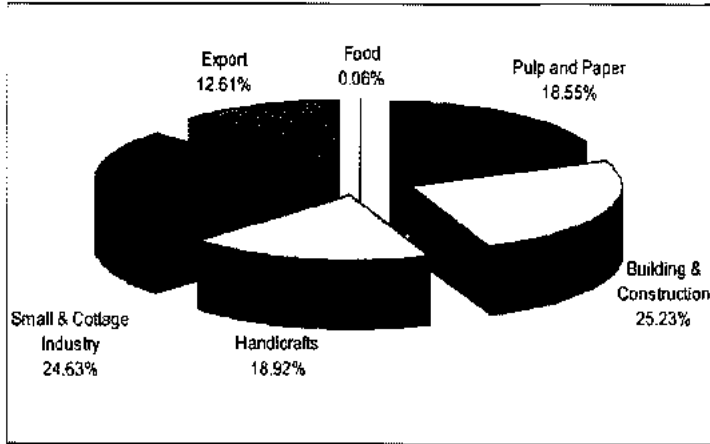


Figure 7. Demand of bamboo in various sectors.

of the total bamboo area of the country is located in North-East India having 66 per cent of the total growing stock. Maximum bamboo for various industrial uses is supplied from North-eastern region. To the total pool of bamboo supply Madhya Pradesh, Orissa and Maharashtra are the major bamboo producing state after northeast. Their per cent contribution in the total supply of bamboo is 12, 7 and 5 per cent respectively, while Andhra Pradesh and Karnataka were recorded with a share of 3 per cent and 2 per cent respectively. Rest of the country contributes only 5 per cent in the supply pool of bamboo (Table 3).

Demand-supply gap

According to Ganguli (2000), India faces severe shortage of wood supply from its

Table 3. Production of bamboo in the country

Year	Production (000' tonnes)
1987-88	642.38
1988-89	829.76
1989-90	1934.59
1990-91	660.12
1991-92	754.64
1992-93	721.34
1993-94	455.4
1994-95	822.63
1995-96	632.54
1996-97	1186.05
1997-98	3629.79
1998-99	1119.67
1999-2000	1261.86
2002-2003	13478.00

(Source: Bhojvaid, 2005 and Planning Commission, GoI, 2003)

forest owing to poor productivity. The demand gap for timber including softwood and hardwood was estimated to be 50 per cent in 2000, which is expected to remain 25 per cent by 2010 and 34 per cent by 2020. The gap is estimated to be shortening in future due to development and availability of wood substitutes. Among such alternatives, bamboo is seen as the best options due to its versatility and applicability to diverse uses. However, in the present scenario, sectors consuming bamboo are also confronted with the shortage of bamboo supply. The demand-supply gap for bamboo followed the same pattern as noticed in case of hardwood and soft wood. The supply from all sources could meet only half of the total bamboo demand of various sectors. The total demand and existing gap is presented in the Table 4.

The data show that most of the bamboo based industries are not operating to their full potential due to shortage in supply (Table 4, Fig. 8). Bamboo shoot industry has been estimated with maximum demand gap percent (88%). It is considered as the most promising sector of bamboo industries which is likely to touch the level of Rs. 4223 crore by 2015. Pulp and paper industry was estimated with 59.7 per cent demand gap followed by tiny and cottage industry, export industry and building and construction industry where demand gap was estimated to be 50.38 per cent, 26.72 per cent and 16.67 per cent, respectively. The least gap in demand and supply was observed in handicraft industry which was recorded to the tune of 8.93 per cent only.

Table 4. Status of demand, supply and existing gap of bamboo industry (million tones)

S. No.	Industry	Total demand	Supply	Difference	Demand-supply gap (%)
1	Bamboo food industry				
(a)	Bamboo shoots	0.0732	0.0082	0.065	88.80
2	Bamboo wood industry				
(a)	Bamboo flooring	0.35	-	0.35	-
(b)	Bamboo board	3.12	-	3.12	-
(c)	Bamboo pulp	6.2	2.5	3.7	59.68
(d)	Bamboo furniture	1.4	-	1.4	-
3	Building and construction sector				
(a)	Scaffolding	4.08	3.4	0.68	16.67
(b)	Housing and temporary structures	0.5	-	0.5	-
(c)	Roads	0.6	-	0.6	-
4	Handicrafts sector				
(a)	Handicrafts	2.8	2.55	0.25	8.93
5	Tiny and cottage industry	0			
(a)	Agarbattis, matchsticks, pencils, looms	3.97	1.97	2	50.38
(b)	Other internal consumption	1.35	1.35	-	-
6	Bamboo joint venture with neighboring countries				
(a)	Export to neighboring countries	2.32	1.7	0.62	26.72
	Total	26.763	13.478	13.285	49.64

(Source: Compiled from NMBTTD report of Planning Commission, GoI, 2003)

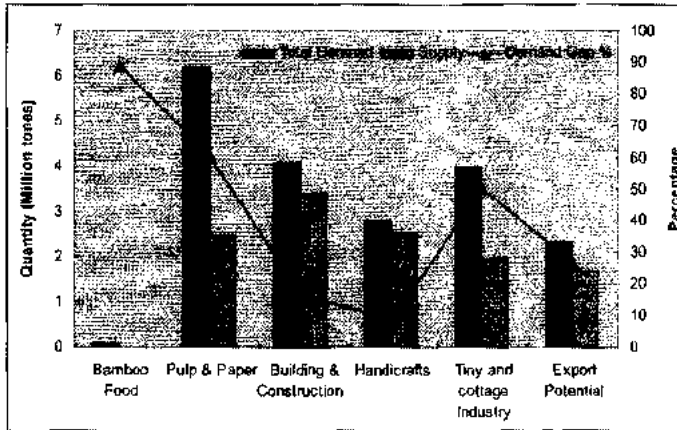


Figure 8. Status of supply and demand gap in bamboo based industries.

There is a growing realization that the potential of bamboo in the country has not been tapped to its fullest. However, the gap between demand and supply is expected to shorten in near future owing to increased attention towards production potential of Indian bamboo reserve, incentives to invest in raising new plantations, commercialization and promotion of value-added bamboo products, *etc.*

Constraints in the procurement of raw material

Despite large reserve and diverse germplasm, availability of raw material is very poor in country. The main reason noticed for the poor availability of bamboo includes:

- Lack of application specific quality material is inhibiting the development of value added applications and enterprises.
- Inaccessibility to the natural plantation area due to difficult penetration, high transportation cost and lack of proper pricing mechanism.
- Lack of management practices to ensure quality and sustainable yield, improved harvesting and enduses oriented preservation and treatment, grading, *etc.*
- Inconsistent supply and poor quality
- Inadequacy of the system to extract and make full use of large volume of bamboo availability from large gregariously flowered bamboo areas especially in Northeast India
- Inadequacy of policies to promote the bamboo as a commercially viable industry. Policy interventions are required to encourage the import substitution and export promotion of bamboo and bamboo based products.

Future strategies

Existence of fairly large gap between demand and supply requires immediate attention to boost the production of bamboo in different parts of the country. Issues related to

proper management to tap the bamboo resource available from large gregariously flowered area, transportation costs, productivity, quality of raw material, *etc.* are needed to be addressed effectively (Pandey and Pandey, 2008). All these measures require careful planning and implementation. Bamboo in addition to massive plantation in forest areas, should also be promoted as component of agro-forestry system and as an agri-horticultural crop as it is amenable to annual harvesting, particularly edible shoots. The strategies to bridge this gap should be well defined, locality specific, oriented to increase the productivity as well as area under bamboo plantation (Kishwan *et al.*, 2006).

Synchronization of bamboo resource growth with industrial growth

The bamboo industry in the country is likely to grow at a compounded annual growth rate of 15 per cent from the year 2001 to 2015 (Planning Commission, 2003). The highest growth is expected in bamboo shoot processing and bamboo flooring industries. A growth rate of 5.5 per cent, 9 per cent, and 20 per cent per year is expected in the paper, scaffoldings, and pencil industries, respectively. Similarly with the acceptance of bamboo as a structural material, its usage in road and housing construction, which may increase at the rate of 10-15 per cent in the initial years is likely to go up to 20 per cent after a few years. The acceptance of bamboo as wood substitute and of bamboo board as a substitute for plywood, is likely to lead to a growth rate of at least 25 per cent per year, since the present low usage is primarily on account of low awareness. The details of bamboo industry growth and additional quantity of bamboo raw material recognized are given in Table 5.

Table 5. Expected growth of bamboo based industries in the country

Industry	Present demand (million tones)	Additional quantity required (million tones)	Growth (%)	Current size of industry (Rs. in crore)	Size of industry by 2015 (Rs. in crore)
Bamboo shoot	0.008	0.065	25	4.8	4272
Bamboo flooring	0.00	0.35	50	0.00	1949
Bamboo board	0.00	3.12	10	0.00	3408
Handicrafts	2.55	0.25	50	765	4312
Paper	2.5	3.7	5.5	250	2088
Scaffoldings	3.4	0.68	9	340	861
Small industries	1.97	2	20	394	3103
Housing and temporary structures	0.00	0.5	15	0.00	1163
internal consumption	1.35	-	-	33.75	58
Export	1.7	0.62		255	1298
Roads	0.00	0.6	25	0.00	1069
Wood substitutes	0.00	1.4		0.00	3260
Total	13.478	13.285		2042.55	26841

(Source: Compiled from NMBTTD report of Planning Commission, GoI, 2003)

Investment to raise new plantations

There is in fact a severe shortage of quality bamboo materials. Hence, the need for new bamboo plantations, in the form of 'industrial plantations' to raise special purpose/ species needed by the industry or crafts have to be identified. State-wise new areas should be selected to raise industrial bamboo plantation. Lack of technologically sound programmes and incentives are the major causes in raising new plantation. In the present scenario, private plantations are being raised primarily as wind break to secure protection to mango orchards, agricultural crops, soil conservation, and to meet the need of domestic consumption and construction sector, while commercial motives to raise bamboo on private land is still a far cry (GVEPJS, 2008). To meet the growing demand of bamboo industry in the country plantation stock on both government as well as private land should be increased by integrating the plantation programmes with employment generations and other community developmental works. National Bamboo Mission, realizing the importance of increasing bamboo resources has proposed the expansion of 1.76 lakh ha bamboo plantation both in forests and non-forest areas during XIth Five Year Plan (NBM, 2006).

Improvement in the bamboo resource productivity

The productivity and quality of natural bamboo forests of the country are poor due to lack of cultural operations for clump management, irregular schedule/cycle of harvesting the mature culms, unskilled manpower and financial limitations to undertake massive operations in bamboo plantation. Currently, the productivity of bamboo forests in the country is only 4 tones/ha/year. It is to be increased to the level of 18 tones/ha/year to bridge the large demand supply gap (NBM Document, 2006). The NBM proposed the stock improvement and management programme for the next Five Year Plans to upgrade the existing plantation stock and improve the productivity. It is targeted by the mission to produce 3.02 million tones of bamboo per year from 4th year of completion of plantation targets.

Value-added products

Slight value addition at source would not only increase the profits of growers but also minimize the transportation cost (Punhani and Pruthi, 1991). Looking at the growth of bamboo value added products (15% compound annual growth rate) the small processing units should be established in the vicinity of bamboo producing areas. The most appealing aspect of the industry is that with a few simple forms like slivers, round strips and splints, numerous value-added applications can be achieved at local level by spending very little amount.

Setting up better marketing facilities

The modern approach to foster the marketing of forest produces relies upon the sound

and effective information management system. However, given the present bamboo markets situation, lack of knowledge of nature of operation, make the producer's interests unsafe. Beside this, bamboo markets, monopolized by big traders, offer little benefits to the market segments operating at lower levels. Absence of common interface to exchange information complicates the situation reflecting inability of various market functionaries in taking decisions and devising strategies of proper marketing. Development and establishment of Market Information Services (MIS) that can provide information and common interface to the bamboo stakeholders, hold the keys to overcome the existing complex situation of bamboo marketing (Gera *et al.*, 2003). Regional markets of bamboo should be established. National Bamboo Mission, look to establish new 195 *bazaars* (markets) for providing better marketing facilities to the growers of bamboo. It should be done on priority basis as the better marketing regimes act as the soul of the development. Markets should be studied to identify the main aspects like input supplies, expected output increase, market potential (demand) and capacity of marketing system to handle increased output and anticipated government interventions (Ranweera, 1984).

Mechanism to utilize bamboo of gregariously flowered area

Large volume of bamboo become available in gregariously flowered areas. But due to inadequacy of mechanism and strategies of utilization such big volume goes waste without being tapped for contributing to the industrial demand (Kishwan *et al.*, 2006). A data base on bamboo plantation area and their probable time of flowering should be prepared to formulate strategies to absorb the huge bamboo material produced from such regions.

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