

The industrialization and market orientation of bamboo shoot production in Lin'an County: a case study

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Abstract—Lin'an County, in the Zhejiang Province of China, began to develop large-scale industrial purpose bamboo shoot plantations in the 1980s. The bamboo shoot plantation area in this county increased from 2180 ha in 1982 to 20000 ha in 2002; at the same time, the annual fresh shoot production increased from 7280 tons to 135250 tons, annual fresh shoot production value increased from CNY 2.19 million to CNY 328.05 million (1 CNY = about US\$ 0.12). The local industry development started from zero to 47 bamboo shoot processing enterprises, the processed bamboo shoot products amount to 114000 tons per year. From these products, 32180 tons are exported to international markets, with an export value of CNY 150 million. The annual per capita income of local farmers increased from less than CNY 800 to CNY 5100. This article introduces how the local farmers in Lin'an County developed the local bamboo shoot production from a natural autarkic economy to an dimensional and market-orientated industry. This progress involves Government supports, training for local farmers, construction of demonstration sites and establishment of technical service network and marketing development. This article provides a successful model for developing bamboo sectors in a community with poor conditions and achieves success in a comparatively short period of time.

Key words: Bamboo shoot; industrialization; market orientation.

BACKGROUND

Lin'an is located in the Tianmu mountain region in the northwest of Zhejiang Province, China, between 118°51' and 119°59' east longitude, 29°56' and 30°26' north latitude. The total area of the county is 3126 km², 86% are mountainous and hilly areas, forest coverage is 71.3%. The total bamboo plantation area is 52000 ha. Lin'an is named by the Chinese Government one of the Ten Homelands of Bamboo in China. The total population is 500000.

Before the 1980s, Lin'an was a poor county in mountains whose livelihood relied on traditional agriculture. The per capita income in 1980 was only CNY 270 (about

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US\$ 50, exchange rate 1980). By then, the main crop of the county was rice; people farmed other crops, such as maize, beans, etc., using the shift cultivation method. As the population grew, the demand for more food result in damage to larger and larger areas of the forest. As the water and soil erosion became more and more serious, large areas of arable lands were flooded every year.

To solve the serious environmental problem brought on by mono-crop, and alleviate the poverty in the county, bearing in mind the fact that the local farmer has the tradition of planting bamboo to meet his own needs for production, construction and food, and that the bamboo plantation is effective at keeping water and soil, the local government began to advocate the cultivation of shoot-purpose bamboo (main species are *Phyllostachys praecox* and *Ph. prominens*) utilizing degraded lands on the hillside in 1983. Since then, Lin'an's bamboo industry has grown from almost zero to China's largest bamboo shoot producing place. It realized industrial processing of the shoots; its shoot products do not only sell in China's domestic markets, but are also exported to international markets. At the same time, local farmers' income was greatly increased, the economy growth enhanced the civil, educational and environmental construction, the livelihood of the local people was improved. At the same time, large areas of degraded land were rehabilitated, the water and soil erosion was controlled. As Lin'an's people are becoming richer and the local landscape is taking on a picturesque scenery, the local eco-tourism began to grow fast.

PROGRESS OF BAMBOO INDUSTRY IN THE PAST 20 YEARS

Lin'an started large area cultivation of shoot-purpose bamboo plantation in 1983, up to 2002, 20 years have passed, and the following progress has been made:

Enlargement of shoot purpose bamboo plantations

In the year 1983, total shoot purpose bamboo plantations in Lin'an County was 2180 ha. Farmers planted shoot purpose bamboo around their houses to supply food for their own families. In the year 2002, the shoot purpose bamboo plantation in Lin'an county reached 20 000 ha, which is 9 times of that in 1983 (Fig. 1).

Growth of shoot production

In the year 1983, the total production of fresh bamboo shoot in the County was 1421 tons. In the year 2002, this had reached 107 150 tons, which is 7.54 times that in 1983 (Fig. 2).

Growth of bamboo shoot production value

In the year 1983, the fresh bamboo shoot production value in Lin'an county was CNY 2.19 million, increasing to CNY 328.05 million in the year 2002, which is

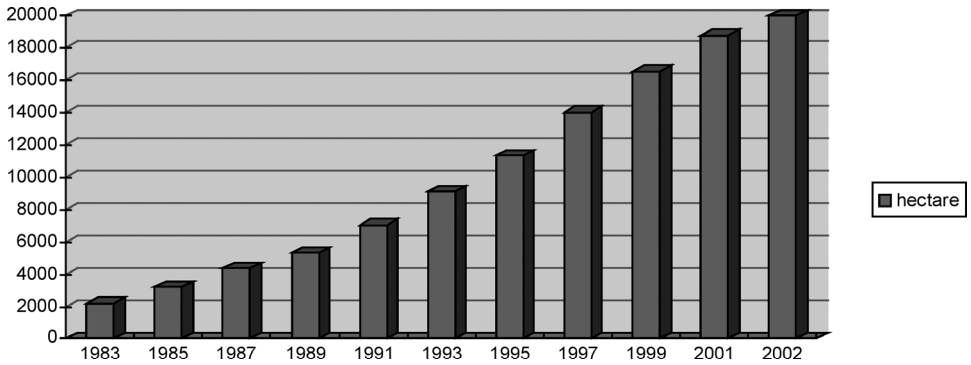


Figure 1. Lin'an's bamboo plantation area growth over the past 20 years (1983–2002).

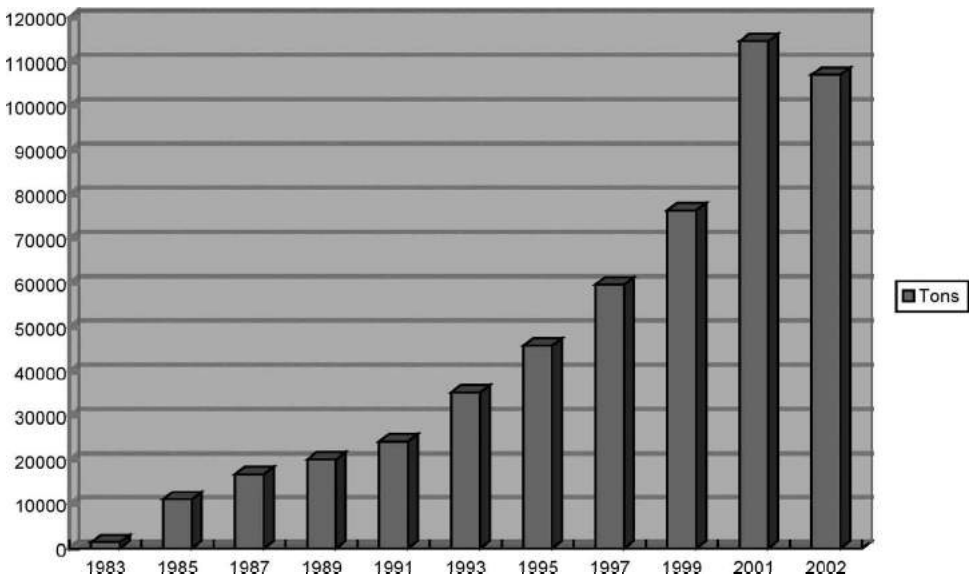


Figure 2. Shoot production growth over the past 20 years (1983–2002).

almost 15 times that of 1983. This value does not include processed shoot values (Fig. 3).

Industrialized processing of bamboo shoots

starting almost from zero, Lin'an's shoot purpose bamboo plantation and its production started to grow in the early 1990s. Other counties and provinces learnt from the successful experiences of Lin'an and followed up in bamboo shoot production. In less than 10 years, the local production of fresh bamboo shoot had exceeded the demand of markets in the local region and big cities nearby. Lin'an was the first in the industrialization of bamboo shoot processing. In the year 2002, there are 47 bamboo shoot processing plants in the county, the total producing

Million CNY

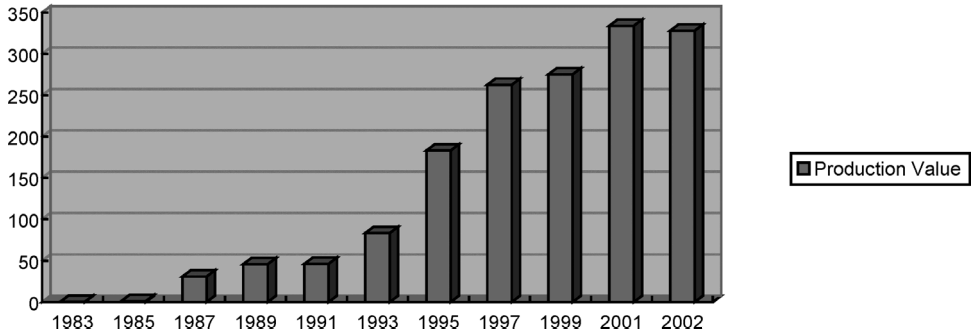


Figure 3. Bamboo shoot production per year.

capacity is 150 000 tons/year. In the year 2003, the factories processed 11 480 tons of fresh shoots. The available fresh shoots in Lin'an county for industrial processing every year is 60 000–70 000 tons (a lot of fresh shoots are sold directly to the market), Lin'an needs to import 70 000–80 000 tons of fresh shoots from other counties and provinces every year to meet the producing needs of the local factories.

A fast extension of bamboo shoot markets

Farmers in Lin'an began to realize the importance of market development in early 1990s. The number of specialized markets for trading fresh shoots in Lin'an was 12 in the year 2002. Besides, with the support of the local government, Lin'an shoot trading markets were established in big cities nearby, such as Shanghai and Nanjing. Now, Lin'an's fresh bamboo shoots are sold in North China, South Korea, Hong Kong, etc. Processed shoot products are exported to other countries in large amounts. In the year 2002, the exported processed shoot products was 32 180 tons, with a value of CNY 150 million.

Distinguished increase in the farmers income and improvement in livelihood conditions

Bamboo shoot industry and other bamboo related sectors have now become the main source of income of the local farmers. 60% of the rural households participate in the bamboo-related sectors (about 60 000 households, a rural population of 210 000). The total production value of the bamboo sectors in 1983 was CNY 20 million, in 2002 it was CNY 1.15 billion. The income from bamboo sectors accounts for 70% of the local farmers' total income. One of the most distinguished changes reflecting the changes of farmer's income is the improvement in their housing conditions. The traditional thatched cottages and slurry-walled houses are replaced by brick-and-tile houses. The per capita living area is more than 50 m². 80% of the new houses are of modern villa style. Almost all rural households are equipped with colour televisions,

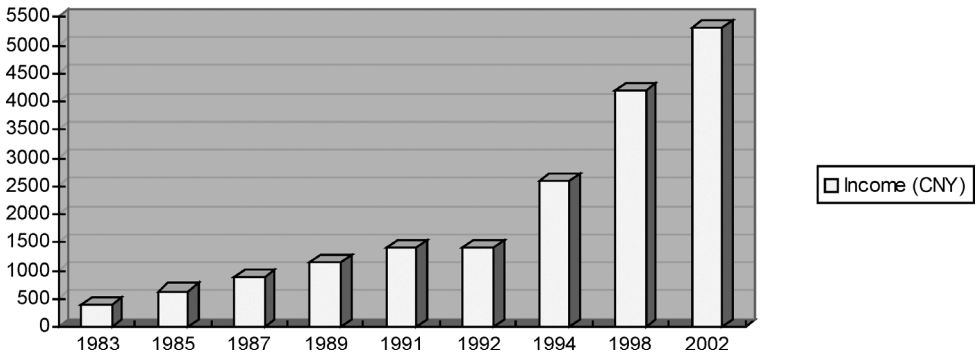


Figure 4. Per capita net income in Lin'an County.

refrigerators and washing machines; more than 80% are equipped with telephone; the gap between urban and rural is greatly reduced. Lin'an is taking on the new look with better civilization, beautiful environment and wealthier population (Fig. 4).

Water and soil control and environment rehabilitation with bamboo

The 30 000 ha shoot purpose bamboo plantations of Lin'an County are mostly located on degraded, wasted lands and slopes where the water and soil erosion is the most serious. Shoot purpose bamboo plantation did not only improve the fertility of the soil, but also controlled the water and soil erosion. Experiments showed that the water and soil controlling capacity of bamboo plantation is 1.5 times that of Masson's pine (*Pinus massoniana*) and 1.3 times that of Chinese fir (*Cunninghamia lanceolata*). As the water and soil were controlled, Lin'an's natural environment was improved, beautiful landscape come into being. From 1990 the County began to develop eco-tourism and many tourists from big cities nearby visited the County. In the year 2002, the County received more than 2 million tourists.

HOW DOES LIN'AN DEVELOP ITS BAMBOO SHOOT INDUSTRY?

Government: preferential policies

In the early 1980s, as the reform and opening policy of China was implemented, the lives of Chinese people began to improve fast, the consumption of fresh shoot and shoot products in local region and big cities nearby began to increase as well. The market price of fresh shoot increased dramatically. According to the market forecast and suggestions by experts, the Government of Lin'an County decided to provide support to the local bamboo shoot production. Based on investigations and information discussions with the farmers, the government formulated a series of preferential policies which encourages farmers to participate in the bamboo shoot production.

China's contract land policy. In China, all land is owned by the state, but not all land is managed by the state. Prior to reform and implementation of an 'open policy', most rural land was managed collectively by the community. After reform in the 1980s, rural areas began to practice a contract land policy. This policy provides for the separate management of land by rural households, with crop fields allocated to households according to household size, and provides rights of ownership and management. During the 1980s, the standard contract period was 10 years; however, in the 1990s it was extended to 30 years.

During the contract period, households choose how to use and manage the land, including which crops to cultivate. Almost all income derived from the land, with the exception of a small land-use tax, goes to the farmer. As the policy also applies to bamboo plantations, the management rights for most collectively managed bamboo plantations were transferred to individual households. The contract household then pays a small amount of the contract fee to the community. The contract period is usually 30–50 years, with a maximum of 70 years. During the contract period, management rights can be inherited or transferred to other individuals or to the private sector. Farmers can also establish contracts over low-productivity and degraded state and collectively owned land. If several households are interested in a specific area of land, the contract is awarded on a competitive basis between the households. The contract land policy played an important role in motivating farmers to manage land for the long-term.

In order to encourage shoot plantation development in combination with degraded land rehabilitation, degraded land contracts are given to individual households on the basis of interests and capability, instead of the number of people in each household. At the beginning, most farmer households were not interested in planting bamboo and contract for degraded land, the government allow interested households to contract for more degraded lands, the contracted area was not limited by the number of people in the contractor household. In 3 to 4 years, the contractor households were rewarded by greatly increased income and their practices inspired the interests of other farmer households to contract for degraded lands.

For example, Baisha Village in Lin'an County, Zhejiang Province, contains large areas of wild bamboo stands (*Phyllostachys nuda*) mixed with the natural forest. Prior to the contract land policy, the community managed only natural forest, with bamboo stands not subject to any form of management. Farmers were free to cut bamboo culms and dig bamboo shoots. Lack of management led to the gradual degradation of natural bamboo stands. Since 1984, the natural forests were contracted to individual households and farmers began to intensively manage the natural bamboo stands. As a result, bamboo shoot production increased, with a corresponding increase in per capita annual incomes from bamboo shoots from CNY 200 CNY (in 1983) to CNY 2000 (in 1993).

Financial support policies. In the 1980s, local farmers in Lin'an County noted that bamboo shoots, especially the shoots of *Phyllostachys praecox*, due to its

early shooting and high-yield, were favoured by consumers in large cities such as Shanghai and Hangzhou. By that time, most farmers did not believe in the high return of bamboo plantations and the interested farmers could not afford to buy mother plants. The local government began encouraging farmers to develop bamboo plantations for shoot production. Each hectare grown for shoots received a subsidy of CNY 300, which allowed farmers to buy mother plants for plantation establishment. The subsidy applied for 4–5 years. By the fifth year, the plantations were established, and large amounts of shoots could be harvested and sold. Farmers who first received the subsidy received high economic returns, with incomes from bamboo shoots per hectare reaching CNY 90 000 (US\$ 11 000). More farmers recognized the economic value of bamboo plantations for shoot production and actively joined in the development of bamboo plantations for shoot production. By this time, there was no longer a need for government subsidies, and the government emphasis shifted to the provision of financial support for technical training and marketing.

From the 1980s to the 1990s, the area of bamboo plantations in Lin'an County, particularly plantations of *Phyllostachys praecox*, increased from 2000 ha to 15 000 ha. Large amounts of fresh bamboo shoots began to be produced, the production in the shooting period (about 1 month) exceeded the consumption in large cities nearby in the same period. Fresh shoot processing became a new problem, processed shoots can be better preserved and can be supplied to the market all year round. However, up to 1990 Lin'an still had no bamboo shoot processing factories. Therefore, the local government encouraged cooperation between farmers and enterprises to develop bamboo shoot processing factories, including the provision of loans provided with government interests to shoot and culm processing factories. Between 1991 and 1995, the local government provided an annual amount of CNY 2 million to bamboo shoot and culm processing factories.

Good international and domestic (especially North China) markets were found in which to sell the processed bamboo shoots. To date, there are 47 bamboo shoot processing factories in the County. The total annual production of fresh shoots is 135 250 tons, 40% of which is processed by factories. About 60 000 tons of fresh bamboo shoots are now bought from neighbouring counties and provinces for processing in Lin'an. After five years of preferential loans by the government, a dozen of shoot processing factories were established, most of them got good profits. As the processing scale grew, the marketing of large amounts of processed shoot products became the new issue, the government loan was then shifted to the establishment of bamboo shoot market. With the support of the local government, 12 bamboo shoot trading markets were established in the County, they provided conveniences for the trading between local farmers and merchants from other regions. At the same time, bamboo shoot markets were also established in big cities such as Shanghai, Nanjing and Beijing.

It can be concluded from the above that government financial support in the early stages of the bamboo sector development is necessary, and plays an important role in

enhancing the sector. The government should provide necessary financial supports when there are difficulties in different stages of the sector development. The largest direct beneficiary of these supports is the participating farmers, the largest indirect beneficiary is the government itself. The bamboo sector became more and more important as a source of taxes.

Policies for technical services and technology transfer. Efficient and in-time technical services for farmers are one of the important methods of the local government in promoting bamboo sector. Technical services are mainly provided through the Forestry Bureau of the County and the forestry stations at grassroot levels:

- Technical training. Various training courses are held for the farmers free of charge. Training may include lectures, field guides or media broadcasting. The training helps farmers to learn about new technologies as quickly as possible.
- Demonstration households and sites. For large-scale technical services, the most active/enthusiastic farmers are usually selected as priorities, if the new technology proves successful and efficient, the government awards the prioritised farmers the title of ‘Demonstration Household’. The experiences of these households are then extended to other households. For example, in Lin’an County, in order to promote the development of bamboo plantation for shoot production, the local government established over 200 demonstration households during the 1980s and 1990s. Some of these households achieved an annual income of US\$ 10 000 from shoot production, which has provided motivation for other farmer households. Up to 1997, through demonstration and training, 6500 farmer households had achieved an annual income of CNY 10 000 (US\$ 1220) through shoot production. The demonstrations was also extended to different types of shoot and culm processing factories, now Lin’an has 400 bamboo processing factories, they produce various kinds of bamboo products. Now, under the support of the local government, a demonstration site for green organic bamboo shoot production has been established under the direction of scientists. The site is composed of several farmer households and comprises a total area of 10 000 mu (666.7 ha). This demonstration will soon extend the non-pollution/organic food standard to all the shoot production plantations in Lin’an.
- Technical service contracts. Commonly, farmers are weary of adopting new technology for fear of suffering financial loss. As a result, the government is encouraging the signing of technical service contracts between technicians and farmers. If the farmers follow the directions of the technicians, the technicians guarantee a certain production level and profit for the farmers. If the production levels and profit are less than the contract figure, the technicians are responsible to compensate the farmers. However, if production and profits are higher than the contract figure, the technicians share a portion of the exceeded profits. The government also awards technicians whose technical service is of most benefit to farmers. For example, in 200, Mr. Wang Anguo, Senior Engineer of the

Lin'an County Forestry Bureau, was awarded the title of 'National Advanced Agricultural Technician' and CNY 200 000 for his outstanding contribution to bamboo development and extension of forest technology. He was also honoured by former President Jiang Zemin and former Prime Minister Zhu Rongji.

- Researchers are required to participate in the extension and application of their research results. The government has always emphasized that researchers, except those doing research in basic fields, should participate in the extending and application of their own research results in person, so as to improve the applicability of the new technologies and accelerate the social and economic benefits of new technologies. There are two important criteria by which to evaluate the achievements of a scientist. One is the results of his/her scientific research/academic research, and the second the social and economic value of his research results in terms of practical application of the technology. A scientist whose research results are of high academic value and which have significant social and economic benefits, will be awarded and promoted. These evaluation criteria encourage scientists to participate in the extending of their research results, helping users to understand and apply new technology as quickly as possible. As developers of new technology, the scientists can also identify practical problems under different conditions, and give feedback and improve future research. Lin'an's scientists have developed a series of new technologies in accordance with practical problems met during bamboo sector development, these technologies are now extended to real production: for example, land covering technology for early shooting, can bring the shooting period of *Ph. Praecox* forward by 5 months. The normal shooting period of this species is usually late March; using this technology, farmers cover the land with chaff and straw, adjust the shooting time according to market demand, and the earliest shooting time can be November. This can avoid the dropping of fresh shoot price when large amount of shoots enter the market in a short period of time. For example, 1 kg of fresh shoot can be sold at a price of CNY 10–16 from November to February, but the price will drop to CNY 1 in April. This technology brought more than CNY 100 million to the farmers every year.

Enterprise management model: enterprise plus farmer

In China, more than 90% of the bamboo sector is composed of middle and small-to medium-scale rural enterprises established by farmer entrepreneurs. Lin'an has 400 bamboo processing factories, among them 47 are shoot processing factories. The workers of these shoot processing factories are mostly seasonal workers, only a small number are year-round workers. In the busiest years, the a shoot processing factory may need more than 7000 workers, among which 2500 are year-round workers. Now there are about 30 000 year-round workers in the bamboo processing factories of the County. The enterprises are staffed by local farmers, and most of the raw materials are sourced locally. A common management model has gradually developed, the model of 'enterprise + farmer'.

For example, a bamboo flooring factory with a capacity of 200 000 m²/year needs approximately 500 workers for all production stages, including processing of raw materials, treatment and product finalization. The establishment and operational costs of the factory are likely to be high. The factory requires a large number of full-time workers; however, only 26% (the middle lower part) of the bamboo culm (*Phyllostachys heterocycla var. pubescens*) can be used for flooring, the other parts can not be used unless the factory adds more equipment to process other bamboo products, including tooth picks, chopsticks, curtains, scaffolding and charcoal. For most small- to medium-scale rural enterprises, it is not possible to purchase the additional equipment and find markets for the products. Thus, the local government now encourages the enterprise + farmer model.

Under this model, the factory contracts with local farmers to buy bamboo strips instead of bamboo culms and the farmers sell the waste parts of the bamboo to other factories. The base part can be sold to bamboo charcoal factories, the middle and upper parts to bamboo curtain factories, and the top part to bamboo stick factories (toothpick or skewer factories, the farmers can also process bamboo chips slips for the pedal on scaffoldings). By providing raw processed products to the factories, local farmers can increase the value of culms 2–3 times, therefore, benefiting from the value adding process. At the same time, the factory reduces its costs. The factory also provides free processing machines to the contracted farmers for free. Under this model, a bamboo flooring factory with a capacity of 200 000 m²/year needs only 100 full-time workers, and approximately 400 farmer households for raw processed products.

The same model is applied to shoot processing factories, beside the full-time workers, every factory have contracted processing sites in the villages. According to the technical standard of the factory, under the directions of technicians, farmers remove the shuck and boil the shoots, then put them into cans and transported to the factory for finishing. Under this model, the factory saves 50% of the transportation costs, and avoided the costs for arranging accommodation for large numbers of seasonal workers. At the same time, the farmers are benefited from the additional values.

Enterprise + farmer has not only brought economic benefits to both parties, but also established a partnership of mutual dependence. Farmers gradually learned about industrialization and market orientation, as well as bamboo processing technology.

Multiple participation

The industrialization and market orientation of the Lin'an bamboo shoot production is also benefited from the multiple participation of farmer households, enterprises, government and scientists. In this aspect, Lin'an Bamboo Shoot Association plays an important role. The Association was initiated at a volunteer bases mainly by shoot farmers, processing enterprises and merchants, government officials and scientists participate actively. The Association provides a platform for information

exchanges, cooperation and technical trainings. The Association also monitors the market pulse and plays the role of agency in shoot trading. Lin'an is not only the largest shoot producing county in China, but also the large shoot processing county. It does not only process fresh shoots from local plantations, but also buy fresh shoots from other counties. Lin'an is the largest bamboo shoot export county in China. In the busy seasons of bamboo shoot processing, more than 5000 farmers are involved in the marketing. They play the role of middlemen or transporters. All shoot products of the County finds markets, one of the indispensable reason is multiple participation.

It can be concluded from the above that the fast development of Lin'an's bamboo shoot production has the following reasons: a series of preferential policies by the government in different periods, a powerful science and technology support, a good model of cooperation between farmers and enterprises, and the coordination of the multiple participated bamboo shoot association. These have accelerated the development of bamboo shoot plantations, industrialized shoot processing and product marketing.

CHALLENGES

Shoot purpose bamboo plantation developing too fast

The successful experiences of Lin'an's bamboo shoot industry soon inspired the development of shoot purpose bamboo plantations, the areas of bamboo plantation as well as the shoot production increased very fast, soon the national production of fresh bamboo shoot exceeded 2 million tons per year, which is the traditional market demand. Therefore, the price for fresh shoot is dropping from year to year; in the 1980s, the highest price of bamboo shoot was 30 CNY/kg, now it is 12 CNY/kg, and the lowest price can be 2 CNY/kg or 0.8 CNY/kg. Although the price is dropping, the farmers' enthusiasm is not, because the annual income from each hectare of shoot purpose plantation is still a considerable figure (CNY 4000–8000), which is much higher than that of other crops such as rice, tea and fruits. However, proper control in the shoot production development is necessary now in a sustainable development view.

Exploration of new markets is slow

Bamboo shoot consumption is closely related to the food cultures in different places. In China, main consumption is in East and Middle South China, thus, the east and middle regions to the south of the Yangtse River. 85% of China's total bamboo shoot consumption is in these regions. Bamboo shoots are rarely found in the food of culture in the north, west and south regions of China. The international market is also diversified in bamboo shoot consumption. The main demands come from Japan and Southeast Asian countries, more than 80% of China's exported fresh

bamboo shoots go to these countries. The demand in European and American markets is comparatively small. Although the markets in North China, European and American are developing as a result of many years' efforts, the speed is very low. Lin'an as a County alone is far from being powerful enough to explore the vast potential markets in these regions and countries. Thus, although there is potential markets, the exploration of new market is slow.

New technology and new product development is comparatively laid behind

New technology and new products are important boosters of bamboo sector development. For example, the marketing of bamboo shoot products, especially fresh shoots, is affected by their short shelf life. New products that meet the niche markets are also missing. Both the local government and bamboo shoot enterprises have now sensed the urgency in carrying out researches. Fortunately, some universities and research institutes have started cooperation projects with Lin'an in new shoot product development.

We could presume that with further efforts, Lin'an's bamboo shoot industry will achieve sustainable, healthy and fast development in the future.

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