

3. Bamboo products and trade

BAMBOO PRODUCT STATISTICS

OVERVIEW

Forest resources are experiencing increasing pressure due to the growing world population and improving living standards. Bamboo is the most important non-wood forest product and in India is known as the 'poor man's timber'. In China, it is the valuable raw material for the booming bamboo industry.

During the last 15–20 years, bamboo has developed as an exceptionally valuable and often superior substitute for wood. Bamboo-based panels and boards are hard and durable and may successfully substitute for hardwood products. Bamboo may replace wood in many industrial applications and thereby contribute to the saving and restoration of the world's forests.

Bamboo is a major construction material in many countries, particularly in rural areas. It can be used for almost all parts of houses, including posts, roofs, walls, floors, beams, trusses and fences. People also use bamboo to produce mats, baskets, tools, handles, hats, traditional toys, musical instruments and furniture. In the food sector, bamboo shoots are becoming more popular. Bamboo has a tremendous potential for economic and environmental development and international trade.

Bamboo raw materials

Bamboo is a non-durable resource. Its use in exposed conditions requires prior treatment (Liese and Kumar, 2003), while its use can be further enhanced through the application of modern engineering techniques. Bamboo can be processed into modern products (engineered bamboo) that may successfully compete with wood products in price and performance. Use of bamboo in composite panels and boards overcomes differences in quality related to the culms and allows the production of homogeneous products. Engineered bamboo may well replace wood, steel and concrete in many uses.

Bamboo charcoal

Bamboo charcoal is traditionally used as a substitute for wood charcoal or mineral coal. It can serve as a fuel, absorbent and conductor. The calorific value of bamboo charcoal is almost half that of oil of the same weight. Activated bamboo charcoal can be used for cleaning the environment, absorbing excess moisture and producing medicines. The absorption capacity of bamboo charcoal is six times that of wood charcoal of the same weight. China is a leader in its production. At present, Japan, the Republic of Korea and Taiwan Province of China are the main consumers, but its importation is rapidly expanding in Europe and North America. There are three main reasons contributing to the success of bamboo charcoal in international trade: 1. bamboo grows faster and has a shorter rotation compared with tree species; 2. the calorific value and absorption properties of bamboo charcoal are similar to or better than those of wood charcoal; and 3. it is cheaper and easier to produce.

Bamboo housing

There are three main types of bamboo housing: 1. traditional houses, which use bamboo culms as a primary building material; 2. traditional *bahareque* bamboo houses, in which a bamboo frame is plastered with cement or clay; and 3. modern prefabricated houses made of bamboo laminated boards, veneers and panels. Experts estimate that over one billion people live in traditional bamboo houses. These buildings are usually cheaper than wooden houses, light, strong and earthquake resistant, unlike brick or cement constructions. New types of prefabricated houses made of engineered bamboo have certain advantages. They can be packed flat and transported long distances at a reasonable cost. They are better designed and environmentally friendly. Bamboo materials are widely available and can be cultivated at a low cost.

Bamboo pulp, paper and cloth

Several bamboo-producing countries, such as China and India, use bamboo in pulp, paper and more recently cloth. Bamboo paper has practically the same quality as paper made from wood. Its brightness and optical properties remain stable, while those of paper made from wood may deteriorate over time. The morphological characteristics of bamboo fibres yield paper with a high tear index, similar to that of hardwood paper. The tensile stiffness is somewhat lower compared with softwood paper. The strain strength is between that of hardwood and softwood papers. The quality of bamboo paper may be improved by refining the pulp.

Bamboo panels

China started producing bamboo panels in the early 19th century. At present more than 20 different types of panels are produced in Asia. Bamboo fibre is longer than wood fibre, which gives bamboo some technological advantages. The panels are widely used in modern construction as structural elements or as forms for concrete moldings. They are also used for flooring, roofing, partitions, doors and window frames. Bamboo panels have some advantages over wooden boards due to their rigidity and durability. Various types of bamboo veneers, panels and boards can be broadly classified as follows: veneers, stripboards, matboards, fibreboards, particle boards, medium density boards, combinations of these, and combinations of these with wood and other ligno-cellulose materials and inorganic substances.

Bamboo flooring

Bamboo flooring is a quality product that can be used widely and has a large, global consumer market. It has certain advantages over wooden floors due to its smoothness, brightness, stability, high resistance, insulation qualities and flexibility. Bamboo flooring has a soft natural luster and maintains the natural gloss and elegance of bamboo fibre. This flooring is attractive to the demanding markets in Europe, Japan and North America. The estimated annual production of bamboo flooring in China was 17.5 million m² in 2004. Exports account for some 65 percent of total production (Customs General Administration of China, 2004).

Bamboo weaving products and crafts

Bamboo crafts and woven mats are traditional products in China, India, Malaysia, the Philippines and Thailand. The technique has been known for several thousand years. These diverse products have become an indispensable part of daily life, literature and art. There are nearly 20 categories of woven bamboo products in Asia, including fruit baskets, trays, bottles, jars, boxes, cases, bowls, fans, screens, curtains, cushions, lampshades and lanterns.

Bamboo fuel

Through pyrolysis, bamboo can be converted into three valuable products: bamboo charcoal, oil and gas. Changing the pyrolysis parameters can change the product shares depending on the purpose and market conditions. Bamboo extracts contain valuable elements and can be used in pharmaceuticals, creams and beverages. Bamboo gas can be used as a substitute for petroleum. Bamboo charcoal is an excellent fuel for cooking and barbequing. Activated charcoal is used as a deodorant, purifier, disinfectant, medicine, agricultural chemical and absorbent of pollution and excessive moisture.

Bamboo shoots

About 200 species of bamboo can provide edible and palatable bamboo shoots, including: 1. monopodial bamboos: *Acidosasa edulis*, *Chimonobambusa quadrangularis*, *Phyllostachys heterocycla* var. *pubescens*, *P. praecox*, *P. dulcis*, *P. iridescens*, *P. makinoi*, *P. nuda*, *P. prominens*, *P. sulphurea* cv. *viridis*, *P. vivax*, *Pleioblastus amarus* and *Qiongzhuea tumidinoda*; and 2. sympodial bamboos: *Bambusa rigida*, *B. pervariabilis*, *Dendrocalamus latiflorus*, *D. asper*, *D. brandisii*, *D. hamiltonii*, *Dendrocalamopsis oldhami*, *D. beecheyana*, *D. beecheyana* var. *pubescens*, *D. stenoaurita*, *D. vario-striata* and *Schizostachyum funghomii*. Fresh bamboo shoots are delicious and healthy, with a high fibre content. Bamboo vegetables can be found in Chinese grocery stores and restaurants

worldwide. After cooking the shoots are still crisp, because cooking does not destroy their texture. Cooked bamboo shoots can be stored in containers and shipped worldwide.

Bamboo furniture

Traditional bamboo furniture uses natural round or split bamboo. A new type of 'pack-flat,' 'knock-down' furniture uses glue-laminated bamboo panels. Unlike the traditional design, this furniture may be shipped in compact flat packs, to be assembled on the spot. The new design overcomes many of the problems of traditional bamboo furniture, such as high labour and transportation costs, low productivity, instability, varying quality and susceptibility to insects and fungi. At the same time, it retains the distinct physical, mechanical, chemical, environmental and aesthetic features of bamboo. Export of laminated bamboo furniture is growing rapidly. However, trade statistics currently do not capture the value, owing to the absence of a special code for bamboo furniture. It is usually classified as wooden furniture.

Bamboo and culture

Bamboo is an important resource, which was discovered, adopted and developed by humans in ancient times. The first scripts were written in China on strips of bamboo more than 6 000 years ago, during the Neolithic period. Bamboo pens, brushes and musical instruments were invented 3 000 years ago. The first paper was produced from bamboo in China in the ninth century. Bamboo culture is an essential part of human history and civilization, especially in Asia.

Bamboo and the environment

Bamboo protects steep slopes, soils and water ways, prevents soil erosion, provides carbon sequestration and brings many other ecosystem benefits.

BAMBOO REMOVALS

OVERVIEW

About 2.5 billion people in the world depend economically on bamboo (INBAR, 1999), and international trade in bamboo amounts to about US\$2.5 million (INBAR, 2005). National and local trade is likely a few times higher. There are other numerous examples of the importance of bamboo for national economies and international trade. However, reliable statistics are still lacking. Most of the economic activities related to bamboo are not recorded officially. They are site-specific, highly diverse and present challenges for official data collection (FAO, 2001a).

Non-wood forest products, including bamboo, do not have standard classifications. They are usually classified according to their structure (roots, leaves, bark) or the end use (medicine, food, beverages, utensils, etc.). Bamboo product classification is even more complicated due to the multifunctionality. Bamboo can be attributed to almost all NWFP categories. It can be used for construction, pulp, board, cloth, food, fuel, medicine, utensils and crafts.

The growing industrial and environmental importance of bamboo requires development of more comprehensive statistics on bamboo resources, utilization and trade. In 2005 the World Customs Organization (WCO) approved an FAO/INBAR proposal to introduce 16 new Harmonized System codes, including bamboo pulp, panels, furniture and shoots. The new codes will take effect in 2007 and will have a profound long-term effect on bamboo statistics and the facilitation of bamboo trade and development (Annex 5).

TABLE 10
Bamboo removals, bamboo products and their value

	Quantity (1 000 tonnes)			Value (million US\$)		
	1990	2000	2005	1990	2000	2005
Bamboo removals						
Bangladesh	993	-	-	-	-	-
Chile	-	6	13	-	1	3
China^a	260 000	610 000	1 230 000	173	762	
Ecuador	35	36	53	1	1	3
Ethiopia (fuelwood)	-	6	-	-	-	-
India	-	-	14 615	-	-	409
wood	-	-	13 470	-	-	409
fuelwood	-	-	1 145	-	-	-
Indonesia	44	215	-	3	4	-
Japan	200	60	40	53	20	12
Malaysia	10	4	-	n.s	n.s	-
Myanmar	7 753	8 481	9 803	660	357	261
Nigeria	-	6 900	7 320	-	65	96
Pakistan	61	95	136	15	23	32
Philippines	16	19	21	n.s	n.s	n.s
Sri Lanka^a	271	1 000	1 500	-	-	-
Other bamboo products						
China						
bamboo shoots	82	346	467	193	539	
bamboo building timber ^b	165	400	-	39	-	-
bamboo pulp	177	300	500	-	-	-
utensils ^c	90 880	-	-	10		
India						
bamboo shoots	-	-	8	-	-	1
utensils	-	-	6	-	-	-
other plant products	-	-	4	-	-	13
Indonesia (bamboo shoots)	-	1	-	-	n.s	-
Republic of Korea	2	1	-	n.s	2	-
Myanmar	11 992	20 418	73 988	49	25	47
bamboo shoots	n.s	1	1	n.s	n.s	n.s
utensils	354	296	459	47	20	20
other plant products (pulp)	11 638	20 121	73 528	2	5	27
Philippines (utensils)^c	45	72	-	2	3	-
Turkey (ornamental plants)^c	-	3	4	-	n.s	n.s

^a 1 000 culms.

^b 1 000 m³.

^c 1 000 pieces.

The issue of statistics was addressed in a study on the bamboo and rattan database for Asia (Pabuayon and Espanto, 1997) and in a series of studies of production-to-consumption systems (INBAR, 1999). The most comprehensive information comes from countries in which bamboo is an important economic asset. The main examples are China, India and Japan. The latest data from China indicate that the Chinese bamboo industry created a value of US\$5.5 billion in 2004. The bamboo-based GDP grew by 120 percent from 2000 to 2004, while export earnings reached US\$600 million, a 20 percent increase (ITTO, 2006).

Table 10 represents a summary of the bamboo removals, products and value presented in the country reports. The submitted data are scattered and incomplete and reflect the current status of bamboo statistics. Country data were collected using various methodologies.

Bamboo is recognized as a wood substitute for its potential to reduce pressure on naturally regenerated forests. According to FRA 2005, 40% of the recorded removals from forest were for fuelwood or charcoal.

ASIA

Bangladesh. The report provides data on bamboo removals extracted from studies published between 1981 and 2000. The studies indicate that over 700 million bamboo culms are removed annually (corresponding to almost 1 million tonnes). Approximately 200 million culms come from state forests and 500 million are logged in village forests. The information on bamboo production did not include explanatory notes. Categories reported include food, medicine, ornamentals, crafts, utensils, construction, basketry, furniture, tools, fuel and fodder.

China. The National Forestry Statistical Yearbook includes yearly data on removals and value of bamboo products. China represents an outstanding exception in terms of accuracy and amount of recorded data. The yearly figures were calibrated for three time periods, including projections for 2005. The value of bamboo culms and products was calculated according to the market price. The Chinese report is the most comprehensive, although it has a number of information gaps. The figure for bamboo poles reported in Table 10 does not include the small bamboo used for pulp and crafts (135 million tonnes in 2003).

India. The data provided in the country report did not include explanatory notes. The National Mission on Bamboo Technology and Trade Development, Government of India, was cited as the main information source. Further information from an INBAR study indicates that the annual bamboo harvest (poles and shoots) was slightly over US\$23 million (Pabuayon and Espanto, 1997). Uncertainty regarding the methodologies used does not allow a comparison between the official and research data.

Indonesia. A conversion coefficient (7.5 kg/culm) was used to convert harvested culms into dry weight. The amount and value of bamboo removals are likely to be underestimates of the real volumes. Contribution of bamboo to the domestic market is probably much more substantial. The amount and value of the bamboo shoots produced does not include rural consumption at the local level.

Malaysia. Bamboo removals were reported in culms and weight, with a conversion factor of 12.5 kg per 6 m of culm. The harvest of 1990 was estimated based on royalty collection. The harvest of 2000 was obtained from a country report to FAO (Malaysia, 2003). The data do not include removals outside of forests, which are not subject to royalty payments.

Myanmar. The Forest Department Planning and Statistics Division compiled the report based on regional data. The number of stems was converted into tonnes with a conversion coefficient of 400 stems per tonne for monopodial and 120 stems per tonne for sympodial bamboo. The reporting table includes private trade and household use, and the figures of removals reported include 100 tonnes of fuelwood in each reference year. The Ministry of Forestry and Ministry of National Planning and Economic Development estimated bamboo consumption per average household. According to this report, bamboo use for pulp and paper amounted to 43 245 tonnes in 1990, 103 597 tonnes in 2000 and 60 412 tonnes in 2004. Supply lagged behind demand. The average export price ranged from US\$24 to US\$150 per tonne. There was no export in 1990/91. Bamboo charcoal export in 2000 reached US\$16 852. Bamboo shoot production data were collected from some states and estimates were made for the other areas. The reporting unit *viss* was converted to tonnes by using a conversion coefficient of 612.3952 *viss* per tonne. Raw material for utensils, crafts and construction constitutes 30 percent of total bamboo stem production. On average, 170 tonnes of bamboo shoots are exported annually, with a

market price of US\$210–600/tonne. The value of annual exports of chopsticks, bamboo wares, etc. varied from US\$880 000 to US\$1 120 000 during 2001–2003.

Pakistan. The figures reported for bamboo removal are the same as those reported for commercial growing stock. However, it is arguable whether all commercial stock is actually removed, so the data should be interpreted as the value of the standing commercial stock. The value indicated was obtained with the assumption that one culm weighs on average 14–15 kg and can be sold at 200 Rs. One US\$=60 Rs.

The Philippines. The data provided were obtained from the Philippine Forestry Statistics Yearbook under the category 'Selected non-timber-forest-products export' for 2001.

Republic of Korea. The data on bamboo shoots were obtained from the Korea Forest Service. Its annual report attributed the increasing value of bamboo to increased prices and exchange rates.

Sri Lanka. The table refers to a single species (*Bambusa vulgaris*), which is in high demand as a raw material for construction. The figures were derived from state-issued permits for bamboo transportation. In rural areas, however, most bamboo is harvested and used without records.

AFRICA

In Africa, the share of removals from forests used for fuel is substantially higher (FAO, 2006). Although little quantitative information was presented on bamboo removals and products, several countries indicated that bamboo energy use is substantial in rural areas.

Lack of knowledge of bamboo management and utilization is indicated as the main obstacle to developing the bamboo sector on the continent.

LATIN AMERICA

From this region, Chile and Ecuador provided information. Chile estimated that 4.5 million culms were traded in the country in 2000 and over 10 million culms in 2005 (corresponding to approximately 6 000 tonnes in 2000 and 13 000 in 2005), with a market value of US\$3 million in 2005. Most of the bamboo trade is not formally recorded. Ecuador harvested 36 000 tonnes in 2000 (US\$1.2 million) and 53 000 tonnes in 2005 (US\$3 million). These figures reflect the annual allowable cuts of bamboo issued by the Ministry of the Environment.

BAMBOO TRADE

Statistics on bamboo include four main elements: resources, production and national and international trade. The last are likely the most complete, but are still far from perfect.

The most recent and comprehensive information on international bamboo trade is collected in INBAR's online International Bamboo and Rattan Trade Database. The database has been tracing bamboo and rattan international trade since the early 1960s. It is based on the COMTRADE statistics of the United Nations Statistical Division, which rely on the WCO six-digit Harmonized System (HS) codes (World Customs Organization, 2002). The codes may include some other commodities mixed with bamboo, such as osier, willow and vegetables. However, as mentioned, they do not capture the rapidly growing trade in new industrial commodities, such as bamboo pulp, paper, boards, panels, parquet floors, furniture, charcoal, medicines, cosmetics, etc. In 2005, as mentioned earlier, WCO approved the joint FAO/INBAR proposal to introduce a new series of six-digit codes for recording the international trade in bamboo and rattan.

According to INBAR's trade database, the annual export of bamboo in 2000 was valued at about US\$2.5 billion (Table 11). China, Indonesia and Viet Nam were the major bamboo producers and exporters

in Asia. The total value of exports of raw bamboo is about US\$89 million. China exported some US\$25 million worth of raw bamboo, roughly a third of the world total. It was followed by Indonesia (US\$10.6 million, 12 percent) and Viet Nam (US\$7.7 million, 8.6 percent). Singapore and Hong Kong were important bamboo and rattan processing centres and exporters. There was a US\$18.6 million trade of bamboo raw materials in Singapore, which accounted for over 20.9 percent of world trade. Hong Kong's annual trade value was US\$4.69 million, which accounted for 5.3 percent of the world total.

TABLE 11
Export of bamboo products in 2000 (million US\$)

	Africa	Asia	Europe	North and Central America	Oceania	South America	Total
Bamboo products	29	1 554	739	120	8	5	2 455
Market share %	1.2	63.3	30.0	4.9	0.4	0.2	100.0

The main importers together make up some 80 percent of the world bamboo import trade (Table 12). The European Union, Hong Kong, Japan and the United States were the major markets for bamboo products, collectively accounting for 71 percent of the total market share.

TABLE 12
Main importers of bamboo products in 2000 (million US\$)

	USA	UK	Netherlands	Germany	France	Japan	Hong Kong	Others	Total
Bamboo import	899	125	106	169	169	349	163	475	2 455
Market share %	36.6	5	4.3	6.9	6.9	14.2	6.6	19.3	100.0

According to Chinese customs statistics, the total trade value of nine bamboo commodities (identified by country-specific, eight-digit codes) was over US\$517 million in 2002 (Table 13). This is 9.4 percent more than the average for the previous four years, 1998–2001.

TABLE 13
Bamboo export value in China 1998–2002 (1 000 US\$)

	Products	Average 1998–2001	2002
07099010	Bamboo shoots, fresh or chilled	4 874	4 957
07119031	Bamboo shoots, in brine	6 376	7 346
07129010	Bamboo shoots, dried	10 469	11 359
14011000	Bamboo, used primarily for plaiting	26 486	25 665
20059030	Boiled bamboo shoots in airtight containers	123 406	116 989
46012090	Mats, matting and screens made of bamboo	20 204	41 424
46021030	Basketwork, wickerwork and other articles of bamboo	103 916	138 199
94015000	Seats of cane, osier, bamboo or similar materials	19 999	21 157
94038010	Other furniture of cane, osier, bamboo or similar materials	34 007	33 627
Total		473 149	517 719

Source: Customs General Administration of China, 2003.

Bamboo serves numerous small users around the globe, but international trade statistics show that it has also become a very competitive resource in the international arena. Small, medium and large-scale industries should be promoted further to more effectively facilitate poverty reduction and sustainable economic and environmental development in the developing world. With modern techniques and technology, bamboo can be processed into a wide range of commodities. Engineered bamboo successfully competes with wood and other raw materials in highly demanding international markets. Trade statistics are important not only for market analysis, but also for assessment of the sustainability of bamboo resources.