Woven bamboo products manufacturing unit

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Sustainable Development Goals
No poverty, zero hunger, gender equality, decent work and economic growth, industry, innovation and infrastructure and responsible consumption and production

Summary
Woven bamboo products are produced from thin strips of bamboo. There are a wide variety of such products and they have been closely associated with the development of civilizations in bamboo growing regions of the world for many millennia. The products may be primarily intended for agricultural use, such as baskets for vegetables or animals and winnowing trays for cereals, or they may be household products such as baskets, trays, jars, cases, lampshades, fans and mats.

Description
1. Development of woven bamboo products in China

China has long history of cultivation and utilization of bamboo resources. Bamboo has a distinctive status in Chinese culture and history and bamboo has deeply colored the lives of the Chinese people. The usefulness of bamboo in daily life especially in the rural areas, has been well eulogized in literature, both scientific and popular. The history of bamboo weaving in China can be traced to the Neolithic Age. More than 200 bamboo woven articles have been unearthed in both the primeval Hemudu Ruin in Yuyao City and the Yanliangchu Ruin of Zhejiang Province, which show comparatively skilled weaving techniques. Baskets and other appliances for food storage were woven from bamboo, rattan, willow and straw, which were cut with stone knives and axes. During the Yin and Shang Dynasties the technology of bamboo weaving developed rapidly and various products were woven from bamboo culms.

The colored bamboo mat and small suitcase found in the Chu Ruin from the Warring States Period (403-221 BCE) in Hubei Province are highly ornamented and delicately woven. Various woven bamboo products such as mats, shades, suitcases, fans and baskets, were widely used in daily life or as decorations. The weaving methods differed considerably. For example, mats were woven by placing bamboo strips across one another either diagonally or longitudinally and baskets were loosely woven in three directions or in a circular pattern.

These methods continue to be applied even now. The woven bamboo products form Shen County, Zhejiang Province enjoyed a high reputation early in the Eastern Jin Dynasty (317–420 CE), and were famous for their use of exceptionally thin bamboo strips. Woven bamboo products diversified...
during the Ming (1368–1644 CE) and Qing (1644-1911 CE) dynasties, the techniques improved and they became popular among ordinary people. As the technology of weaving continued into modern times, it has been further developed in the southern provinces of China. Various products such as boxes, cases, trays, fans, lanterns, folding screens, jars, and baskets are produced, some of which are exported to countries in Europe and America.

These various colored products are more widely used than before. Zhejiang, Fujian and Sichuan Provinces are the front runners in the bamboo weaving industry in China. As an example, in Shengxian county in Zhejiang Province over 5,000 varieties of woven products have been produced and more than 200 new products are developed annually. Ninety-five percent of the total output is exported.

The production of woven products is a traditional technology that has been practiced for more than a thousand years, and is widely distributed in southern China. Manufacturing woven products combines traditional weaving skills with modern technology. The majority of the remaining mills are grouped as cottage and small-scale enterprises.

In China, there are various bamboo woven products including baskets, trays, jars, boxes, cases, vases, folding screens, models of animals and figures, buildings, furniture, lamps and lanterns, bags, toys, fans and mats. Some are graceful pieces of art for decoration or enjoyment and some are indispensable commodities. The styles of the products often varies according to place of production.

For example animal models are characteristic of Shengxian in Zhejiang province, the household utensils from Dongyang, Zhejiang province are famous, gaily decorated baskets are produced in Gutian, Fujian Province, bamboo pillows are speciality products of Ningde, Anhui province, woven surrounds for porcelain articles are from Chengdu, Sichuan Province, famous fans come from Zigong, Sichuan Province, and the mats from both Yiyang, Hunan Province and Shucheng, Anhui province are well known.

2. What is the role of a woven bamboo

A woven bamboo products unit provides income generation and skills development to those that it employs. The work is gender sensitive and often favors women. Weaving can be done on site or at home in spare time. Increasing the use of local bamboo resources also encourages their sustainable management and benefits the bamboo cultivators.

3. How do I establish a woven bamboo products unit?

A woven bamboo products’ unit can be established very cheaply. If splitting is done by hand then the costs can be limited to land, raw materials and labor. 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.

3.1 General development attributes

The main development attributes of the technology are listed below. The technology is:

- labor intensive;
- gender sensitive;
- increases the use of sustainable bamboo

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resources;
• flexible in time and place; and
• It can build upon inherent weaving skills in the community.

3.2 How are they produced?
Bamboo culms are split longitudinally to produce pliable, thin sections of the culm. These are then used to weave the products. The techniques require considerable skill and experience on the part of the weavers and the designs require innovation on the part of the designers.

3.3 What is the market for bamboo products?
The market for bamboo handicrafts is large and ever-expanding. Handicrafts are very popular in many countries of the world where their natural appearance and their environmentally friendly production methods are major selling points. There is also a stable market for agricultural-use products in many countries.

4. Manufacturing woven bamboo products
4.1 Introduction
The technical stages involved in manufacturing woven bamboo products are:
• conception and design of handicrafts;
• strip and split making;
• weaving skills; and
• methods of coloring, preservation and protection against pests and relevant facilities.

Bamboo woven articles are made with various widths, thicknesses, lengths and sizes of bamboo splits made from bamboo culms, based on the design of the products.

There are two kinds of bamboo splits used for weaving: bamboo threads and bamboo strips. As their names imply, the thickness and width of threads are approximately equal. Strips are much broader than they are thick.

The technology is suitable for all areas that grow bamboo that can supply the raw materials for the unit. This includes sustainably managed natural bamboo forests and plantations. Management of plantations and natural stands is highly desirable to guarantee a standard level of supply to the unit and to maximize the benefits of the plantation to the owner and cultivators.

The woven bamboo products unit is especially suitable for areas where bamboo plantations are desirable for the restoration of degraded lands such as abandoned shifting cultivation areas, or where bamboos can be grown to reduce soil erosion, particularly on steep slopes in high rainfall areas.

4.2 Raw materials
Bamboo culms are hard and flexible but can easily be split lengthwise into strips and threads for weaving. Many different bamboo species can be used, but the best are those with long internodes such as B. textilis and B. chungii.

4.3 Making strips and threads
Strips and threads are the basic materials for weaving various bamboo crafts. Proper treatment of raw materials is a very important procedure that affects the final quality of the goods. The processing techniques for making bamboo splits are briefly described below:
• bamboo culms
• cross-cutting
• knot removal
• splitting
• smoothing
• width-sizing
• stripping

4.3.1 First Step
The narrow tip of the culm and the stout bamboo rhizome are removed before the culms are cross cut to length.

4.3.2 Second Step
Remove the waxy epidermis and nodal flange: The waxy epidermis and nodal flange should be removed from culm surface preferably on the day of cutting to guarantee the brightness and smoothness of the culms. The nodal flange is removed first and then the culms are fixed to a frame and the waxy epidermis removed by scraping gently and evenly with a sharp knife, without damaging the surface appearance.

4.3.3 Third Step
There are two procedures for splitting bamboo culms. The first involves marking out lines 2 - 3 cm apart, and then splitting into pieces with a knife. The other method is to split the culms in half longitudinally and then further split them into sections based on size of splits required. Attention should be paid to ensuring smooth passage of the knife through the nodes. This operation can be carried out manually or on a machine. Bamboo splits should be put on frames in the open air and dried under the sun with the green skin-side upward. The air-drying process continues until the bamboo skin turns light yellow or yellowish white. To retain their natural beauty the bamboo splits should not be exposed to rain.

4.3.4 Fourth Step
Production of bamboo strips and threads: Split bamboo parts vertically along the radius of the cross section into bamboo strips. Bamboo strips can then be cut into bamboo threads according to the requirements for the final products. All the bamboo strips should be of same width and same thickness and each strip should be of equal width and thickness throughout its length. It is important to make sure that strips are straight and smooth.

5. Weaving methods
Bamboo threads are mostly used for making articles such as baskets, boxes, bottles, jars and dolls. All these goods are woven from their base upwards. After the base is finished the weaving continues spirally upwards. Bamboo strips are used for making bamboo mats and curtains. These types of goods are usually woven from the middle outwards to the borders and corners.

5.1 Tools and Machinery
The tools required for weaving bamboos are strip knives, saws, striking planks, sharp knives, shaving knives and hand drills. These tools can easily be purchased from any tool supplier or can be made by the weavers themselves.

Although cross-cutting, splitting of bamboo culms and making strips and threads can be done manually, machines are normally used to increase productivity, reduce wastage of raw materials, increase the yield of bamboo strips and remove drudgery in the primary processing of the culms. The main machines are crosscutting machine, sliver-making machine, splitting machine and width sizing machine.

5.2 Requirement for success
The essential requirements for a successful unit are:
• regular supply of bamboo culms;
• unskilled and skilled labor;
• small amount of start-up capital; and
• market access.

The land requirement for setting up the unit is negligibly small and the investment required low. As a micro enterprise it can be established near the resource, and can form a significant part of both the monetary and non-monetary economies in bamboo growing regions. However, technical assistance for production, organizing seminars and training courses (management, production and maintenance), conducting relevant research and development are all required to ensure success, especially in the establishment phase.

Manufacturers rarely conduct market surveys to keep abreast of business trends and accepted products. In the export markets, the low prices offered for relatively high quality products deter them from entering these markets and so assistance is required to disseminate information on marketing.

Institutional and economic policy support is also required to guide new products into markets, to introduce preferential financial investment policies and to set up networks of technical and information services to train workers.

6. Comprehensive input requirements

Bamboo is traditionally used in rural areas for weaving products or handicrafts. Manual crosscutting, splitting and slivering of bamboo culms is normally done by men with various tools like knives. Women, disabled or infirm people usually work as weavers.

It is possible for people to weave products such as mats and baskets after short-term training. Much more experience and higher levels of skill are required to weave superior quality handicrafts and these can only be learnt from master craftsmen and women, ideally under an apprenticeship scheme.

6.1 Variability in input supplies and costs

The cost of investment for this project includes fixed capital and flow capital that is essential to ensure project implementation and management activities for production. The input supplies should contain technological service fee, training fee and exploitation fee for new products, as well as investment costs.

6.2 Institutional support

Many farmers in some developing countries are illiterate and live in small villages under conditions of perpetual poverty. Some rural peoples who take up weaving in their spare time to supplement their income from seasonal agriculture are economically strong and have the capacity to organize themselves into cooperatives or aided institutions to benefit from schemes funded and aided by government agencies.

7. Outputs

The main outputs of this project are bamboo-weaving products for both commodity and handicrafts such as mats and baskets, as well as processing waste which can be sold for papermaking materials, for energy production, or for making activated charcoal.

7.1 Financial attributes (Net Present Value, Internal Rate of Return, Benefit-Ratio, Break-even Period)

The average price of one Moso culm with 8 cm DBH was 7 to 8 RMB Yuan in 1998. The woven products made from one Moso culm with 8 cm DBH are valued at about 60-100 RMB Yuan in China, yet the benefits, value and costs of different bamboo weaving products varies widely. Based on
the costs of various woven products, which include raw materials (bamboo culms), other materials (chemicals for preservation, bleaching, staining etc.), energy, water, and the outputs mentioned above, the Net Present Value, Internal Rate of Return, Benefit-Cost Ratio, Breakeven Period will be 15.33 percent, 30.13 percent and 5.01 years respectively.

7.2 Target groups and benefits
The main target group are the rural poor. Weaving can be done as an additional activity during spare time or outside the cropping season and thus the farmers can maximise their productivity. Bamboo weaving is a traditional labour intensive industry.

Although the weaving of handicrafts involves high levels of skills and creativity on the part of the weavers, in general, the technology for making commodities such as mat and baskets, is not so intricate such that unskilled workers and those with lower levels of education require only short periods of training before they are competent in it.

Bamboo weaving can be done in a very decentralised manner and is easily done by homebound women and those that are unable to do manual labour. The unit may be established on a small scale as private household businesses or on a larger scale as a cooperative or government enterprise. Therefore, bamboo weaving generates employment, especially for women and other disadvantaged groups, ensures better income distribution, and earns valuable foreign exchange through exports.

The development of bamboo weaving-based industries will not only generate income for both men and women, but also will create more economic activities and benefit the growth of the rural economy in bamboo growing regions and countries. Woven products, particularly woven handicrafts, have high value addition and their production does not damage the climate or environment.

In addition, manufacturing woven products consumes a large quantity of bamboo materials that lead to more income activities based on bamboo forestry, which promotes cultivation and management of bamboo stands and generates incomes for farmers. Additionally, bamboos can be intercropped with food crops and thus enhance the food security of the growers.

The bamboo weaving industry will play an important role in poverty alleviation in bamboo growing regions, which are in mountainous areas with poor transport, lack of energy, technology and finance. These all present some difficulties in developing other industries, yet there are rich bamboo resources and sources of labour available. Woven handicraft units would be ideal for this type of location.

8. Concluding remarks
A woven bamboo products unit is an excellent option for rural development in bamboo growing regions. Weaving is gender sensitive and can be done by people in their own homes in spare time or at the unit itself.

Because of the need for initial expert inputs in training weavers and seeking markets, it may be appropriate to establish the unit with the support of state agencies or NGOs.

9. Validation of practice
The technology was tested in China by local farmers.
10. **Minimum requirements for the successful implementation of the practice**

The essential requirements for a successful unit are:
- regular supply of bamboo culms;
- unskilled and skilled labor;
- small amount of start-up capital; and
- market access.

11. **Agro-ecological zones**
- Subtropics, warm/mod cool; and
- tropics, cool/cold.

12. **Related/Associated Technologies**

13. **Objectives fulfilled by the project**
- Women-friendly;
- resource use efficiency; and
- pro-poor technology.