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# Market Potential of Bamboo and Rattan Products

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INBAR

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# Foreword

"Bamboo and rattan are two of the most valuable Non-Timber Forest Products in the world today, providing livelihoods to millions of people across the tropical and subtropical regions of the globe. Increasingly their products are also sold to consumers further afield in the more affluent regions of the world.

Making products from bamboo and rattan often involves a series of stages, from growing and harvesting the bamboo or rattan in the forest, through a range of processing stages, to final production of the finished item, and then marketing. This last stage is perhaps the most important, as earning incomes from bamboo and rattan products necessarily requires that the products meet market demand.

Over the past decade since INBAR became the International Commodity Body for Bamboo and Rattan of the Common Fund for Commodities (CFC), INBAR has pioneered the establishment of a number of CFC-funded value chain projects in bamboo and rattan in Asia and Africa that show real improvements in the incomes generated by the producers within sustainable market environments.

This book takes a product approach to encapsulate the experiences gained by INBAR and our partners during the development, implementation and evaluation of the projects, and is aimed at inspiring others to adopt and adapt the products and their production chains for community-based income generation and poverty alleviation."

Coosje Hoogendoorn
Director General
International Network for Bamboo and Rattan (INBAR)

# Why bamboo can play an important role in rural development

Bamboo, a giant woody grass that grows throughout the tropics and subtropics, provides rural farmers and foresters with unparalleled opportunities to access a diverse range of markets. With over 100 species used commercially around the world, bamboo-based production is an excellent means of generating sustainable economic growth and rural employment for the following key reasons:

1. Bamboo has a fast growth rate and, after 4-6 years of planting, can be used dually for the production of timber and edible shoots in short rotation cycles that have similar land and labour productivities as agricultural crops. This makes bamboo an economically attractive land-use option for farmers;

2. Bamboo can be managed with very few agricultural inputs even on small areas of land unsuitable for agricultural crops. This provides a low-maintenance, regular source of income for smallholder farmers and households;

3. Bamboo's spreading, rhizomatous root systems help bind soil and prevent erosion;

4. Bamboo, with its lightweight and linear-splitting nature, is comparatively easier to process than timber. This provides farmers, who are often women, with opportunities to engage in initial processing and thus increase their share in value addition;

5. Bamboo has a multiple array of high-value end-uses, such as laminated plywood, flat-pack furniture and activated charcoal. This allows for non-competing diversification of production within a region;

6. Markets for bamboo are growing rapidly, as many countries have an increasingly insufficient capacity for wood production and bamboo is a very versatile and highly effective substitute for timber.

# Why rattan can play an important role in rural development

Rattans are palms that grow in the tropical regions of Africa and Asia. Rattan has been an important source of income for many rural forest-dependent communities for centuries, who use it to produce household items, such as baskets and furniture. Since the 18th Century, the market for rattan furniture in the more affluent countries has developed, and there exists now a thriving export market for higher quality rattan furniture. With over 600-known species around the world in 13 genera, rattan-based production can be an excellent means of generating sustainable economic growth and rural employment for the following key reasons:

1. Producing furniture from rattan involves many processes in the production chain, all of which add value, and all of which represent income-generating opportunities.

2. Producing goods from rattan creates community-based jobs, many of which are for semi-skilled labour in processing and finishing, which require training to increase individual's skills and thus helps empower them.

3. The market for rattan remains strong, especially exports of high-value furniture. The organic nature of the material makes it particularly popular in an increasingly environmentally-aware market.

In many places, rattans are threatened by overharvesting and by destruction of the forests in which they grow. Developing sustainable rattan businesses can potentially help increase broader management of tropical forest resources and reduce damage to the forests. In other locations, rattans are plentiful, but the production chain is not based on community management.

# The global market of bamboo and rattan products

Trading in bamboo and rattan, particularly in value-added products, such as bamboo shoot, charcoal, bamboo panels, flooring tiles, handicrafts and housing materials, has the potential to make positive contributions to the global environment and economy. In recognition of this potential, in 2007, 14 new 6-digit individual codes for bamboo and rattan were introduced under the Harmonized Commodity Description and Coding System (HS) for global trade, an increase from only two specified for bamboo and rattan earlier. These individual codes cover bamboo and rattan raw materials, plaiting articles, furniture and seats, as well as bamboo charcoal, flooring, plywood, pulp, paper and preserved bamboo shoots. The new codes reflected the significant changes in the bamboo and rattan industry sector and the increasing trade in bamboo and rattan over the years.

Based on available United Nations Comtrade data, the global export value of bamboo and rattan commodities[1] has been estimated to have increased to US$4.3 billion in 2005 from US$2.8 billion in 1995, with furniture export growing steadily from US$1.3 billion to US$2.4 billion. During the same period, the export of raw materials saw a 42% fall from US$158 million to US$91 million, while the export of bamboo and rattan plaited articles, the most traditional of bamboo and rattan products in global market, registered a 21% growth (Figure 1).

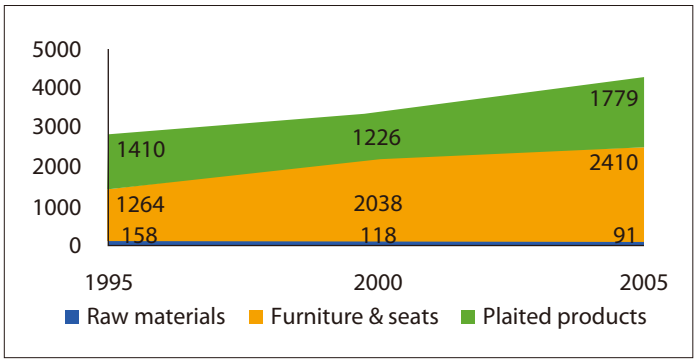


*Figure 1: Global export values of bamboo and rattan products (US$ million)*

[1] *HS codes for bamboo before 2007 were normally mixed with wooden or plaiting materials (rattan, willow, etc.), except the code for raw bamboo. Therefore, the total export value of bamboo and rattan with HS codes before 2007 must be overestimations.*

According to incomplete UN Comtrade statistics, in 2009, the global export value of bamboo and rattan commodities[2] was about US$1.82 billion, showing a decline of US$750 million from the export value for 2008, when the total world export of bamboo and rattan was estimated to be US$2.56 billion, up from the US$2.35 billion in 2007. This decline is attributed to the global financial crisis of 2008. The total import value of bamboo and rattan commodities in 2009 was about US$1.6 billion. The difference in export and import values of about US$237 million in 2009 is accountable to factors, such as the costs of re-export, re-import, transportation, and currencies exchange. The 2009 export values of bamboo and rattan raw materials, bamboo shoots, bamboo plaited products, rattan plaited products, bamboo and rattan furniture and seats, and bamboo processed products are shown in Figure 2. Traditional bamboo and rattan products, especially the plaited products, including mats and screens, baskets and wicker work products, and semi-finished plaiting articles, continued to be the main contributor (40%) to the global export market. The further-processed bamboo products, such as flooring, panels, charcoal, pulp and paper, constituted 23% and bamboo and rattan furniture accounted for 21% of the total export.

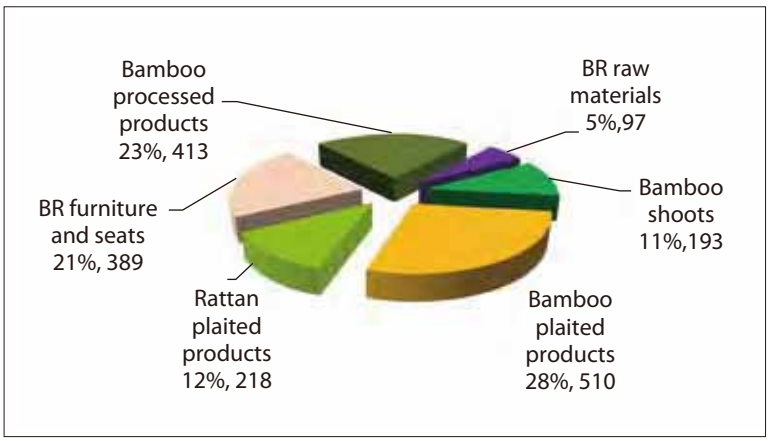


*Figure 2: Trade breakdown of bamboo and rattan commodities in 2009 (US$ million)*

[2] *A few countries – including the very important producers, such as Indonesia, Myanmar and the Philippines – have not uploaded data to UN Comtrade. For these countries, the data provided for 2009 are estimates by their trade partners.*

Besides the international market, bamboo and rattan products have broad domestic markets in many countries, especially in those Asian countries that are traditionally bamboo and rattan producers and consumers. For example, in China, the largest bamboo producer and exporter in the world, there has been a rapid increase in both internal and external trade in the past few years. The total export trade value of bamboo products in China increased to about US$1.6 billion[3] in 2008 from US$0.4 billion in 1992, with an average annual growth rate of 17% during the period. Statistics show that China's bamboo industry output reached about US$2.5 billion in 2000 and boomed to approximately US$14 billion in 2010, which is obviously much more significant than its external market.

Most of bamboo and rattan commodity trade occurs within Asia, in Europe, and between Asia and Europe and North America. Asian producer countries with abundant bamboo and rattan resources are key exporters who contributed about 83% of the global bamboo and rattan export value in 2009, while consumer countries in Europe and North America form the major import market with their imports accounting for 71% of the global import value in 2009. As the largest exporter of bamboo and rattan commodities in the world, China made up 57.3% of the global bamboo and rattan exports worth US$1.0 billion in 2009, followed by Indonesia and Vietnam, who contributed about 14.8% and 4.6% to the total, respectively. The European Union (EU), the United States of America (USA) and Japan together consumed more than 56% of bamboo and rattan commodities in the global market. Figure 3 shows the top 10 exporters and importers in the world.

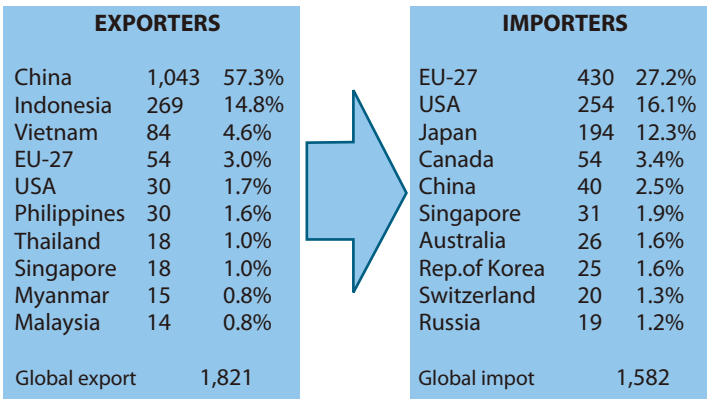


*Figure 3: Top traders of bamboo and rattan commodities (US$ million)*

[3] *Source: Statistics from China's Customs, which specifies 26 individual codes for bamboo and rattan commodities – ten more than the HS codes for bamboo and rattan. Therefore, the total export value by this source (US$1.6 billion) is higher than that shown by UN Comtrade (US$ 1.0 billion).*

# Raw Bamboo Materials

## Product profile

There are over 1200 bamboo species and varieties and about 100 of them are cultivated for commercial use. Growing and harvesting bamboo is easy and can bring significant incomes to farmers. Bamboos produce woody poles that can be used for a huge range of uses; there are over 1500 uses of bamboos recorded providing a wide range of different markets for the poles. Poles can be used whole for construction, short sections can be used for products, such as furniture and handicrafts, or poles can be split lengthwise to produce splits, slivers and sticks that can be used to produce modern products such as bamboo flooring, woven articles and incense sticks, to name a few.

## Production process

Bamboo is a perennial plant and bamboo poles should be harvested selectively each year. There are six main methods for propagating a bamboo, and the time from planting a bamboo to first harvest of poles is usually four years. Productivity increases for years after that until it reaches a plateau after about ten years when the plantation/plant is mature. Usually 4-year old poles are harvested, because their moisture content is lower at this age than when they are young, and so they are stronger and most suitable for use. It is usually best to maintain approximately equal proportions of one, two and three-year old poles in a plantation. The inputs are minimal and should be available on a farm; organic fertilizer is usually applied twice per year at the same time as soil turning to help aerate the soil, and watering may be required in very dry spells. Pest and diseases are rare, but proprietary pesticides and fungicides are appropriate for bamboo pests and diseases.

## Market for raw bamboo materials

The export value of raw bamboo materials (poles) decreased from US$ 61 million in 2001 to US$ 45 million in 2009, with 63% supplied from China. 59% of these materials were exported to the USA and the EU. National trade is not known, but is expected to be much higher.

## Socio-economic benefits

Growing and harvesting bamboo increases farmers' incomes, and broadens their plant cultivation skills base, making them more able to handle shocks and empowering them with new abilities. Growing bamboo can increase the areas of bamboo plantations, helping reduce soil erosion and bringing back unproductive land into productivity. Growing bamboo builds upon rural farmers own inherent plant-cultivation abilities and hence is easily adopted, and it is extremely environmentally friendly; organic inputs, such as fertiliser are better for bamboo growth than inorganic ones.

A community bamboo nursery is owned and managed by the community. It enhances the livelihoods of poor, rural farmers by building upon their own inherent plant cultivation skills. It empowers each worker with a voice and a role in its running. It also promotes wider environmental protection, especially if established on degraded land. Bamboos can be intercropped with other food plants, and so it also helps to improve food security.Community bamboo nurseries are the starting point for development of productive industries in areas in which either there is little bamboo, or the bamboo that exists is poorly managed and utilized. Nurseries can supply not only the communities' needs, but those of others – including government forestry departments and commercial growers.

## Investments required

Creating a bamboo nursery or a plantation requires minimal investments. The main costs are for land, bamboo propagules (which, if using seeds, are often free), and labour.

## Case study: Bamboo plantation, Oinamlong Village, Tamenglong District, Manipur, India

This ten hectare plantation was established in 2004 and was planted by all village members including the village chairman, and the church leaders. All revenue generated from the sale is used by the Village Development Council for village investment. Bamboo poles are sold at Rs 35(approximately US 80 cents), and the plantation yield is/was projected as: **Year 5** : 400 **Year 6** : 530 **Year 7**: 667 **Year 8**: 800 **Year 9**: 940 **Year 10**: 1067 The plantation, which has a cost-benefit ratio of 2.10, an IRR of 32 percent and an NPV of INR133,985 (roughly US$3,000), is a highly viable community-based enterprise.

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# Bamboo Shoots

## Product profile

Bamboo shoot, the emerging young bamboo culm (stem), is usually harvested soon after it sprouts above ground. Being a perennial plant, bamboo produces new culms (bamboo shoots) every year. Some species produce shoots that are edible and very nutritious. Bamboo shoots, which are usually eaten fresh, are a traditional vegetable in China, Japan and other Southeast Asian countries and are rapidly growing in popularity in other countries. Bamboo shoots can also be processed and preserved in cans or soft-packages.

## Production process

Bamboo shoots are harvested soon after they emerge from the ground. In general, fresh bamboo shoots are cleaned, the outer portion is removed, the head and tail portions are cut off, and then the shoots are cut into strips, slices, cones or shreds. After grading of pieces, they are cooked in a weak brine solution, drained and then canned in brine solution or vacuum-packed.

*For more information on bamboo shoot production, please see INBAR's Transfer of Technology Model at : http://www.inbar.int/TOTEM/totemdetail.asp?id=88&codeid=2*

## Market for bamboo shoots

Domestic markets in China, Japan and South East Asia are the biggest markets for bamboo shoots. Countries such as India, Bangladesh, Sri Lanka, Indonesia, the Philippines, Malaysia and Vietnam also produce bamboo shoots, mainly for the domestic markets.

China is the largest bamboo shoots exporter, accounting for 75% of global exports, which, in 2009, were worth US$195 million according to UN Comtrade data. Thailand is the second largest exporter with about 6%. The world demand for preserved bamboo shoots is growing and, in 2010, the total export value increased to US$214 million.

Japan, the United States of America (USA) and the European Union (EU) are the top importers of preserved bamboo shoots. In 2010, Japan imported US$136 million, the USA US$36 million, and the EU approximately US$30 million.

In the past twenty years, the per capita consumption of shoots in Japan has increased from 1.2 kg to 3.0 kg. In China, the per capita consumption is less than 1.0 kg, but is expected to grow. With the increased popularity of organic produce, bamboo shoots consumption and exports are expected to grow globally.

## Socio-economic benefits

Bamboo shoot production has the potential to garner significant economic benefits, and the social advantages that higher incomes bring. In Lin'an County, in China's Zhejiang Province, bamboo shoot production has had an enormous impact on livelihoods. In the mid-1980s, the government started a support programme for shoot-species plantation development, utilizing degraded lands. Annual per capita net income then was less than US$50; 20 years later, this increased to almost US$700.

The government provided subsidies for the establishment of shoot-species bamboo plantations, low-interest loans to shoot processors, and training and extension services for farmers. Fresh shoots were first sold to nearby cities, and then to other provinces in China. Processed shoots export started to grow and in the early 2000s, more than 32,000 tons of processed shoots were exported. Annual income from bamboo shoots increased tenfold in a period of 10 years, and the percentage of income generated by bamboo shoots touched 70% by the year 2000. Since then, other economic activities in the County have picked up, as the farmers have additional funds to invest in such activities.

The County's employment opportunities have also increased with the increased production of bamboo shoots. More than 40 processing units in Lin'an, with an average annual production capacity of 10,000 tons each, now employ about 100 long-term employees and 400 seasonal workers a year. About 5,000 farmers in the County are now also engaged in sales and marketing activities.

## Investments required

The cost for a processing facility will vary according to local raw material, land, labour and consumables prices. A factory with a canned shoots production capacity of 15 tons per shift/400 tons per month/1,200 tons per year would require 1,200 m2 area. The indicative costs for such a factory are given in Table 1.

| Item | Specifications | Unit cost | Quantity or unit | Approximate cost (China) | Total cost |
|---|---|---|---|---|---|
| Factory area | $m^2$ | 116.25 | 1,200 | 139,500 | 139,500 |
| Bamboo shoots | ton | 250.00 | 2 ton/ton | 50% of material will be waste | |
| Package (can) | 18 litre | 110.00/ton | | | |
| Workforce requirement<br>- Semi-skilled labour<br>- Maintenance personnel<br>- Management staff | <br>Person<br>Person<br>Person | | <br>90<br>5<br>6 | | |
| Machinery required | The machinery & equipment have a service life of 15 years | | | | |
| - Boiler<br>- Sterilizer<br>- Can seamer<br>- Cleaning/washing<br>- Other equipment<br>Total | 1 kW (2 ton cap.)<br>3 kW<br>1 kW<br>1 kW<br><br>6 kW | 30,000<br>10,000<br>11,000<br>500<br>10,000 | 1<br>2<br>2<br>5 | 30,000<br>20,000<br>22,000<br>2,500<br>10,000 | 84,500 |
| Consumables | 3% of the ex-factory price | | | | |
| Total capital cost | | | | | 224,000 |

*Table 1: Indicative costs (in US$) for a canned bamboo shoots factory (1200 tons/year)*

## Case study: Pilot bamboo shoots processing facility, Sri Lanka

Sri Lanka is a country where traditionally bamboo is used for many applications, but bamboo shoots have had a limited use in the local cuisine. This is now changing with the active promotion of bamboo shoots as a healthy vegetable. With funding from the Common Fund for Commodities (CFC) and support from International Network for Bamboo and Rattan (INBAR) and the International Centre for Bamboo and Rattan (ICBR), a pilot bamboo shoots processing facility was set up at the Industrial Technology Institute (ITI) in Colombo. This facility is being used by students and entrepreneurs to introduce bamboo shoot processing in the country, while also promoting bamboo nurseries and plantations. ITI has initiated a bamboo shoot marketing campaign to introduce bamboo shoot vegetables in the local dishes and the production is now sold in the local market. There is great potential for fresh and preserved bamboo shoots in the domestic market.

# Bamboo Handicrafts

## Product profile

The versatility of bamboo is well documented. One product group with which it is typically associated, and for which its versatility is ideally suited, is handicrafts. The term handicraft generally refers to items that are constructed by hand, using simple tools, rather than through mass production methods. This is well suited to the labour-intensive properties of bamboo production. Decorative items make up a large part of the handicrafts industry, largely because products that are considered necessities tend to be well supplied by mass-market production.

Bamboo is used to make a huge range of handicraft items, many of which are woven from thin strips of bamboo. They include common objects for household and agricultural use, such as baskets, bags, trays, vases, lamps and screens, as well as more decorative, creative pieces of art, such as models, toys, fans and carvings. The history of bamboo weaving can be traced to the Neolithic age in China, where it remains strong even today. However, specialized techniques and craft skills for bamboo engraving and carving are on the decline.

## Production process

As with most bamboo products, proper treatment of raw materials is an important part of the production process that affects the quality and durability of the final product. The narrow tip and stout rhizome are removed from the culm before it is cut to length, after which the waxy outer skin and nodes are also removed.

Next, the culm is split along the length of the culm into bamboo strips. These strips can then be cut to the length, width and thickness according to the requirements of the final product. For good quality, all the bamboo strips used should be the same width and thickness throughout the length. Thin bamboo strips (or sliver) are mostly used for making articles such as baskets, boxes, vases and dolls. All such products are usually woven from their base upwards. Thicker bamboo strips are mostly used for making bamboo mats, curtains and screens. These types of goods are usually woven from the middle outwards. Some products, particularly the ones meant for high-end markets, receive a finishing treatment, such as a coat of lacquer or varnish.

*For more information on woven bamboo product manufacture, please see INBAR's Transfer of Technology Model at : http://www.inbar.int/totem/totemdetail.asp?id=13&codeid=5*

## Market for bamboo handicrafts

Bamboo handicrafts are very popular in many countries of the world, where bamboo's elegant, natural appearance and renewable properties provide a unique point of difference. There is also a stable market for agricultural-use products in many countries.

As with most bamboo products, the market leader for bamboo handicrafts is China, and specifically China's bamboo-rich southern provinces of Zhejiang, Fujian and Sichuan. For example, in Shengxian County, in Zhejiang Province, over 5,000 varieties of woven bamboo products have been produced and more than 200 new products are developed annually. About 95% of the total output is exported. In China, specific handicrafts tend to come from specific areas: animal models are associated with Shengxian, Zhejiang; household utensils with Dongyang, Zhejiang; decorative baskets with Gutian, Fujian; woven porcelain with Chengdu, Sichuan; and fans with Zigong, Sichuan.

Total export data for bamboo handicrafts is difficult to determine, as few handicraft products have their own trading codes. However, one important handicraft item that can provide an indicator of overall market trends is 'bamboo and rattan baskets and wickerwork' (woven products).

In 2009, the total export value of bamboo and rattan baskets and wickerwork products was US$435 million (see Figure 10), nearly a quarter of the total export value of all bamboo and rattan products. Of this, bamboo articles accounted for just over half (US$227 million) the amount. This represented 34% decrease from 2008 and a 7% decrease from 2007. China was by far the largest producer, making up 58% of the total export value, followed by Vietnam (14%) and Indonesia (11%). Other significant exporters are the Philippines, the European Union (EU), the United States of America (USA), Myanmar and Thailand. More than 60% of imports are to markets in EU and USA, while Japan, Canada, the Republic of Korea, Australia and Russia also have significant import markets

## Socio-economic benefits

Bamboo handicrafts provide a great deal of livelihood and employment opportunities for poor, rural communities as the production process tends to be labour intensive, gender sensitive, and flexible in time and place. Although the weaving of handicrafts involves high levels of skill and creativity, the technology required is such that unskilled or uneducated workers require only short periods of training to gain competence.

Moreover, weaving can be carried out at the household level, which can provide an important source of income and empowerment for women and other disadvantaged groups, as well as provide an additional source of income for seasonal farm-based workers outside the cropping season. The wide variety of woven bamboo products enables small-scale producers to adjust their production to meet changing demand.

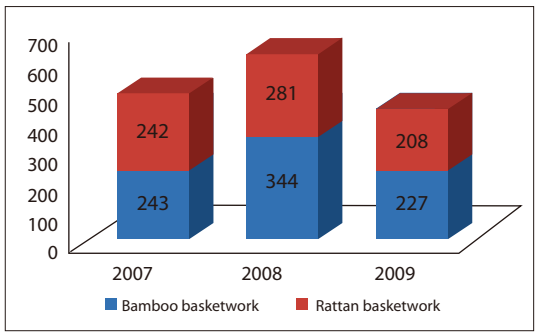


*Figure 4: Exports of bamboo and rattan wickerwork (US$ million) (Source: UN Comtrade)*

In addition to the need for skilled and semi-skilled staff in the production process, the demand for a regular supply of bamboos will encourage the establishment and sustainable management of bamboo stands and plantations. At the farm level, bamboo can be harvested in short rotation cycles, and be cultivated with minimal agricultural inputs even on small units of land that are nor suitable for food crops. It can thus provide a low-maintenance, regular source of income for smallholder farmers and households.

## Investments required

A woven bamboo handicraft unit can be established very cheaply. If splitting is done by hand then the costs can be limited to land, raw materials and labour. The unit can be established at any scale, from a single person enterprise to a community cooperative. Proper links to markets and feedback on market demands are very important, and continued innovation and development of new product designs will help maintain sustainability of the enterprise.

The main raw materials are bamboo culms. Auxiliary raw materials include dyes, lacquer, varnish, bleaching agents and preservatives. The main tools required for hand weaving bamboos are a slivering knife, shaving knife, hand saw, mallet, and hand drill. Although cross-cutting, splitting of bamboo culms and making strips and slivers can be done manually, machines are often used to increase productivity, reduce wastage of raw materials, increase the yield of bamboo strips and remove drudgery in the primary processing. In this case, machine tools required include a crosscutting machine, sliver-making machine, splitting machine and width sizing machine. In China, the total cost of these is estimated to be approximately US$10,000, around one-third of which is to cover simple tools.

## Case study: Lalitpur and Bhaktapur Districts, Nepal

In the village of Badikhel, Lalitpur District, Nepal, bamboo has long been used to weave baskets and other simple items. However, these handicrafts tended to be of relatively poor quality, and were for household or farm use only.

Since 2009, with funding support from the Common Fund for Commodities (CFC), INBAR, together with our national partner the Department of Forest Research and Survey, Ministry of Forestry and Soil Conservation (DFRS), has worked with the villagers to improve the productivity and sustainability of their bamboo management and harvesting practices, upgrade their bamboo weaving techniques, and bring their products to market. Now, bamboo is the main source of income in Badhikel, with more than 600 households involved in producing and marketing bamboo products. The households cooperate in transporting and selling their baskets in Kathmandu, clearing approximately US$5 a day for each household involved.

In a community where livelihoods have traditionally been subsistence, this additional income provides an important welfare safety net for families, enabling them to invest in healthcare, education and nutritional intake.

# Bamboo Stick Products

## Product profile

The biophysical properties of bamboo, namely its relatively low density, high-strength and good flexibility, make it a suitable alternative to timber for many stick-based household products. These include chopsticks, toothpicks, incense sticks and matchsticks. Moreover, bamboo is a renewable resource that can be harvested annually and, if cultivated well, produces a known yield per unit, which makes it ideal for supplying the relatively low but regular inputs of raw materials required for such products.

## Production process

To make bamboo sticks, culms are split along the length, nodes removed and then the splits are progressively reduced in width. Chopsticks are made by slicing the splits into pieces 14 mm in width and 7 mm in thickness. These pieces are then shaped and sharpened on tailor-made machines. Finally, the sticks are bleached to prevent insect and fungal attack, dried to prevent mould growth, and then sanded to a smooth finish.

Toothpicks are produced by splitting bamboo culms into thin splits, and then shaped into round rods 2 mm in diameter. These are then cut to length, polished and the ends sharpened. This can be done by hand or machine; mechanized production permits greater productivity, increased uniformity and higher quality than hand production.

Agarbatti (incense stick or joss stick) production entails four stages. Firstly, bamboo splits are cut into thin sticks of desired dimensions and hand-dried to make the central core. Secondly, charcoal and jiggat (an adhesive made from the bark of certain trees) powders are prepared and mixed to produce incense paste (masala), which is then rolled onto the bamboo stick to produce the batti. Finally, a proprietary blend of perfumes is applied (by dipping or spraying) to produce the agarbatti. Over the years, some of the steps have been mechanized, but overall the process has remained the same.

To produce matchsticks, bamboos are progressively split into fine sticks 1.5 mm in cross section and cut to length. They are then bleached to maintain an even colour, carbonized to deepen the colour, treated with wax, and finally the head is fixed (the incendiary mixture is applied and dried). The matchsticks are then packed and dispatched.

*For more information on bamboo matchstick production, please see INBAR's Transfer of Technology Model at: http://www.inbar.int/TOTEM/totemdetail.asp?id=92&codeid=5*

*For more information on bamboo toothpick production, please see INBAR's Transfer of Technology Model at: http://www.inbar.int/TOTEM/totemdetail.asp?id=14&codeid=5*

## Market for bamboo stick products

Bamboo is already widely used in China and elsewhere and chopsticks are an indispensable item of oriental tableware. In 2008, the export value of all bamboo 'stick' products from China was approximately US$105 million, up 66% since 2006. Around 70% of this total is estimated to be made up of bamboo chopsticks. They are sold primarily to markets in Japan, the United States of America (USA,) Russia, Canada and Singapore.

The market for bamboo toothpicks, especially in Asia, is also very large, although figures are not available. In addition to export markets, there are also significant domestic markets, especially in China, where there are a large number of small-scale toothpick production units.

India is the largest producer of agarbatti in the world, with an estimated annual production of more than 200 billion sticks, made from 85,000 tons of bamboo, and a market value of more than US$926 million in 2008. The sector is estimated to be growing at 20% annually. In the past, up to 90% of the bamboo sticks used in the agarbatti industry came from Tripura, a state in the north-eastern part of India. However, much of the growth in stick production has since taken place outside the state, and Tripura's share is now estimated to have dropped to 50-60%.

The global market for matchsticks is huge, and growing. In India, for example, this growth is estimated at approximately 5% per annum, and similar rates are expected elsewhere. Bamboo is yet to penetrate the timber-dominated industry, but with supply of suitable wood species declining, there is potential for bamboo to capture a market share, especially given its short rotation period.

## Socio-economic benefits

With growing domestic and international markets for chopsticks, toothpicks, incense sticks and matchsticks, there is significant potential for bamboo to utilize its physical properties and trade on its sustainable properties to capture an increasing market share from wood-based options. This can create significant income-generating opportunities for local people. In addition to the need for skilled and semi-skilled staff in the production process, the demand for a regular supply of bamboos will encourage the establishment and sustainable management of bamboo stands and plantations.

Bamboo-based industries are particularly attractive for those with limited capital. At the farm level, bamboo can be cultivated with minimal agricultural inputs on small parcels of land, even marginal and degraded land, and harvested in short rotation cycles. Thus it can provide a low-maintenance, regular source of income for smallholder farmers and households. In addition, much of the production process, or at least semi-processing, for these stick-based products, with the possible exception of chopsticks, is labour rather than capital intensive, which lends itself to home-based production. This can mean an important source of income and empowerment for women and other disadvantaged groups.

## Investments required

As stated earlier, bamboo incense sticks can be produced entirely by hand, even very high volumes. The process is predominantly labour intensive, with the most important requirements being a sustained supply of bamboos, a reliable and semi-skilled labour force, and easy access to markets.

Bamboo toothpicks and matchsticks require more capital investment. For example, in China, processing machinery for medium-scale production of bamboo toothpicks in community or village level enterprises will cost approximately US$15,000. This would enable the employment of approximately 20 people. In India, equipping a cottage unit to manufacture 100,000 bamboo matchboxes per day, which could provide regular employment for more than 70 people, will cost approximately US$30,000.


## Case study: Tripura State, India

Tripura State in India has many development challenges: geographical isolation, difficult terrain, slow development of infrastructure, lack of major industries, absence of developed markets, poor purchasing power, shrinking availability of land, falling agricultural productivity, high rural poverty and low representation of women in the workforce.

In 2003, the International Network for Bamboo and Rattan (INBAR) and the Centre for Indian Bamboo Resource and Technology (CIBART) joined forces to establish the Tripura Bamboo and Cane Development Centre (TRIBAC). The primary aims were to create new employment opportunities and increase the returns for women in the bamboo sector, and to redress bamboo resource loss.

Strengthening of the local agarbatti industry has had an exponential impact on the livelihoods of rural women, with 1,387 provided with steady, first time employment by 2008. Adding batti rolling and other processes to the local agarbatti production value chain was found to have generated 11 new jobs for each existing job in stick production. Average monthly incomes rose from pre-employment level of US$0-0.50 to US$30-90 for fulltime workers.

Production of batti by TRIBAC and TRIBAC-supported community enterprises increased from 170 kg (255,000 sticks) in 2005 to 33,322 kg (49,983,000 sticks) in 2007 – an increase of 19,500%! Taking into account the current production of 125 billion sticks in the State, there is potential for creating up to 150,000 full-time jobs through community enterprise clusters in incense stick production.

*For more information on TRIBAC and agarbatti production, please read "A Pathway Out of Poverty" at http://www.inbar.int/publication/TXT/A%20Pathwayout%20of%20Poverty.pdf.*

# Bamboo Mat Board

## Product profile

Bamboo mat board is produced from woven mats of bamboo strips that are applied with an adhesive resin and then pressed firmly together in a hot press. It was the first among the wide range of bamboo-based panel boards presently available. Bamboo mat is one of the simplest bamboo product to produce, as it involves only bamboo as the raw material, and has great income generating potential for the rural poor, as the mats can be woven from home with rudimentary tools and techniques.

Bamboo mat board is very versatile and can be produced to varying levels of thickness by using different numbers of mat layers; boards are usually formed of 2, 3, 5 or 7 mats. For thicker laminated boards, wood veneers are interleaved with the bamboo boards to produce bamboo mat-veneer composite boards. Bamboo mat board is at least as durable and stable as wood-based plywood and is very resistant to pest attack, extreme climatic conditions and fire. It can be used for many of the uses to which plywood is now put, such as panelling, ceilings, prefabricated shelters, packing cases, storage bins, roofs, doors and door panels, furniture, and household utensils such as trays and plates. It can be made into corrugated roofing sheets and is also used in concrete formwork on building sites. Bamboo mat board is produced in most parts of Asia, particularly in China, India, the Philippines and Vietnam.

Bamboo mat boards possess physical and mechanical properties similar to waterproof plywood and have excellent internal bond strength, a high plane rigidity and hence high racking strength. They are as durable and resistant as plywood to boiling water, weather and biological agencies (decay, insects and termite attack). Bamboo mat boards have better scratch and stain resistance properties than plywood. Besides their rich natural appearance, they can be made as fire resistant as fire-retardant treated plywood.

## Production process

Bamboo mat board is produced by the following stages:

- Bamboo poles are split progressively into thin, long strips;
- Strips are woven into mats;
- Mats are soaked in adhesive resin;
- Soaked mats are allowed to drain and dry;
- Mats are pressed together under high temperature and pressure to from boards; and
- Boards are trimmed to shape.

*For more information on bamboo mat board production, please see INBAR's Transfer of Technology Model at: http://www.inbar.int/TOTEM/totemdetail.asp?id=16&codeid=5*

## Socio-economic benefits

The production (weaving) of mats is labour-intensive and difficult to mechanize. Bamboo mat board has enormous income generating potential for the rural poor and particularly for women, who make up the vast majority of weavers. By 1997, in India, the eight BMB factories in operation were generating 2.5 million workdays per year for mat-weavers and during the five years up to 1997, demand was such that the price for individual mats increased from Rs 17 each to Rs 55. Substituting BMB for plywood also reduces the pressure on timber forests.

The main development attributes of the technology are as follows:

- Usage of bamboo mat boards rather than plywood reduces dependence on timber resources and natural forests helping protect the environment;
- Creation of employment opportunities in mat weaving, particularly for rural and tribal women, and in bamboo growing;
- Improvement of peoples' skills and enhancement of their earning capacities, leading to improved welfare of the economically weaker sections of society; and
- Weaving bamboo mats is flexible in time and place, favouring part-time workers who can work part-time at home, such as young and old people, and housewives, who can combine weaving with other household/farm duties as and when they are able.

## Investments required

Establishing a bamboo mat board enterprise requires a regular supply of bamboo mats, electricity and labour and easy access to markets. A small enterprise with a capacity of 100 moulded mat board trays per day may be established with as little as US$20,000 (in India), or a unit with a capacity of 129, 000 sheets per year established for US$400, 000. A suitable system for collecting the mats from the weavers needs to be established to ensure smooth workflow, and production schedules for mats need to be planned in order to meet expected demand for finished mat boards.

# Laminated Bamboo Flooring

## Product profile

Laminated bamboo flooring is a unique flooring product that is as tough and durable as many hard wood-based alternatives (see Table 2). As laminated bamboo flooring is made from a more renewable material than timber and has distinctive finishes, these products have great market appeal, fetching high prices in affluent western markets. Therefore, laminated bamboo flooring provides great opportunities for economic growth in developing producer countries, especially in areas where timber-based harvesting is restricted or prohibited.

| Wood type | Hardness scale |
|---|---|
| Pecan | 1820 |
| Hickory | 1800 |
| Maple | 1450 |
| White Oak | 1360 |
| **Natural Bamboo** | **1340** |
| Ash | 1320 |
| Beech | 1300 |
| Northern Red Oak | 1290 |
| Iroko | 1260 |
| Birch (species average) | 1210 |
| Southern Red Oak | 1060 |
| **Carbonized Bamboo** | **1010** |
| Teak | 1000 |
| Walnut | 1010 |
| Cherry | 950 |
| African Mahogany | 830 |
| Honduran Mahogany | 800 |
| Pine (species average) | 540 |
| Fir (species average) | 440 |

*Table 2: Wood Flooring Hardness Scale – Numbers denote dent resistance in pounds*

*(Source: http://www.shakuhachi.com/BF-Tech.html#anchor843374)*

## Production process

There are several methods of producing laminated bamboo flooring. The basic production principle involves crosscutting and then splitting bamboo culms into thick, flat strips. The outer skin and nodes are not used. These strips are then cut to required length, typically coated with resin, assembled into three-layer thick units and pressed firmly together in a hot press. After curing, the flooring tiles are usually trimmed to shape and finished with a coat of paint, lacquer or varnish.

*For more information on bamboo flooring production, please see INBAR's Transfer of Technology Model at: http://www.inbar.int/TOTEM/totemdetail.asp?id=15&codeid=5.*

## Market for bamboo flooring

At present, the majority of bamboo flooring is produced in China. In 2009, the international export market for bamboo flooring was worth approximately US$252 million, with China accounting for US$224 million, or 89% of this total value. In addition to China, other significant exporters of bamboo flooring include the European Union EU), the United States of America (USA), Mexico, Vietnam and Indonesia.

In 2009, EU and Canada were the two largest international importers of bamboo flooring, accounting for US$26 million and US$18 million, respectively, of the total global import market. USA, Mexico, New Zealand, Japan and Singapore are the other key international importers of bamboo flooring.

## Socio-economic benefits

Producing laminated bamboo flooring is a good means of reducing poverty and generating rural and urban employment. Flooring products are generally exported to lucrative western markets. Furthermore, a flooring company provides employment to labourers and semi-skilled and management staff, while the forward and backward linkages create livelihood opportunities in bamboo farming and product marketing. Given that utilization rate of bamboo in a basic Chinese flooring factory is only 25%-28%, many flooring enterprises also diversify production into other industrial products, such as bamboo charcoal, curtains and mats, further increasing economic returns and livelihood opportunities.

## Investments required

In Anji County, Zhejiang Province, China (see case study below), a bamboo flooring factory with an annual production capacity of 2,000 $m^3$ can be established with approximately the following inputs and investments.

- A stable supply of 2 million bamboo culms per year;
- Factory building space of 7,000 $m^2$;
- Equipment capital investment of 2.5 million yuan (US$392,000);
- Transporting costs of roughly 0.5 million yuan (US$78,000);
- A workforce of approximately 60 people; and
- Six months of technical training for local partners costing 1.2 million yuan (US$188,000)

In Anji County, this type of factory could generate annual revenue of 20 million yuan (US$3.1 million) at a profit margin of 20%. On average, workers in such a factory would earn 3,000 yuan/month (US$470)

## Case study: Anji County, Zhejiang Province, China

Anji County, in Zhejiang Province, China is a leading example of how bamboo-based sector development can help to improve rural livelihoods and generate income. For example, from 2002-2006, bamboo raw material transportation and sales helped raise the income of local rural communities by 500 million RMB (approximately US$62.5 million), an average increase of 6,250 RMB per household (approximately US$750). Nearly 60% of the income for the county's 120,000 households is now directly generated from the bamboo sector, with approximately 50,000 households cultivating bamboo, 35,000 farmers engaged in bamboo product processing and 3,000 households engaged in product sales. The bamboo flooring industry in Anji, which is a large user of bamboo and accounted for 1.1 billion RMB of sales in 2006 (approximately US$137.5 million), has played a major role in this success story. According to statistics from the Anji County Party Secretary, Anji produced an incredible 20 million $m^2$ of bamboo flooring in 2008.

# Bamboo Charcoal

## Product profile

Bamboo is an excellent resource for charcoal because of its high surface area (up to 385 m2/g) and the ability to reach high temperatures (the surface temperature of bamboo charcoal can reach 700°C). It can be used as household fuel for heating and cooking, as well as in a range of purification and absorption applications, such as purifying drinking water, in air filters, in mattresses and pillows as a deodorizer, and for certain industrial purification uses. Bamboo vinegar, a by-product of the manufacturing process, is also used as an ingredient in health products.

## Production process

Bamboo charcoal is made from pieces of bamboo, which are subjected to pyrolysis, a controlled process of heating under high temperature and very limited supply of air. Solid parts of bamboo, such as the stem (culm), branches, and roots, can be used for charcoal.

Bamboo can be pyrolysed in metal or brick kilns, or in traditional earth kilns built as pits or mounds. The process is faster in more modern automated kilns. The bamboo material has to be dried well before placing it in the kiln and the temperature in the kiln needs to be continuously and closely controlled to prevent burning. Once made, bamboo charcoal can be used as such, or pulverized and mixed with other materials (such as clay) to make charcoal briquettes or balls for economy and convenience.

*For more information on charcoal production, please see INBAR's Transfer of Technology Model (TOTEM) at: http://www.inbar.int/TOTEM/totemdetail.asp?id=93&codeid=5*

## Market for bamboo charcoal

There is an enormous potential for bamboo charcoal for the domestic markets and also for export. In Africa, where electrification rates are low, 70–90% of the people rely on biomass for household energy, most of which comes from firewood and wood-based charcoal. The annual rate of deforestation in Africa is about 4 million hectares, with wood charcoal production being a major contributor to the deforestation.

As bamboo is a fast-growing and sustainable resource, it is an ideal and profitable raw material for charcoal production and an excellent substitute for wood-based charcoal.

The world production of wood charcoal is steadily increasing each year; according to FAOstat, it increased from 40,000 kiloton in 2000 to 47,000 kiloton in 2009. In 2010, the total value of wood charcoal imported by the European Union (EU) was €187 million (approximately US$255 million), of which more than 55% came from developing countries such as Argentina, Paraguay, Nigeria and South Africa. Therefore, the potential of bamboo charcoal as substitute for wood-based charcoal is significant.

The total export value of bamboo charcoal in 2009 was about US$25 million, and both Africa and Asia are important production areas for bamboo charcoal. Nigeria was the top exporter of bamboo charcoal in 2009, with an export value of about US$7 million, followed by China, which provided US$6 million worth of bamboo charcoal to the global market. EU, the United States of America (USA), Japan and the Republic of Korea are the top importers of bamboo charcoal.

The export markets of EU, USA, Japan and the Republic of Korea are lucrative, while the market in China is growing, primarily as a result of innovative product development and marketing. It is likely that markets in other countries will also develop further.

## Socio-economic benefits

Charcoal trade is a massive industry, particularly in Africa where it provides income to millions of people. The World Bank estimates that the charcoal sector creates at least 20 times more jobs than the liquefied petroleum gas (LPG) sector in Africa (for example, in Kenya, 200,000 people are employed in the charcoal sector). Charcoal provides more work and income for the African rural poor than any other kind of energy. As most of the raw material for charcoal comes from forests and is harvested unsustainably, deforestation is a key issue. However, charcoal and biomass will remain important fuels for a long time, especially in Africa, as there is often little alternative. Bamboo charcoal production will therefore have a positive impact not only on the environment but also on producers, traders and users. It will reduce the pressure on timber forests, and bamboo cultivation and harvesting will provide income-generating opportunities to farmers. Processing and marketing will provide work also for other community members.

## Investments required

A very small-scale unit can be established for the cost of a small brick kiln (approximately US$500)[4] . It is important to have in place adequate linkages to the market and to ensure a sustainable source of bamboo material. A larger brick kiln for charcoal can be built for about US$3,000, but a shelter and a warehouse for the materials will be necessary. If briquettes or small charcoal balls are produced, a grinding machine for grinding the charcoal, costing about US$3,000, and a charcoal ball press, costing about US$3,000, are also required. 5 tons of fresh bamboo culms will produce 1 ton of bamboo charcoal.

## Case study: Bamboo charcoal pilot projects Ghana

In Ghana, INBAR has been working with the Forestry Research Institute of Ghana (FORIG) and Bamboo and Rattan Development Programme(BARADEP)in two pilot sites in Tandan in Ellembelle District and Daboase in Mpohor Wassa District to set up kilns to produce bamboo charcoal. The local community and enterprises involved in charcoal production, local transportation, distribution and trade participated in training on charcoal making that INBAR organized. The Micro Small Enterprise Association at Daboase has started production of bamboo charcoal for the local market, and the Chief and Elders of Tandan have provided land to set up a bamboo charcoal production technology centre. The brick kilns built can produce 800 kg of bamboo charcoal per two weeks.

[4] *All costs are indicative and will vary according to local conditions.*

# Bamboo Plywood for Construction

## Product profile

Bamboo plywood is an innovative product, which has sufficient mechanical properties to act as a structural load bearing material (Table 3). For example, two-storey, North American style, two-by-four lightweight wood-frame houses have already been constructed with bamboo plywood. Bamboo plywood has also been used in the construction of bridges for human and vehicular traffic, as well as to build transitional shelters after the 2008 Wenchuan earthquake in China. In the future, the development of modern bamboo plywood structures can potentially generate major employment in producer countries, while helping to conserve forests and reduce the use of energy-intensive materials, such as steel. In addition to construction, bamboo plywood can also be adapted for use in furniture and interior design applications.

| In-plane compressive strength (MPa) | Perpendicular to plane compressive strength (MPa) | In-plane tensile strength (MPa) | Bending strength (MPa) | Elastic modulus (GPa) | Density (kg/m3) |
|---|---|---|---|---|---|
| 54 | 68 | 20 | 75 | 9.4 | 880 |

*Table 3: Basic material properties of laminated bamboo, tested according to GB 1991 and GB/T 2002 Chinese Standard (Source: Xiao et al., 2009)*

## Production process

There are two main types of bamboo plywood that are made from laminated bamboo sheets: thin layer and thick layer. Bamboo plywood produced from thick layer laminated bamboo sheets is typically pressure-glued using three layers of relatively thick (5-7 mm) bamboo strips. Top-of-the-line products can make floor plates (currently available in the North American market). Bamboo plywood made from thin layer laminated bamboo sheets, typically have a thickness of 10 to 15 mm, and are made by laminating approximately 2 mm thick bamboo strip mats. In China, this product is mainly used as concrete formwork substitute for plywood sheets.

## Market for bamboo plywood

At present, China is the industry pioneer for bamboo plywood manufacture, accounting for approximately half of all international export trade. Although, bamboo plywood is an early stage of development, in 2009, international export for bamboo plywood products accounted for US$111 million, equivalent to a 6% share of total bamboo and rattan exports. This highlights the potential future importance of bamboo plywood manufacturing to the bamboo sector. In addition to China, Indonesia, Malaysia, Singapore, the United States of America (USA), the European Union (EU) and Myanmar are other significant bamboo plywood exporters.

In a number of western countries, where timber is a commonly used construction material, bamboo plywood has large potential markets. This is highlighted by existing trends in international imports, which show Singapore and the USA as the largest importers, accounting for US$16 million and US$14 million of the import market respectively in 2009. Canada and the EU are also comparatively large importers of bamboo plywood. In addition to Western markets, in many developing countries, such as India (another bamboo plywood importer), where there are wood harvesting restrictions, bamboo plywood has scope to gain greater market share. Bamboo plywood adapted for use in furniture and interior design applications also has large potential markets.

## Socio-economic benefits

Establishing an industry for the construction of bamboo plywood has the potential to generate significant employment opportunities at both the rural and urban level. Rural communities gain employment through supplying raw bamboo materials and setting up local pre-processing centres that produce bamboo mats and curtains for bamboo plywood manufactures. The main bamboo plywood manufacturing plants also provide downstream (transport) and upstream (marketing) livelihood opportunities, while directly employing labourers, semi-skilled workers and plant managers. Finally, bamboo plywood products can be sold in both domestic and international markets and can be adapted for a range of end-use applications.

## Investments required

In Ethiopia (see case study), to set up three pre-processing centres for bamboo mats and curtains and a bamboo plywood workshop with a production capacity of 2,970 $m^3$ (12mm-thick panels) per year, requires roughly the following inputs and investments:

Pre-processing centres
- 7 -10 workers per shift, and one or two 8-hour shifts per day
- 20 × 30m2 building space

Bamboo plywood workshop
- 29 workers per shift, and three shifts per day for 330 days a year
- 70 × 16m2 workshop building space

Equipment
- US$370,000 capital investment for pre-processing, processing and testing equipment
- US$76,700 for transportation of equipment from China to Addis Ababa

## Case study: Bamboo plywood processing plant, Addis Ababa, Ethiopia

With funding support from the Common Fund for Commodities (CFC), The International Network for Bamboo and Rattan (INBAR) and project partners, the International Centre for Bamboo and Rattan (ICBR), China, and the Federal Micro and Small Enterprises Development Agency (FeMSEDA), Ethiopia, are currently transferring bamboo plywood technology from China to Ethiopia. In 2012, the project will establish a workshop for structural-grade bamboo plywood panels, beams and building components in Addis Ababa. The project is also setting up three pre-processing centres in the rural areas of Hagereselam, Tikur Inchin and Injibara to supply the bamboo plywood processing centre with bamboo mats and curtains. The project has an agreement with the Addis Ababa Housing Authority, which will purchase bamboo plywood panels from the centre to use as wall partitions in government condominium housing for low-income families. The processing centre will have an annual production capacity of 2,970 $m^3$ for 12 mm-thick panels, which will cost roughly US$382/$m^3$ to produce (or US$13-14 for one bamboo panel of 2,440 × 1,220 × 12 mm). This will provide direct employment to 29 people per shift at the centre and further employment to approximately 7-10 people per shift in each rural pre-processing centre.

## References

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# Bamboo Furniture

## Product profile

Bamboo can be used to produce virtually any kind of furniture, depending on the processing method, but is most commonly used for chairs, sofas, bookshelves, cabinets, tables and beds. Bamboo furniture is considered an excellent substitute for wood furniture, both in strength and quality. Traditional bamboo furniture has the added benefits of being lightweight, elegant and natural. On the other hand, laminated bamboo furniture, while it doesn't retain the same organic characteristics of raw bamboo culms, offers more versatility to designers and is highly durable. In both cases, bamboo's fast growth rate can offer an attractive point of difference to wood furniture, especially in western markets, where sustainability of the source is an increasingly important factor.

## Production process

Traditional bamboo furniture is constructed using the whole culm (or 'round pole'), while laminated bamboo furniture is constructed using split culms pressed into pre-shaped components. This can include 'flat pack' panels, which increases the product's volume to value ratio for economical shipping and transport.

One of the most important steps in the production of bamboo furniture is to treat, or preserve, the raw bamboo culms. Bamboo is an organic material, which is susceptible to insect and fungal attack and will decay with time. Preservation treatments extend the life and maintain the quality of bamboo.

Traditional bamboo furniture is produced by cutting the treated culms to length, removing external nodes and skin, and joining the lengths. Joinery can be as simple as binding the pieces together, or can employ a more sophisticated 'interlocking method', whereby holes are made to enable adjoining lengths to sit firmly inside the hollow internodes. The furniture is often finished by tying cane around the joints for aesthetic value, sanding and spraying with lacquer or glaze.

Laminated bamboo furniture is made by splitting bamboo culms into longitudinal sections and coating them with glue. These are bonded together under pressure in shaping jigs or moulds to produce different component parts, which are then assembled into furniture. The furniture is finished by sanding, and lacquering or polishing.

*For more information on bamboo furniture production, please see INBAR's Transfer of Technology Model (TOTEM) at: http://www.inbar.int/TOTEM/totemdetail.asp?id=19&codeid=5 and http://www.inbar.int/TOTEM/totemdetail.asp?id=107&codeid=5*

## Market for bamboo furniture

Traditional bamboo furniture is produced in many parts of the world, with varying levels of quality and craft skills. India, for example, and some African nations (such as Ethiopia) have growing domestic markets, but are yet to export in any significant volume. Major exporters of traditional bamboo furniture are Indonesia, the Philippines, Vietnam and Thailand, while China is the only major producer of laminated bamboo furniture. The major importers of both traditional and laminated bamboo furniture are the European Union (EU), the United States of America (USA) and Japan.

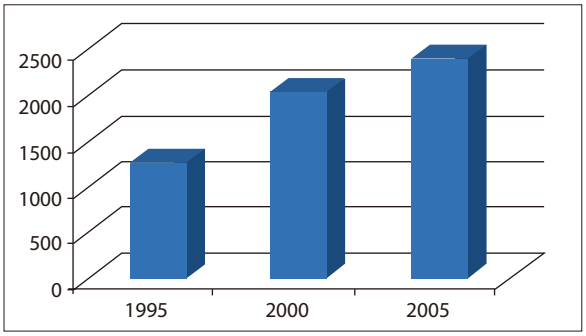


*Figure 5: Exports of bamboo and rattan furniture (US$ million), Source: UN Comtrade*

According to pre-2007 UN Comtrade data (Figure 17), the export value of bamboo and rattan furniture nearly doubled during 1995-2005 (from US$1.26 million to US$2.41 million). However, these figures are not entirely reliable, as export codes for many bamboo and rattan products were often aggregated with similar timber products in this period (see chapter on "*The global market of bamboo and rattan products*"). According to the more accurate, yet less comprehensive, post-2007 UN Comtrade data (Figure 18) a significant shift in trends is seen, with the export value of bamboo and rattan furniture falling 34% between 2007 and 2009 (from US$0.59 million to US$0.39 million). In both cases, bamboo and rattan furniture makes up a significant proportion of overall bamboo and rattan trade, though it moves from 50% according to 2005 codes to just over 20% according to 2009 codes.

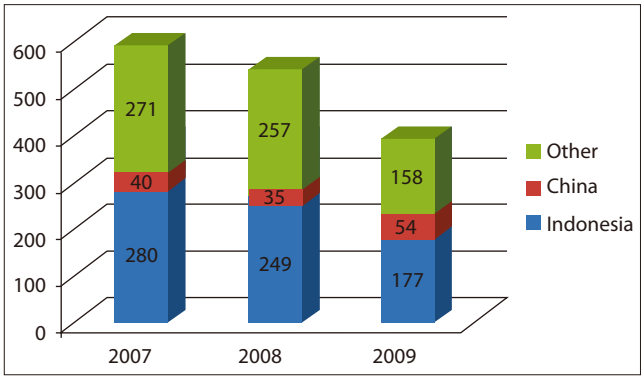


*Figure 6: Exports of bamboo and rattan furniture (US$ million), Source: UN Comtrade*

## Socio-economic benefits

With an export market of nearly US$400 million in 2009, bamboo furniture production, both traditional and laminated, can create significant income-generating opportunities for local people. In addition to the direct employment of skilled and semi-skilled staff in the production process, the demand for a regular supply of bamboo will encourage the establishment and sustainable management of bamboo stands and plantations.

Bamboo-based industries are particularly attractive for those with limited capital. At the farm level, bamboo can be harvested in short rotation cycles, and can be cultivated with minimal agricultural inputs on small units of land that are unsuitable for food crops. It can thus offer a low-maintenance, regular income option for smallholder farmers and households. In addition, many of the components needed for making furniture, such as bamboo nails and bamboo splits, can be produced at the household level, which can provide an important source of income and empowerment to women and other disadvantaged groups.

## Investments required

The manufacturing process for traditional bamboo furniture is relatively simple and can be undertaken with little capital investment. The process is predominantly labour intensive, with the most important requirements being a sustained supply of bamboo, innovative designs, skilled artisans and access to markets. Preserving the raw bamboo culms is an essential part of the production process. However, this doesn't necessarily require great expense. A village bamboo preservation unit can be established for approximately US$2-3 for a drum, or at about US$5,000 for a pressure treatment plant.

A laminated bamboo processing unit, however, requires more heavy machinery and tools. For example, a typical processing unit in Anji County, China, a major hub of modern bamboo industry, cost approximately US$35,000, and features machinery for planing, boiling, colouring, drying, moulding and sanding. Establishing such a venture as a community-run cooperative might provide an opportunity to raise the capital and spread the returns, though strong linkages to supply and markets should be established.

## Case study: Konkan Region, Maharashtra State, India

In 2003, the International Network for Bamboo and Rattan (INBAR) and the Centre for Indian Bamboo Resource and Technology (CIBART) joined forces to establish the Konkan Bamboo and Cane Development Centre (KONBAC). The aim was to enhance rural livelihoods, while addressing local, social and economic challenges, such as dependence on rain-fed agriculture, male urban migration, social prejudices and low market demand.

KONBAC set up furniture, packaging, craft and construction enterprise units. These units provided community members with access to training and equipment, with a particular focus on empowering local women as income earners. It also intervened to develop bamboo resources in the area, improving bamboo stocks and diversity, as well as bamboo supply chains and returns for farmers. Since then, more than 3,500 artisans from 70 villages have been trained. About 100 of them are now employed full-time, more than 350 on a regular part-time basis, and at least 250 local farmers supply the growing market for high-quality bamboo furniture.

In early 2009, having grown steadily in volume and expertise and yet unable to meet the growing market demand due to the constraints of working within a grant-based project model, KONBAC floated a for-profit sister institution NATIVE KONBAC Bamboo Products Limited. This enabled the operation to accept capital investment, to invest in plant machinery and other infrastructure, engage and retain professional resources and, most importantly, to share equity in the business with its bamboo artisans. The company now holds - standing orders worth nearly US$500,000.

One of these artisans is Lahu Joshi. Lahu, his mother and one of his sisters all suffer from a genetic disorder known as brittle bone disease (Osteogenesis imperfecta). Sufferers are unable to carry the weight of their body on their legs, and live in constant fear of fractures, which essentially leaves them housebound. Lahu and his family had become completely dependent on the income of their unaffected sister, Rakhi, who worked as a domestic helper for just 800 rupees (US$17) a month.

When he heard about the family, Sanjeev arranged for Lahu and his sister, Prathiba, to be trained in making bamboo pegs, and for the raw bamboo culms to be delivered to their home. Today, their combined incomes are now more than five times what Rakhi was making alone. “KONBAC has changed me from being useless to being useful,” said Lahu. “I was so ashamed of accepting charity from neighbours and relatives. I hated the sympathy I got. Now I lead a life of dignity.”

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*For more information on KONBAC, please access the INBAR Working Paper No. 56 “Breaking Barriers and Creating Capital” at: http://www.inbar.int/publication/PDF/Konkan%20impact%20study_Final.pdf*

# Rattan Furniture

## Product profile

Rattan, or cane, furniture has been produced for millenia. The furniture is elegant, natural, stylish and very popular in many countries. Rattan grows in Southeast Asia and parts of Sub-Saharan Africa, and rattan furniture is a well-known export of countries such as Indonesia, which has 80% of the world's rattan resources.

During the 19th and much of the 20th centuries most of the world's rattan furniture was produced in affluent countries that imported raw rattan from producing countries. Nowadays, furniture is manufactured in the raw material producing countries and so the benefits of the high value-addition that manufacturing imparts remain in the producing country. Increasingly, countries such as China that have depleted their own raw rattan resource base are now major importers of raw materials, whilst more affluent countries sometimes add value to existing partly-completed products, and export the finished items.

## Production process

Most higher-quality furniture producers have factories, where production inputs can be managed and quality maintained. The stages of production are:

- Preservation of raw rattan
- Production of sub-assemblies
- Assembling sub-assemblies into furniture framework
- Weaving (backs, seats and so on)
- Varnishing/painting
- Addition of other components (such as cushions)
- Marketing

Initially, design and market acceptance of the product are of great importance, and a rattan furniture-making unit can employ product developers and designers. It may be suitable to tap into the existing skills of staff for this, with design and marketing training.

## Market for rattan furniture

World demand for rattan products is strong, particularly as rattan has a natural, tropical feel about it. Annual recorded world rattan exports are about USD$850 million - the main exporters being Indonesia (44%), China (26%), Vietnam (10%) and the Philippines (8%). The largest importers of rattan furniture are the EU and the USA. National markets in many countries are unrecorded, but are expected to account of significantly more trade than international markets. In Ghana, for example, most rattan furniture is for local consumption, and there are only a handful of exporters. The quality of nationally-traded furniture is often much lower than internationally traded furniture.

## Socio-economic benefits

A rattan furniture production unit will provide jobs to local people. Rattan harvesters, primary processors, furniture makers and marketers are all needed in the production chain. In Indonesia, it is estimated that in 2005 over 80,000 people earned incomes from harvesting and primary processing of rattan, and a further one million from producing rattan products. Steam bending and oil curing, bleaching and preservation are integral parts of the earlier stages of production and require semi-skilled labour, as does the later stages of producing the furniture. A rattan furniture unit creates employment and income generating opportunities for a wide range of people and helps improve the economies of the rural communities in which is established. Processing imparts a high level of value addition, and if established as a community cooperative venture and well run, the community should benefit considerably. Improving management and harvesting practices of rattan benefits the local environment and those involved with their cultivation.

The main development attributes of producing rattan furniture are:

- It creates a large number of income generation opportunities for people at different stages during the production chain.
- Producing and marketing rattan furniture is an excellent way of developing individual and collective entrepreneurship skills and experience.
- It increases community welfare.
- It is gender insensitive, though some tasks, such as harvesting rattan and preservation of rattan poles are physically demanding and are traditionally the work of men.
- Sustainable use of rattan can promote community awareness and ownership of tropical forest resources, and rattan as a substitute for furniture made from tropical timber.
- Promotes rattan furniture as a substitute for timber-wood furniture

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Bamboo and rattan grow in abundance throughout many tropical and sub-tropical regions of the world, and can be used to make literally hundreds of products, often with very little capital investment. As a result, these Non-Timber Forest Products (NTFPs) support the livelihoods of many millions of the world's poorest people. Increasingly, bamboo and rattan are being used to produce high quality, long-lasting consumer goods for export, contributing significantly to a number of developing world economies.

This book provides a broad overview of the production process, global markets, socio-economic benefits and investments required for a selection of the most important bamboo and rattan products, including furniture, handicrafts, flooring and edible shoots. It is for anyone with an interest in promoting or investing in these unique and renewable resources, be it for people, planet and, or, profit.

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