

Impact Assessment of Bamboo Shoot on Poverty Reduction in Lin'an, China

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Key word: Poverty reduction; Bamboo shoot sector; Rural livelihood development

Abstract

This paper gives an overview of the development of the bamboo shoot sector in Lin'an over the past eighteen years (1985-2002) and the results of a case study on its effect on poverty alleviation. The large quantity of data presented convincingly illustrates the positive impact of the bamboo shoot sector on the overall development of local farmers livelihoods in terms of increases in income, employment generation, increase in education and attendance rate at schools, improvement of life and living conditions and increased social equality.

The paper also analyzes the reasons why the bamboo shoot sector in Lin'an was able to develop so quickly in a short period of time to become one of the pillar industries and had significant impacts on the local socio-economic rural development. These involve preferential government policies including supportive land and financial policies, a high quality technical extension service and the establishment of demonstration sites and model enterprises and households. They are also due to the multiple involvement and participation of people from all circles including government officials, technical staff, bamboo researchers, manufacturers, farmer households and NGOs.

Finally some constraints and challenges facing the bamboo shoot sector in Lin'an are examined and analyzed, based on which a series of recommendations are put forward with an aim of achieving sustainable development for the bamboo shoot sector.

1. Assessment Activities and Approaches

1.1 Why is Lin'an selected as the first place to conduct the assessment?

To achieve a desired result of the assessment work, we selected the Lin'an County in the Southeast Zhejiang Province of China to be the first case assessment area. We focus the study specifically on bamboo used for producing bamboo shoots (hereinafter referred as shoot-species bamboo) and its industrial utilization since 1985. The experience drawn upon from this county can serve as an example for the following two case assessments in Anji, another bamboo town in Zhejiang and Anhui.

There are several reasons why we select Lin'an as the pilot site to conduct the assessment:

- 1) The bamboo project /intervention history and context in this county is clear-cut and obvious. It has been 18 years since the local government initiated the campaign for developing shoot species bamboo plantation in 1985. The entire production– consumption system from resources cultivation – industrial processing and utilization – marketing is very clear. The chief executors (actors) and technical experts ever involved in the project/intervention activities are readily available and most of them are as yet still actively engaged in this sector.

- 2) Bamboo shoot sector has close connections with the lives and livelihood of local farmers and has had visible impacts upon the poverty alleviation, employment and education. In the meantime, the development of bamboo shoots industry facilitates other sector's development.
- 3) The local government has formulated and released a series of policies with regard to bamboo, some of them aim specifically at bamboo shoot sector. The relevant documents, statistics and data are easily sourced and collected. This makes the whole assessment work, either quantitative or qualitative, much easier.
- 4) Since the formal establishment of INBAR in 1997, a series of international bamboo training workshops have been held in Lin'an. Lin'an is also a demonstration site for advanced bamboo development frequently visited, studied and assessed by international visitors for the purpose of learning experiences. Prof. Zhu Zhaohua, the advisor of the county government, knows very well about the situation of this county as well as the people concerned: local government forestry officials, technical experts and even some farmer entrepreneurs in this sector.

1.2 Assessment Approaches

The following methods are used in the course of the assessment in Lin'an:

- 1) *Group discussion/meeting at county level.* Key policymakers and project actors, including the director of the Forestry Bureau, the President of the Association of Bamboo Industry, the Secretary of the Association of Bamboo Shoot Processing, the head of the County Forestry Research Institute and the Chief Forester etc. were invited to attend the meeting. Based on the originally designed Assessment Framework Sheets1, 2, 3a, 3b and 4 by Mr. Joost Kessler, with the actual condition of the bamboo shoot industry in Lin'an being considered, a new survey framework at county-level was designed, including the following key points: project background, objective, duration, target groups, implementation, budget, main activities, relevant documents and statistics, follow-up actions and contact information. Total 54 questions in 10 aspects were discussed in the meeting. Because all participants know very well about the situation, it is easy to reach common agreements on many questions being discussed.
- 2) *Collection of relevant documents and statistics.* Through discussion, the meeting participants gained a good understanding on the assessment objective and methods and immediately understand what kind of documents and materials needed. They themselves are like an information resource depot (pool). Even if some of the files are not readily available from themselves, they provided clues on how to source the needed information. To our great surprise, in less than 3 days we obtained a lot of materials needed for the assessment of which a complete set of County Yearly Statistics (1994-2002) was included.
- 3) *Survey and interview at Township (Xiang) Level.* Township (Xiang) is the basic unit used to collect various kind of economic statistics in China. The Township government is the main facilitator mobilizing farmers to carry out important policies or projects in rural areas and also responsible for coordinating the interests of all stakeholders. To ensure successful implementation of the projects, the township government often takes specific measures to encourage farmers' active participation and involvement. In this context, a representative township in Lin'an -Gao Hong Town was selected for further analysis and survey. A questionnaire oriented at collecting statistics at township level was designed. People who were involved in the township-level survey were: the chief of the Forestry Station, the deputy village head responsible for the rural economic development, the chief forester of the county Forestry Bureau etc

During the stay in Lin'an, we got the chance to attend an Evaluation Meeting on a 10-year Sustainable Forestry Development Plan of Tai Hu Yuan Town. It enhanced our understanding on their ways of thinking at township level on the formulation of forestry development plan as well as principles and concepts applied in practice.

- 4) *Survey at village-level.* The village farmers are the implementers and direct beneficiaries of projects/interventions. Two representative villages were selected, one was Nong Jia Kan Village at Gong Hong Town and the other was Wu Shan Village at Xi Tian Mu Town. The village heads and Party Secretaries, heads of several villager's group and villagers representatives participated in the survey meeting. The survey mainly focused on collecting information on indices directly connected with the lives of farmers such as incomes, education level, living conditions, disparity between rich and poor, investment and productivity, products sales and marketing, employment, women's participation etc. in addition to the basic conditions of the villages.
- 5) *Interviewing manufacturing enterprises.* There are about 50 bamboo manufacturers on a relatively large scale in Lin'an. They are one important driving force for the development of local bamboo industry. They are also the main employment bases for local farmers. Two privately-owned bamboo shoot manufacturing enterprises were selected as the survey targets. It is interesting that the Presidents of both of the two enterprises are female. The survey focused on the manufacturer's main products, composition of labors, cooperation ways with bamboo suppliers (farmers growing bamboo), main production and management indices, government policy, domestic and international market as well as future development plan etc.

Based on the above-mentioned interviews, plus collection and review documentation and group discussion/meetings at various levels, the basic framework of the intended Impact Assessment on Poverty Reduction in Lin'an was formed.

2. Basic information about Lin'an

2.1 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 3,126 Km², 86% are mountainous and hilly areas, and forest coverage is 71.3%. With total bamboo plantation area 52,000 ha, Lin'an is named by the Chinese Government one of the Ten Bamboo Towns in China. The total population is 500,000.

Before the 1980s, Lin'an was a poor mountainous county where people's livelihood mainly relied on traditional agriculture. The per capita income in 1980 was only RMB 270 CNY (about 50 USD). 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 caused serious damage to the forests. And the increasing water and soil erosion resulted in large areas of arable lands being flooded every year.

To solve the serious environmental problem brought by mono-cropping, and alleviate the poverty in the County, in view that local farmers have the tradition of planting bamboo to meet their own needs of production, construction and food, and the bamboo plantation is effective at keeping water and soil, the local government began to advocate the cultivation of shoot-species bamboo

(main species are *Phyllostachys praecox* and *Ph. prominens*) by utilizing degraded lands on the hillside in 1983. Since then, Lin'an's bamboo industry has been growing from almost zero to China's largest bamboo shoot producing base and industrialized production has been realized. The bamboo shoot products are not only sold domestically in China, but also exported to international markets. Local farmers' income greatly increased. The economy growth enhanced the civil, educational and environmental construction and improved the livelihood of the local people. At the same time, large areas of degraded land were rehabilitated, and the water and soil erosion was controlled. As Lin'an's people are growing richer and the local landscape is taking on a picturesque scenery, the local eco-tourism emerged and began to grow fast.

2.2 Relevant socio-economic statistics

The selected statistics in the following table reflect a general development track of Lin'an in population, industry, agriculture, education and people's living conditions etc since 1985 (the first year of advocating the development of bamboo shoot). Attention is primarily focused on rural areas in sorting out all the statistical information since shoot species bamboo are mainly planted in the countryside, which is also the inhabited area of the target group of poverty alleviation

Some important statistics in Lin'an from 1980-2002

Item	Unit	1980	1984	1988	1992	1996	1998	2002	
Population (the year end)	Thousand (1000)	450.2	466.0	490.2	500.1	507.3	510.3	517.3	
Natural population growth rate (per annum)	‰	4.7	5.6	9.0	6.0	3.4	1.2	0.62	
GDP	Million yuan	204.35	353.97	794.20	1659.00	5844.70	6904.20	9656.33	
Index (100 in 1949)	%	900.9	1208.9	1980.1	3423.4	7359.7	8744.7	12230.48	
Total Industrial output value	Million yuan	161.63	284.69	1169.46	3573.77	11318.68	14341.59	16062.58	
Total industrial value of 5 sectors *	Million yuan	142.34	202.58	349.24	506.01	1333.75	1454.68	1624.02	
Area of the arable land	1000 mu (15mu=1 ha)	317.3	318.8	311.9	302.2	285.5	286.5	/	
Area of the arable land in rural areas (per capita)	mu	0.71	0.69	0.64	0.61	0.56	0.56	0.56	
Disposal income in urban areas (per capita)	Yuan	476	714	1476	2475	6934	7364	10675	

<i>Net income in rural areas (per capita)</i>	<i>Yuan</i>	246	714	840	1305	3620	4199	5362	
<i>The composition of the industrial values of the 5 sectors</i>									
<i>Agriculture</i>	%	61.5	64.5	63.3	51.6	40.1	40.4	35.59	
<i>Forestry</i>	%	15.8	16.9	14.4	22.6	37.3	40.1	45.64	
<i>Livestock Agriculture</i>	%	22.1	17.9	21.4	24.7	21.2	182	17.94	
<i>Fishery</i>	%	0.6	0.7	0.9	1.1	1.4	1.3	0.83	
<i>Percentage of children going to primary and high school (primary education)</i>									
<i>Primary school</i>	%			99.78	99.71	99.98	99.98	100	
<i>High school</i>	%			85.59	95.53	96.97	99.36	99.98	
<i>High school non-drop-out rate</i>	%			94.18	97.35	98.28	99.99	99.90	
<i>The structure composition of the GDP</i>									
<i>The first industry</i>	%	49.6	45.3	32.6	22.7	17.7	16.7	12.6	
<i>The second industry</i>	%	32.5	33.9	46.5	50.5	57.2	57.4	55.8	
<i>The third industry</i>	%	17.9	20.8	20.9	26.8	25.1	25.9	31.5	

- Refer to agriculture, forestry, livestock agriculture, fishery and other sidelines.

The following findings are reached after analysis of the above statistics:

2.2.1 Population. Over the last 23 years from 1980-2002, the population of Lin'an increased by 14.9%, but the trend of natural population growth rate is on a decline year by year. The average natural population growth rate per annum is 8.25% from 1980-1989 and 4.52% from 1990-1998. From 1999-2002, it decreased to less than 1% and in 2002 it was 0.62%. Since 2002, the population increasing rate of 14 among the total 26 administrative districts in Lin'an (most of the 14 districts are in rural areas) is a negative. Thus, it is concluded that with the economic development, the quick increasing population has been under effective control and a general balance has been reached between the birth and death rate. Another obvious tendency is the population movement from rural areas to urban cities. This phenomenon is particularly conspicuous in relatively economy-backward areas.

2.2.2 GDP. It is apparent that the economic growth rate over the 23 years from 1980-2002 is much quicker than that in the preceding 30 years from 1949-1979. The GDP in the preceding 30 years is 6.21 times that of 1949, while the GDP in the 23 years from 1979-2002 is 29.36 times that of 1979 (counted at comparable prices). Like other regions in China, the last 23 years is the prime period of Lin'an characterized by high speed of economic growth.

The structure composition of the GDP has been undergoing great changes. In 1949 Lin'an is a typical agricultural county. The first, second and third industry accounting for the total GDP was 90.1%, 31% and 6.8% respectively. Till 1980, the first industry still constituted almost half (49.6%) of the GDP and the second and third industry 32.5% and 17% respectively. Till 2002, these figures are 12.6%, 55.8% and 31.5%. The agriculture-dependent economic structure has been entirely altered.

2.2.3 *Rural industrial structure.* Great changes have taken place in rural industrial structure. The previous farming-dependent structure (planting crops and other major economic crops) has been gradually changing to one in which the forestry and agriculture have equal importance and/or even the importance of the forest products exceeds that of the agricultural products. The occurrence of the change is mainly due to the quick growth of the economic value of the non-timber forest products, of which bamboo shoot and hickory nuts play a central role.

2.2.4 *Per capita net income in rural areas.* Lin'an was a very poor county in early 1980's with the annual per capita income less than \$50. However in 2002, this figure amounted to \$654. Farmers are very rich now. Most of the villagers have moved in self-built villa-like independent house. The average living area per household is 206.88 m² and per capita living area is 61.45 m².

2.2.5 *Quantity of durable consumables per 100 households in rural areas.* The table below shows the interesting statistics on this item started since 1986.

	1980	1984	1988	1992	1996	1998	2002
Bicycle	43	103	133	202	180	187	157
Sewing machine	23	60	62	68	68	47	/
Watch	90	202	217	287	257	247	/
Radio	47	48	50	32	27	25	/
Tape recorder	7	7	15	38	53	55	35
Black & White TV		15	25	65	57	55	/
Color TV			8	32	55	78	118
Electrical Fan	3	36	40	135	193	245	245
Washing machine			2	23	38	42	58
Refrigerator				23	47	52	62
Motorcycle			3	8	28	37	73
Camera				5	12	12	15
Video recorder					2	5	5
Air conditioner					3	3	17
Telephone							73
Mobile phone							42
VCD player							47

Bicycle, sewing machine, watch etc. used to be the symbols of rich families in 1980's now are replaced by color TV, telephone, car and other modern household electrical appliances. It doesn't make much sense to collect statistics on outmoded durable consumables like black-white TV, sewing machine, tape recorder etc. now.

2.2.6 *Percentage of children going to primary and high school.* Since 1998 the 9-year Compulsory Education System began to take effect. Till 2000, the percentage of children able to receive basic education reached 100% (both female and male). Ordinary farmer's children going to college is very common nowadays.

2.3 *Land and forest resources.*

The total area of Lin'an County is 3126.8 Km². Its topography is featured by uplands and hills, covering 86% of the total area. The per capita area of arable land is not much. With the development of manufacturing, transportation and tourism industry, some arable land were occupied. In addition, in order to control the water and soil erosion, some farmlands in the steep slopes were rehabilitated into forests. In the past 23 years, the total area of arable land has been decreasing. In 1998, it was 21,153 ha and in 2000 it decreased to 19,100 ha. And the per capita area decreased from 0.047 ha to 0.937 ha. The farmer's attention is moving gradually from farmland to forestry products in the upland and hills. Due to the implementation of the Natural Forests Conservation Project, logging large areas of natural forests and ecological forests is prohibited. Both the government and farmers start to pay more attention to the development of non-timber forests products such as bamboo, hickory, ginkgo, torreyia grandis, tea, chestnut, medicinal plants, wild fruits, wild flowers and wild vegetables.

The forestry coverage in Lin'an is increasing year after year. It was 64.1% in 1983, 71.4% in 1994 and increased to 74.9% in 2000. The total forests area is 219,126 ha, of which 67% is natural forests and the rest 33% is plantations. There are 60,667 ha bamboo forests, covering 25.4% of the total forests.

Lin'an is a nice place in terms of natural environment, with green mountains and blue waters. With over 3000 species plants, it is rich in biodiversity. Two Natural Conservation Areas were established with a view to protecting environment as well as biodiversity. In addition to the Natural Forests Conservation Project, an Eco-forests Construction Project is currently on-going. It is estimated that the Eco-forests will account for 47.6% of the total forests in the next 10 years.

2.4 Eco-tourism

Because of the beautiful natural environment, Eco-tourism emerged in Lin'an since 1998 and has achieved a rapid development in a short period of 5 years. Now 13 tourist sites have been established, of which 3 are featured by bamboo landscaping. In 2002, they attracted 2,350,000 visitors and the revenue generated reached 1.2 billion yuan. Eco-tourism has become an emerging industry with promising future in Lin'an.

2.5 Proportion of economic income in rural areas (from equity aspect)

2.5.1 The disparity of per capita net income between different towns in Lin'an .

The table below shows the statistics of per capita net income in 2002 of 11 towns where shoot species bamboo are mainly distributed in Lin'an. We can see from the table that despite the differences in geographical locations as well as the level of industrial development, there are not big disparities between different towns in terms of per capita income

Town	Per capita net income generated from production activities	Number of township enterprises	Number of labors (employees)
Ling Long	5512	921	9452
Qing Shan Hu	6118	1717	7937
Shang Gan	4661	2921	2635
San Kou	4501	2372	1017
Heng Ban	5131	870	3116
Gong Hong	5183	460	8620

Tai Hu Yuan	5385	2916	17913
Ban Qiao	4658	153	3695
Yu Xi	4618	1638	6229
Tai Ying	5101	1367	6872
Xi Tian Mu	4803	357	2016
The whole Lin'an County	4864	27473	143617

2.5.2 *The disparity of per capita net income between households and individuals in different villages.* Four villages where bamboo shoots are the main source of income were selected for collecting the relevant statistics.

Village	Quantity of household and members		Per capita income (yuan)													
			<3000		3000-4000		4000-5000		5000-6000		6000-7000		7000-9000		>10,000	
	H	M	H	M	H	M	H	M	H	M	H	M	H	M	H	M
Chang Shan Nong	27	98	1	3	0	0	0	0	5	18	12	40	3	12	6	24
San Kou	25	108	0	0	1	2	0	0	2	5	1	3	10	48	7	30
Cha Chuan	26	120	0	0	0	0	0	0	1	2	0	0	19	94	6	24
Wu Shan	207	528	4	4	8	19	4000-6000				6000-9000					
							62		188		93		280		40	137

Note1: H refers to the number of households & M refers to the number of members per household

Note 2: Those households whose per capital income less than 4000 Yuan is mainly due to the following reasons: family members are mentally disabled, handicapped or sick; elderly people living alone without children or without labor force ; There is only exception case which the less income is due to the laziness of the family members. Even so, all these household don't need to worry about the food and other basic living needs.

Note 3: Through survey, we found that the real income of the farmers is far more than the figure they reported to the government. Take Wu Shan Village as example, the reported per capita income is 5100 yunan, but the real figure is more than 7500 yuan.

2.6 *Bamboo plantation and industry*

Lin'an is a traditional bamboo-producing county, with more than 60 species bamboo widely growing and distributed throughout the county. The main species for industrial use is Moso Bamboo (*Phyllostachys Pubescens*). Since 1980's, the overall development of bamboo industry has been given due attention by Lin'an government. As a result, bamboo forests, especially shoot species forests like the *Ph. Praecox*, the *Ph vivax* and *Ph Nuda* have had a quick expansion. With more and more bamboo species used for industrial production, the bamboo panel and shoot industry gained a rapid development momentum. In 2002, there are 60,667 ha bamboo forests in Lin'an, of which Moso bamboo is 20,000 ha, *Ph. Praecox* is 15,333 ha and *Ph.Vivax* 466 ha. Among the 16,667 ha natural bamboo stand there is 5,333 ha *Ph. Nuda*. In 2002, the production output of bamboo culms and fresh bamboo shoots is 206,700 ton and 180,481 ton respectively. The total value is 455 million yuan. Now there are 129 bamboo panel/flooring manufacturers, annually processing 10.8 million bamboo (*Phyllostachys Pubescens*) culms. The main bamboo products are bamboo flooring, curtain, toothstick, charcoal, pulp and paper and weaving products.

The processing value of bamboo panelling is 0.3 billion yuan in 2002. There are 47 bamboo shoot processing factories with total production value 0.37161 billion yuan. Each year, the locally produced raw bamboo can't meet the industrial production demands and about 60,000 tons of bamboo shoots were imported from other counties and provinces in 2002.

The table below shows the growth of the bamboo plantation in Lin'an. (unit: ha)

Bamboo species	1983	1987	1991	1995	1999	2002
Ph. Pubescens	15307	15953	16720	18099	19030	20007
Ph.Praecox and Vivax	2181	4348	7059	11333	16452	20000
Species for dried bamboo shoots	11477	12078	13247	14974	16849	16883
Others				4002	4289	4290
Total	28965	32379	37026	48403	56710	61160

3. The Bamboo Shoot Development Project in Lin'an

3.1 Project background

In early 1980's, with the implementation of the Opening up and Reform Policy, the Chinese government brought forward the ambitious objective that the Gross National Product (GNP) in China would increase by 4 times by the year of 2000. Under this context, people from all walks of life in China were actively contributing ideas and wisdom for the realization of this goal. In 1982, a Forests and Land Resources Survey was jointly conducted by local Forestry and Agriculture Bureau in Lin'an. During the survey, it was found that many farmers in Shang Gan Xiang had benefited a lot from the plantation of two species of bamboo (*ph.praecox* and *ph. vivax*). Encouraged by the finding, the survey conductors wrote an article titled "Bamboo will play the central role in achieving the goal of 4-fold increase of the economy". In 1984, they wrote another proposal on Bamboo and Its further Development and Utilization in Lin'an, in which it was suggested that the government should vigorously advocate and support the cultivation of bamboo, especially shoot-species bamboo, in rural areas. This proposal was approved by the Lin'an government in 1985 and a decision was made on the establishment of a 100,000 mu (6667 ha) shoot-species bamboo plantation. Since 1985, all areas fit for growing shoot-species bamboo got an accelerated development. Through 10 years efforts, the total area of shoot-species bamboo plantations in Lin'an had been up to 105,000 mu in 1995.

The Bamboo Shoot Project is one part of the whole Bamboo Development in Lin'an. The aim, objective and related policies of the project were adjusted from time to time along with the actual development of the bamboo shoot industry. Therefore, it is a long-term continued project, and an industry as well.

3.2 Project objective and duration

With the development of the bamboo shoot industry, a series of proposals in different phases were put forward by local Forestry Bureau and related agencies and NGOs such as the Bamboo Industry Society and Bamboo-Shoot Processing Association to request the local government to adjust the project objective to a higher end. For example, the main objective for 1985-1995 is to establish a 100,000 mu shoot-species bamboo plantation base. This task was achieved in 1991,

going beyond the original expectation in that the production volume of bamboo shoots of that year exceeded 50,000 tons. Then in 1994 the Forestry Bureau and Bamboo Industry Association made another proposal that the overall objective in the following years from 1994-2000 be the completion of a series of projects with a productivity of bamboo shoot 100, 000 tons. The series projects include: first, the annual productivity of bamboo shoot is up to 100,000 tons and the unit productivity (per mu) will increase from 1000 kg in 1993 to 1500kg. Second, the total production value of bamboo industry will be doubled compared to that in 1993 to 0.2 billion yuan. Third, the per capita income of bamboo farmers of the whole county will increase 330 yuan. To fulfil the above objective the concrete measures taken are: establishing 3 bamboo-shoot processing factory, a packaging plant and a refrigeratory, a fresh bamboo trading shoot market and a high-yield shoot-species bamboo plantation base. As a matter of fact, the above second-phase objective had been fully fulfilled by 1998.

Starting from 1997, with the gradual increasing of the productivity of bamboo shoot, processing and marketing became the highlighted concern. Therefore the main objective set from 1997 to present is to boost the industrial processing and expand the market. By 1999 over 5000 farmers had been engaged in the transportation and sales of bamboo shoot throughout the county. There were 18 fresh bamboo shoot market and 47 bamboo shoot manufacturers. Thus, the sales problems were solved in an effective way. Since 2002 more bamboo shoots have to be bought from other places to meet the local demand for export.

In conclusion, the project has been implemented by the following phases:

1982-1984: awareness raising and preparation work

1985-1991: resources cultivation and policy formulation and development

1992-1997: high-yield technical extension and processing demonstration

1997 – present: industrialized manufacturing and market exploration

3.3 Project target

The target area of the project is mainly in the east of Lin'an, where the topography is featured by upland and its middle and lower part is suitable for growing shoot-species bamboo; while in the west of Lin'an there are more high mountains with steep slopes, the economic forests are therefore mainly hickory. In Lin'an 60% farmers have shoot-species bamboo from which approximately 72,500 households with 250,000 farmers benefit economically. The manufacturing and trading markets are mainly distributed in the east.

3.4 Project Implementation

Project Executing Agency: Lin'an county government with involvement of government bureaux of Forestry, Land, Finance, Tax, Industry, Township enterprises and other related agencies.

Project Implementing Agency: Forestry Bureau, the Society of Bamboo Industry, the Association of Bamboo Shoot Processing, the Forestry Technology Extension Station and related township government

Project Staffing: There are too many people ever involved in the project to be fully listed. The following is the name list of some key persons:

Tang Mingrong, Deputy Director of the Forestry Bureau

Wang Anguo, Vice president of the Society of Bamboo Industry
 Yu Jinzhang, Secretary General of the Association of Bamboo shoot Processing
 Zhou Chen, Director of Country Forestry Research Institute
 Liu Wei, Senior Forester

3.5 Project Budget

1. Shoot-species bamboo plantation subsidy/allowance: total 3 million yuan from 1986-1988 (20 yuan per mu)
2. Government discounted loan to bamboo shoot manufacturers: 4.5 million yuan from 1998-2000 (1.5 million yuan per year)
3. Farmer's Training fee: 4.5 million yuan
4. Bonus reward from government: 3 million yuan
5. Related activities expenses (meetings, technology guidance, extension etc.): 0.5 million per year

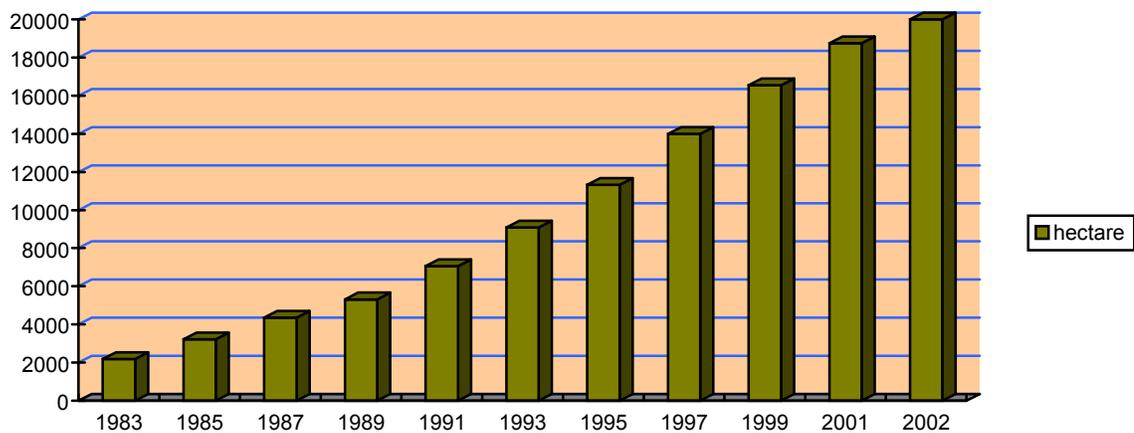
3.6 Progress of bamboo industry in the past 18 years

Lin'an started cultivation of large area shoot-species bamboo in 1985. Up to 2002, the following progress has been made over the past 18 years:

3.6.1 Enlargement of shoot species bamboo plantations

In the year 1983, total shoot species bamboo plantations in Lin'an County was 1,867 ha. Farmers planted shoot species bamboo around their houses to supply food for their own families. In the year 2002, the shoot species bamboo plantation in Lin'an county reached 20,000 ha, 10.7 times that in 1983 (only the two species *ph Praecox* and *ph. vivax*). See Fig-3-1.

Fig -3-1 Table of Lin'an's bamboo plantation area growth (1983-2002)

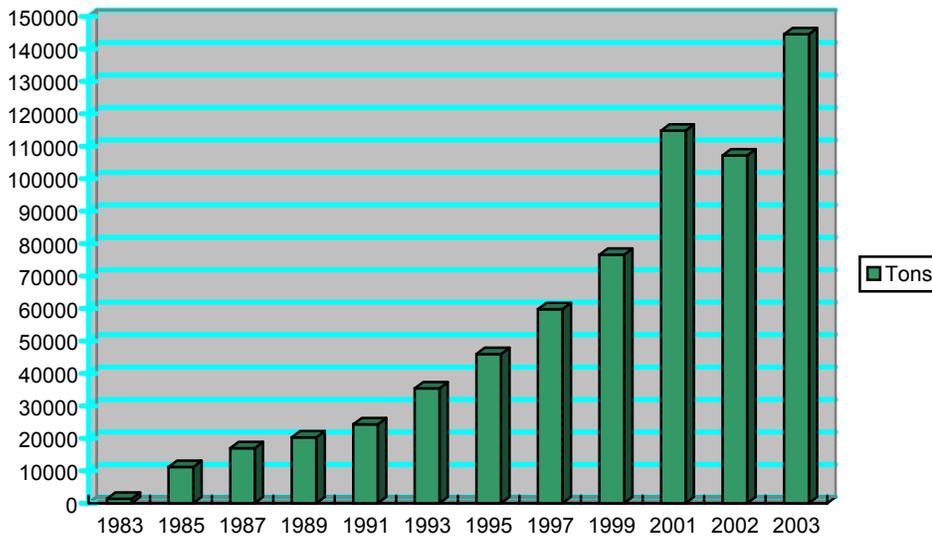


3.6.2 Growth of bamboo shoot production

In the year 1983, the total production of fresh bamboo shoot in the county is 1,421 tons. In the year 2002, the number reached 107,150 tons, which is 75.4 times that in 1983. (This figure only covers the two species *ph Praecox* & *ph. vivax*, with dried bamboo species and Moso Bamboo

ph.perbescens excluded). The total productivity is 135,250 tons with the dried bamboo species and Moso bamboo included). The total production is 144,481 tons in 2003 (excluding dried bamboo species and Moso Bamboo *ph.perbescens*) . See Fig 3-2.

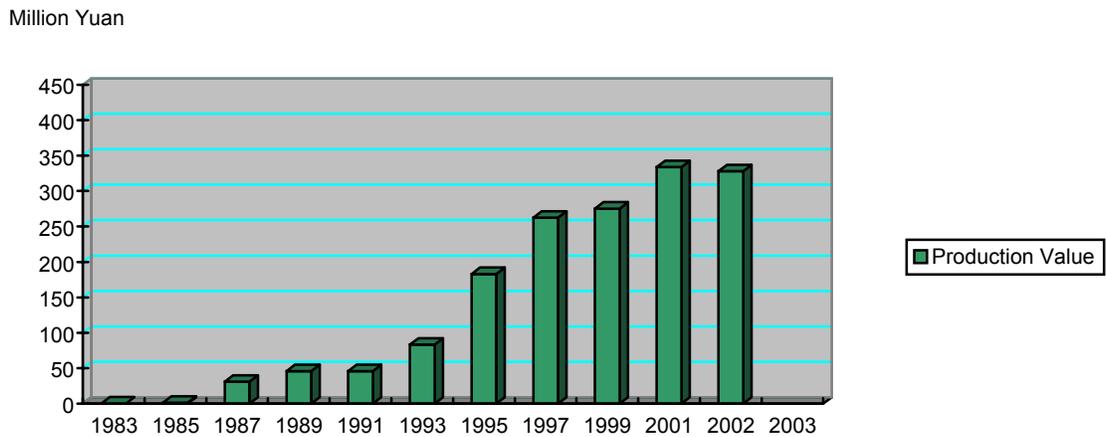
Fig 3-2 Table of Lin'an bamboo shoot production growth (1983-2003)



3.6.3 Growth of bamboo shoot production value

In the year 1983, the fresh bamboo shoot production value in Lin'an county is 2.19 million yuan. The value increased to 328.05 million yuan in the year 2002 and 418.37 million yuan in 2003, which is almost 191 times that of 1983. This value does not include processed shoot values and the total value will exceed 500 million yuan with all other bamboo species included . See Fig3-3.

Fig 3-3 Table of the growth of Lin'an bamboo shoot production value (1983-2003)

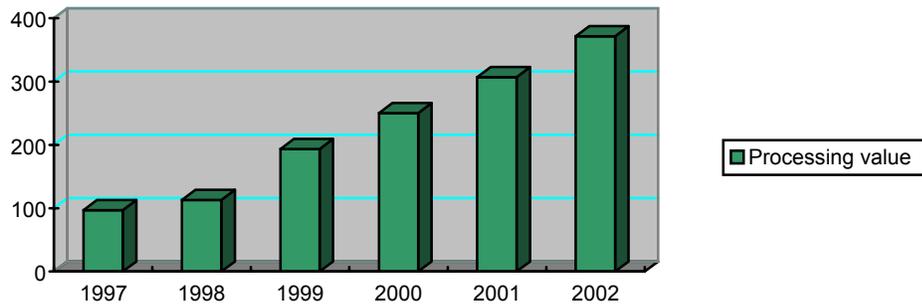


3.6.4 Advanced industrialized processing of bamboo shoots

Lin'an's bamboo shoot sector started to grow in the early 1990s. Other counties and provinces learnt from the successful experiences of Lin'an, followed up on the bamboo shoot production. In less than 10 years, the local production of fresh bamboo shoot had exceeded the demand of local markets and of surrounding big cities. Lin'an is taking a pioneering position in the industrialization of bamboo shoot processing. The first bamboo shoot processing plant was established in 1996. In the year 2002, there were 47 bamboo shoot manufacturers in the county and the total annual production capacity was 150,000 tons. In the year 2003, total 11,480 tons of fresh shoots are processed. The fresh shoots in Lin'an county available for industrial processing every year is 40,000-50,000 tons (most of them are sold directly to the market). Lin'an has 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. See Fig. 3-4.

Fig. 3-4 Table of the growth of Lin'an bamboo shoot processing value (1997-2002)

Million yuan

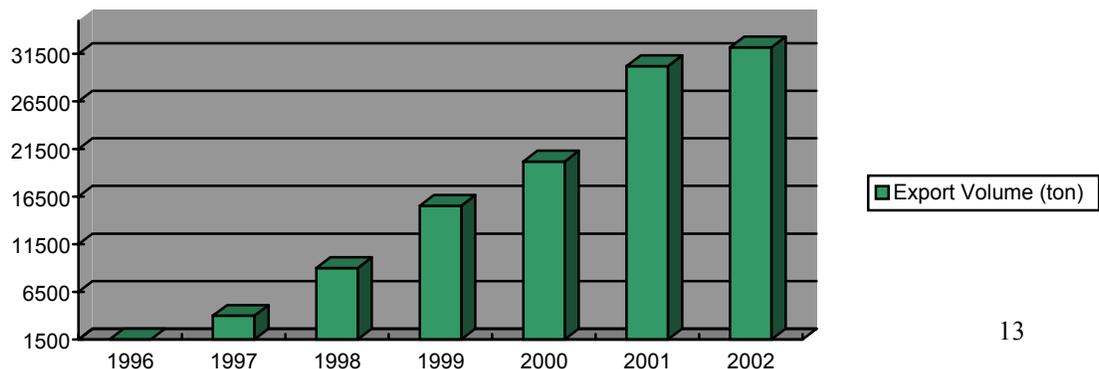


3.6.5 Fast expansion of bamboo shoot markets

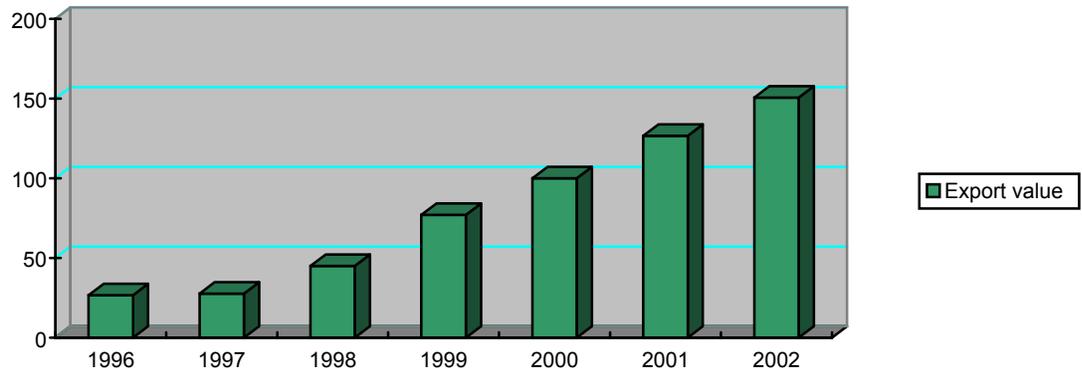
Farmers in Lin'an began to realize the importance of market development in early 1990s. The number of specialized bamboo shoots trading markets in Lin'an was 12 in the year 2002. Besides, with the support of the local government, Lin'an shoot trading markets were also established in big cities nearby, such as Shanghai and Nanjing. Now, fresh bamboo shoots produced in Lin'an are sold in North China, South Korea, Hong Kong, etc. Processed shoot products are exported to many other countries in large quantities. In the year 2002, 32,180 tons of processed shoot products worth 150 million yuan were exported. See fig- 3-5 & 3-6.

Fig 3-5 Table of the growth of the bamboo shoot export volume (1996-2002)

Fig 3-6 Table of the growth of the bamboo shoot export value (1996-2002)



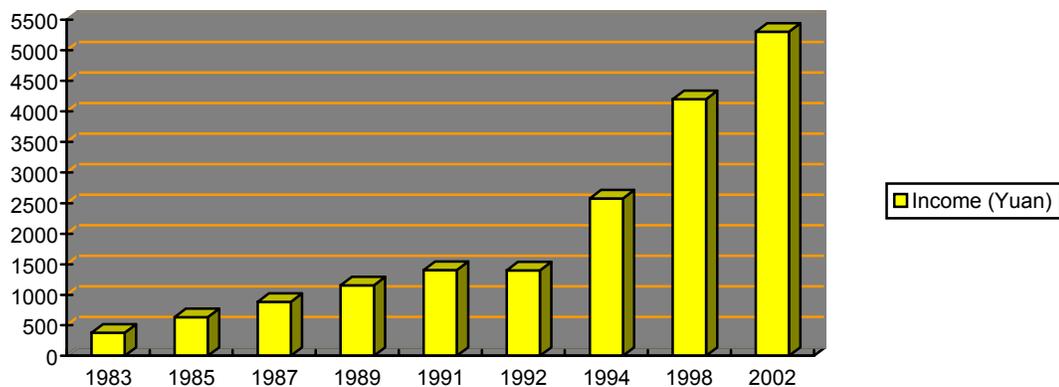
Million Yuan



3.6.6 Distinguished increase in farmers' income and improvement in livelihood conditions

Bamboo shoot industry and other bamboo related sectors have now become the main sources of income for the local farmers. 60% of the rural households are engaged in bamboo sector (about 70,000 households, with a population of 250,000). The total production value of the bamboo sector in 1983 was 20 million yuan while in 2002 was 1.15 billion yuan. 60% of the farmer's total income in 10 townships were generated from bamboo. The 2001 statistics showed that the per capita net income generated from bamboo shoots was 1400, counting 32.6% of the total per capita income of that year. 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 50m². Almost all rural households are equipped with color televisions, 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. See Fig. 3-7

Fig.3-7 Table of the growth of the Per Capita net income in Lin'an (1983-2002)



3.6.7 *Water and soil control and environment rehabilitation with bamboo*

The 20,000 ha shoot species bamboo plantations of Lin'an County are mostly planted on degraded, wasted lands and slopes where the water and soil erosion is the most serious. Shoot species bamboo plantation did not only improve the fertility of the soil, but also control the water and soil erosion. Experiment showed that the water and soil controlling capacity of bamboo plantation is 1.5 times that of Masson's pine (*Pinus massoniana*), 1.3 times that of Chinese fir (*Cunninghamia lanceolata*). As the water and soil were controlled, Lin'an's natural environment was improved and beautiful landscape came 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.

4. How does Lin'an develop its bamboo shoot industry?

4.1 *Government preferential policies*

In the early 1980s, with the implementation of the opening up and reform policy in China, the lives of Chinese people began to improve fast and the consumption of fresh shoot and shoot products in local region and big cities nearby began to increase as well. Market price of fresh shoot was dramatically increased. According to the market forecast and suggestions by some experts, the Government of Lin'an County determined to provide support to the local bamboo shoot production. Based on the investigation and discussion with the farmers, the government formed a series of preferential policies to encourage farmers to participate in the bamboo shoot production.

4.1.1 China's land-contracted Responsibility 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 the 'open-up policy', most rural land was managed collectively by the community. After reform in the 1980s, rural areas began to practice a Land-contracted Responsibility policy. This policy provides for the separate management of land by rural households, with crop fields allocated to households according to household size. During the 1980s, the standard contracted period was ten years, and in the 1990s it was extended to thirty years.

During the contracted 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 contracted household then pays a small amount of contract fee to the community. The contracted period is usually between thirty to fifty years, with a longest period of seventy years. During the contracted period, management rights can be inherited or transferred to other individuals or to the private sector. Farmers can also contract low-productivity and degraded land owned collectively by the state. If several households are interested in one specific area of land, the contract is awarded on a competitive basis between the households. The land contracted policy played an important role in motivating farmers to manage land for a 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, because most farmer households were not interested in planting bamboo so were not interested in contracting for degraded land either, the government allowed interested households to contract for more degraded lands and the contracted area was not limited by the number of people in the contractor household. In 3 to 4 years, the contractor households are rewarded by greatly increased income from bamboo shoot production and their practices inspired the interests of other farmer households to follow up.

For example, Baisha Village in Lin'an County has large areas of wild bamboo stands (*Phyllostachys nuda*) mixed with the natural forest. Prior to the implementation of the land-contracted 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 generated from bamboo shoots from 200 CNY (in 1983) to 2,000 CNY (in 1993).

4.1.2 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 favored 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. From 1986-1988, the government appropriated 1 million yuan each year as a specialized subsidy for shoot production. Farmers were received a subsidy of 300 yuan for growing shoot species bamboo per hectare, which allowed farmers to buy mother plants for plantation establishment. By the 4th 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 90,000 yuan (11,000 USD). When more farmers recognized the economic benefit of bamboo shoots, which is much higher than that derived from other crops such as rice and tea etc., they started to actively join in the development of shoot species bamboo plantations. 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.

Between the 1980s and 1990s, the area of bamboo plantations in Lin'an County, particularly plantations of *Phyllostachys praecox*, increased from 2,000 ha to 18,000ha. Large volume of fresh bamboo shoots began to be produced and the production in the shooting period (about 1 month) exceeded the consumption in large cities nearby in the same period. Processed shoots can be better preserved and supplied to the market all year around, but fresh shoot processing became a new problem. Up to 1994, Lin'an still had no bamboo shoot processing factories. The local government therefore encouraged cooperation between farmers and enterprises to develop bamboo shoot processing factories, including the provision of loans with government interests to shoot and culm processing factories. Between 1995 and 1997, each year the local government provided 1.5 million yuan to bamboo shoot and culm processing factories.

Processed bamboo shoots are sold to international and domestic (especially North China) markets. 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 60,000-80,000 tons of fresh bamboo shoots are now bought from neighboring counties and provinces for processing in Lin'an. Now the processed bamboo shoots in Lin'an approximately account for 20% of the total products in China and Lin'an has become the largest bamboo shoot processing base. 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 amount 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, providing 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 it also plays an important role in enhancing the sector. The government should provide necessary financial supports when difficulties arose in different stages of the sector. The largest direct beneficiary of these supports is the participating farmers, while the largest indirect beneficiary is the government itself. The bamboo sector became more and more important as a source of taxes for the government.

4.1.3 Policies for technical extension and technology transfer services

Efficient and in-time technical services for farmers and enterprises are one of the most 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 grass-root levels:

- a. *Technical training.* Various training courses are held for the farmers and enterprises 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. The following are some related information about these training courses:

Training target group: Bamboo farmers, village cadres, high-school graduates and township forestry staff

Training contents: Early-shooting and high-yield technology of shoot species bamboo; High-yield technology for bamboo plantations used for producing both bamboo shoots and bamboo timber; Synthesized sustainable development for mountainous areas; Natural bamboo forests improvement techniques; Standardized cultivation technique for non-pollution shoot species bamboo plantation; Pest and disease-control techniques etc. The following table 4-1 shows the times of the training courses held and the number of participants each year from 1990-2002:

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total
Times	17	21	46	36	46	20	60	28	40	68	72	68	56	578
Number of participants	1180	1208	3808	2760	2006	1160	3401	1280	3080	4480	2480	3320	3296	33459

- b. *Demonstration households and sites.* For large-scale technical services, the most active/enthusiastic farmers are usually selected as priority targets. If the new technology proves successful and efficient, the government awards the prioritized 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 10,000 USD from shoot production from less than 0.5 ha bamboo plantation. It provided motivation for other farmer households. Up to 1997, through demonstration and training, 6,500 farmer households had achieved an annual income of 10,000 yuan (1,220 USD) through shoot production. The demonstrations were also extended to different types of shoot and culm processing factories. Now Lin'an has 300 bamboo processing factories, producing various kinds of bamboo products. Now, with the support of the local government, a demonstration site for green organic bamboo shoot production has been established under the guidance of scientists. The site is composed of several farmer households, and has 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.

- c. **Technical service contract.** Generally, farmers are wary of adopting new technology for fear of suffering financial loss. As a result, the government encourages 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 figure set in the contract, the technicians are responsible for compensating 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 benefits to farmers. For example, in 2000, Mr. Wang Anguo, Senior Forester of the Lin'an County Forestry Bureau was awarded the title of '*National Advanced Agricultural Technician*' and 200,000 CNY, for his outstanding contribution to bamboo development and extension of forest technology. He was also honored by Former President Jiang Zemin and Former Premier Zhu Rongji.
- d. *Researchers are required to extend and apply their research results.* The government has always emphasized that researchers, except those doing researches in basic fields, should participate in the extension and application of their own research results in person, so as to improve the applicability of 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 extension of their research work and help 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 these feedback will improve future research. Lin'an's scientists have developed a series of new technologies in response to practical problems met during bamboo sector development. These technologies are now extended to real production. For example, shoot plantation land covering technology for early shooting, which can bring the shooting period of *Ph. Praecox* 5 months earlier. The normal shooting period of this specie is usually in late March. Using this technology, farmers cover the land with chaff and straw, adjust the shooting time according to market demand, thus 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 10-16 yuan during November to February, but the price drops to 1 yuan in April. This technology brought a value of more than 100 million yuan to the farmers every year and has been awarded a prize by Hangzhou city of Zhe Jiang Province. The following table 4-2 shows some information with regard to the technique extension and increased generated profits.

The year	Area	Area of putting into production	Land covering technique for early shooting			Increased profits (million Yuan)
			area	productivity	Production volume	
1988	39421					
1989	42965		0.38	0.893	0.3605	
1990	54526	21800	0.8	1.614	0.6332	
1991	66182	25300	90	90	45	0.362
1992	77163	37800	1530	920	460	3.537
1993	93697	42300	4545	3750	2250	18.407
1994	111236	48800	9000	8000	4800	39.287
1995	125000	60000	10000	10000	8000	70.00
1996	145000	73000	12000	12000	14400	129.049
1997	160000	86000	15000	15000	13500	119.786
1998	175000	100000	20000	15000	15000	134.40
1999	193133	115000	25384	26440	14192	122.885
2000	203823	130000	28000	24144	18372	161.915
2001	216351	145000	34288	33448	21593	195.359
2002	230000	165000	40000	39000	21060	189.701
2003	240000	181000	51000	47052	32581	297.539

Since 1984, 21 research and new technology projects have been applied or extended by scientific researchers and technical staff in Lin'an, among which 10 were awarded Provincial /Ministerial prizes and 6 items were awarded by Hangzhou City. Some awarded research subjects are listed below as examples:

- Selection and processing technology research on new types of canned bamboo shoots
- Early-shooting and high-yield cultivation technology research of Ph. Praecox
- Transformation technology research on low-yield shoot species bamboo plantation
- Standardization of cultivation technique of bamboo plantation for producing organic shoots.

4.2 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 and only a small number are year-round full-time workers. In the busiest years, a shoot processing factory may need more than 7,000 workers, among which, 2,500 are year-round workers. Now there are total about 30,000 year-round full-time 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 factory requires a large number of full-time workers and the establishment and operational costs of the factory are likely to be high. However only 26% (the middle lower part) of the bamboo culm (*Phyllostachys heterocycla var. pubescens*) can be used for producing 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 etc. 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 enterprise + farmer model is promoted by the local government.

Under this model, the factory contracts with local farmers to buy bamboo strips instead of bamboo culms. The farmers sell the wasted 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 by 2-3 times, therefore benefit from the value-added process. At the same time, the cost of the factory is reduced. The factory also provides 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. Besides the full-time workers, every factory has contracted processing sites in the villages. In accordance with the technical standard of the factory, under the directions of technicians, farmers first remove the shuck, boil the shoots, then put them into cans and transport to the factory for finishing. Under this model, the factory saves 50% of the transportation costs, and avoids the accommodation costs for large numbers of seasonal workers. At the same time, the farmers are benefited from the additional values.

Here giving another example. Kangxing Food Co., Ltd is a private-owned enterprise with its head office and general factory located in Lin'an and 15 primary processing factories established in Fujian, Jiangxi and other counties of Zhejiang Province. Its products are 100% exported. Over 200 local farmers are employed as full-time workers and there are over 400 additional temporary workers. To defend the interests of local farmers, Kangxin Company started to sign Supplying and Marketing Contract with them since 2003. It is agreed in the contract that the company guarantees to buy all bamboo shoots produced by local bamboo farmers at the market price. If the market price drops to a certain low level (lower than 0.8 yuan/kg, *Ph. Perbescens*), the buying price still remains as 0.8 yuan/kg. Now more than 700 bamboo farmer households have signed contracts with this company, covering 5300 ha bamboo plantation.

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

4.3 Multiple participation and NGO's role

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 and Bamboo Industry Association established in 1997 and 1986 separately, played an important role. The Association is originally initiated voluntarily by shoot farmers, processing enterprises and merchants, government officials and scientists. The Association provides a platform for information exchanges, cooperation and technical trainings. Lin'an is not only the largest shoot producing county in China, but also the largest shoot processing county. It does not only process fresh shoots from local plantations, but also buy fresh shoots from other counties. Lin'an is also the largest bamboo shoot export county in China. In the busy seasons, more than 5,000 farmers are involved in the marketing of bamboo shoots as middlemen or transporters.

The Bamboo Shoot Association and Bamboo Industry Association are NGOs. Every year they organize a series of symposiums, during which cooperation issues are discussed and information exchanged among members. They also organize various kinds of technical and market group tours, sometimes even organize overseas market (Japan, Europe and the United States) tours for their members. In addition, they publish two News Bulletins on a regular basis, one is Information on Bamboo Shoot Processing, the other is Bamboo Information In Lin'an, in which various kinds of information about bamboo such as new practical technology, new products, market information, events and activities, government policy etc are being introduced to members as well as local bamboo farmers. It serves as a bridge linking farmers, enterprises, government and scientific researchers together. Up to now, more than 200 issues of the above bulletins have been issued. Being lively and brief in style, they are well received among all the members.

In conclusion, the fast development of Lin'an's bamboo shoot production is due to the following reasons: preferential policies by the government in different periods, powerful science and technology support, a good model of cooperation between farmers and enterprises, and the coordination work done by the multiple participants esp. bamboo shoot associations. These have accelerated the development of bamboo shoot plantations, industrialized shoot processing and product marketing.

5. Direct and Indirect Impact of Bamboo Shoot Development on Poverty Reduction

In order to learn more about the impacts of bamboo shoot on poverty reduction in rural areas, we made surveys in Gaohong Town, its 3 affiliated villages and Wushan Village of Xitianmu Town. In the meantime, meetings/discussions were held with people at various levels ranging from the chief of the Village Forestry Station, village heads to farmer representatives.

5.1 Bamboo shoot development in Gaohong Town and its impact on income generation for local farmers.

Gaohong Town is a rural area featured by low uplands. Its population is 10422 and most of them, (10037) are rural population living on agriculture. There are 2886 rural households and on average in each household there are around 3.5 people. This town started to vigorously develop shoot-species bamboo since 1990, with the area of shoot species bamboo plantations increasing by 4.26 times from 167 ha in 1989 to 711 ha in 2002 and the production volume of bamboo shoots also increased by 15.95 times from 418 ton to 6670 ton. The production value increased by 13.3 times from 1.8 million yuan in 1990 to 23.98 million yuan. It was in 1997 that the production value reached 26.18 million yuan, the highest point since 1990, as a result of the high market price of the bamboo shoots in that year. Up to 2002, the per capita income of the rural population generated from bamboo shoots was 2387 yuan, accounting for 45.3% of the per capita total income, which was 5276 yuan. The average income per household generated from bamboo shoots was 8754 yuan and if plus those derived from bamboo culms and leaves, the average income per household would have exceeded 9000 yuan. In 2002 there were 1462 households, 50.7% of all the households, whose income through bamboo shoots are above 10,000 yuan. Among them, there were 139 households whose income through bamboo shoots ranged from 30,000-50,000 yuan and 19 households whose income through bamboo shoots ranged from 50,000-80,000 yuan. The above statistics suggested that bamboo shoot has become a main source of income for local farmers. In 1994, the 4th year since the start-up of the bamboo shoot development project, the percentage of the income generated from bamboo shoots accounting for the farmers total net income increased from 19.1% in 1990 to 32%. It soared to 70.6% in 1996.

The rapid increase of the local farmers' income due to the rapid development of bamboo shoot sector makes the farmers have more money invest into other sectors, such as industry, transportation, commerce and trade. Starting from 1998, despite the fact that the farmers' bamboo shoot income has been on a rise, its proportion accounting for the per capita total net income has been on a gradual decline. This suggests on one hand that bamboo shoot played important roles in boosting the development of other sectors, on the other hand that the economic structure in rural areas has gradually been rationalized. The risk of monoculture are avoided in this way.

Fig-5-1 Statistics of Bamboo Shoot Production Volume and Value of Gaohong Town (1990-2001)

	90	91	92	93	94	95	96	97	98	99	00	01	02
Production Value (Million yuan)	180	230	350	580	680	1700	2618	2132	2535	2018	2168	2580	2396
Production Volume (ton)	690	810	1050	1260	1960	3024	4133	5838	6002	6085	1853 ?	6118	6670
Rural Per capita net income (Yuan)	931				2111	3173	3641	3792		4270	4510		5183
Bamboo shoot income (%)	19.1				32	53.1	70	67.8		47	47.7		45.3

Fig 5-2 The Growth Chart of Bamboo Shoot Production Volume in Gaohong Town (1990-2002)

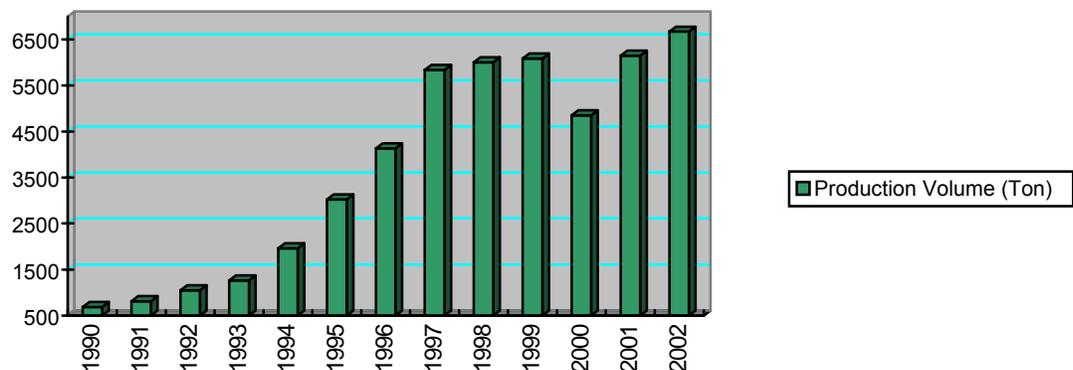
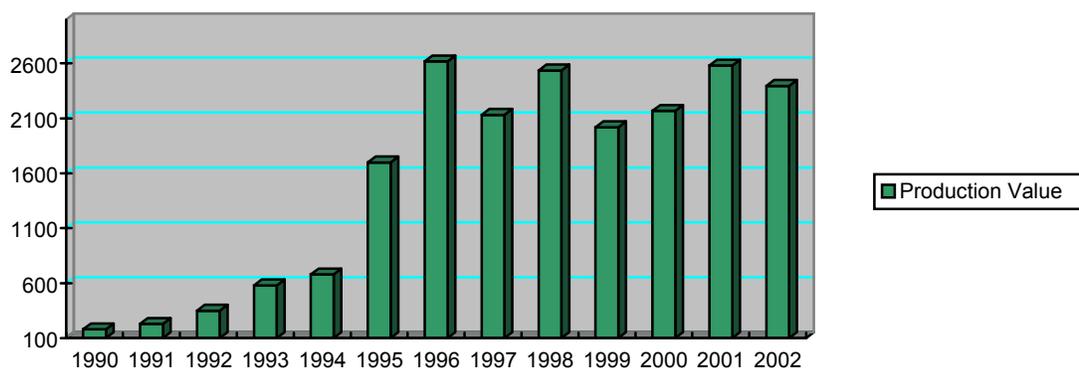


Fig 5-3 The Growth Chart of Bamboo Shoot Production Value in Gaohong Town (1990-2002)

Unit: Ten Thousand Yuan



5.2 The impact of bamboo shoot development on the livelihood of Dongjiakan Village, Gaohong Town

5.2.1 Impact upon the per capita income

Chenjiakan Village is one village in Lin'an which started to develop bamboo shoot in an earlier period and has achieved a better result. It is composed of 6 villages with 230 households and 721 people. In 1990, there was 7 ha shoot species bamboo forests and it enlarged to 53.4 ha in 1995, 57 ha in 1997 and 80 ha in 2002 respectively. In 1997, the bamboo shoot production value was 3 million yuan, with approximately 13636 yuan per household and 4243 yuan per capita. In 2002, its bamboo shoot production volume was 2.93 million yuan, with 12739 yuan per household and 4064 yuan per capita. Over 60% of the total income came from bamboo shoot. Through interviewing villagers, we found that there was a big difference between the statistics collected by the government about the net income of farmers and the real situation. A survey focusing on 3 villages (the 2nd, 5th and 6th one) with 79 households and 326 villagers was conducted. The fig 5-4 below shows the income information in these 3 survey villages in terms of the number of households and family members.

Income range (yuan)	< 3000		3000-4000		4000-5000		5000-6000		6000-7000		7000-8000		8000-10000		> 10000	
	H	M	H	M	H	M	H	M	H	M	H	M	H	M	H	M
Number of Households (H) and family members (M)	1	3	0	0	1	2	8	25	15	44	10	36	27	137	19	78

From the above table we can see that there are only 10 households and 30 family members whose income is less than 6000 yuan. The number of these households and people under this income category account for only 12.8% of the total household number and 9.2% of the total population separately; while there are 56 households and 251 people whose income is between 7000-10000 yuan and they account for the 71.8% of the total household number and 77% of the total population separately. Therefore we estimated that the actual per capita net income of this village should be more than 8000 yuan, not the figure provided by the township government as 5197 yuan. Why is there such a big difference? According to the villagers, the reason why they don't want to report the true figure to the government is due to the concern that this will be reported,

interviewed and publicized by mass news media, which are not liked by the farmers. In addition, taxation is also a concern. Our estimation is also validated by other statistics from the government, which indicates that the total bamboo shoot production value of the 230 households and 721 villagers in Chenjiakan village was 2.93 million yuan in that year. There were 160 households whose bamboo shoot income is above 10000 yuan, of which there are 25 households whose income is between 30000-50000 yuan and 5 households whose income is 50000-80000 yuan.

5.2.2 Social Equity

a: Equity on financial income, land resources and education. The survey conducted in the 3 villages shows that it is the development of bamboo shoot that make the Chenjiakan village be alleviated from poverty and become rich on a whole: there is only 1 household with 3 members whose income is lower than 3000 yuan. The poverty line in Lin'an set by the government is 3000 yuan, i.e those whose income is less than 3000 yuan will be treated as the target group of government aid, while the national poverty line is 800-1200 yuan. The poverty line varies from place to place in China. At the national level, the per capita income of 3000 yuan can be seen as a standard of a better-off life in rural areas. The reason of the relative impoverishment of the only household in Chejiakan Village is due to the lack of labor forces caused by the fact that the family adults are handicapped and the child is sickened. But the daily living (food, clothes, shelter etc) is not a problem for this household. A series of government aid policies have been put in force to help this type of disadvantaged household in Lin'an, such as exemption of children's tuition, reduction of tax and granting specialized yearly subsidy etc. The disappearance of poor population group in this village is determined by the equity of government policies. First, equity policy in land allocation. The land is distributed on the basis of the number of family members. In this sense, the land resource is shared by every household on an equal basis. With times going on after the signing of the land contract, lots of changes have taken place in different household caused by natural death and birth, urban migration and moving from agriculture to industrial field etc., thus disparity occurred with regard to the originally equally-allocated land resource, but the occurrence of the disparity in land resource control is not due to the encroachment on other people's land. Farmers enjoy equal rights in the aspects of education and technical training, which are open to every household free of charge. For those skillful villagers who performed very well in new technology extension, they will be provided more training opportunities and established as models by the government to provide demonstration and technical guidance for other villagers.

b: Sex Equality. It is mentioned in one previous part of the paper that almost 100% children are able to get access to the 9-year compulsory education. Both male and female enjoy equal rights. As to the division of labor from the perspective of gender, we have the following findings:

	The ratio of male labors (%)	The ratio of female labors (%)
Bamboo Shoot Cultivation	60	40
Bamboo Shoot sales and Marketing	40	60
Bamboo shoot processing	50	50
Industrial production	37	63
Agriculture	50	50
Transportation	100	0
Construction/Building	70	30

The above findings suggested that the division of labor between male and female is mainly determined by the type of work they do and has nothing to do with the gender discrimination. The reason why there are more females engaged in industrial production than male is that the Energy-efficient Light industry is well developed in Gaohong Town and obviously there are more female labors than male labors working in this sector.

However, the feudalistic thinking still remains in some aspects. For example, there are more men than women going to attend various training workshops; most farmers including women prefer giving birth to boys instead of girls.

5.3 The importance of bamboo shoots upon the Villagers' livelihood in Chejiakan Village

5.3.1 changes of the crops structure.

Before 1990, tea, rice, rapeseed and bamboo shoot were main economic sources of Chenjiakan Village. However great changes have taken place in the crop structure since the start of the development of shoot species bamboo. The table below shows the changes of the area of land cultivating different crops from 1990-2002.

Unit: ha

	grain crops	tea	rapeseed	vegetable	Shoot-species bamboo plantation	Other crops
1990	112.50	21.5	6.5	6.0	7.0	17.7
1995	100.9	13.3	6.7	10.0	53.3	22.2
1997	94.1	6.7	5.3	6.7	56.7	6.8
2000	78.3	5.3	16.0	6.5	63.3	2.7
2002					80.0	

We noticed some interesting changes from the above table about the land utilization: the land area for cultivation of grain, tea and other crops gradually declines year by year, the land area for cultivation of rapeseed and vegetable remains stable without big changes and the area of shoot species bamboo increases quickly. Up to 2002, bamboo shoot had become the most important crop in this village.

For the farmers, the changes about the land area are due to the good economic benefit generated from bamboo shoot. Compared to the cultivation of other crops, the financial input in bamboo shoot is less and the production output is good. The labor forces can be freed from those labor-intensive crop cultivation such as rice and tea and transfer to other sectors like industrial production, sales and marketing and transportation etc. Through interviewing farmers in these 3 villages, we made a primary comparison between the rice and bamboo shoot in terms of the input and output as following:

Crops		Input/ha		Output (kg/ha)				Production Value (yuan/ha)					Net income (yuan/ha)
		Working days	Capital (yuan) *	Bamboo shoot	Bamboo Culm	Rice	Straw	Bamboo Shoot	Bamboo Culm	Rice	Straw	Total	
Shoot-species bamboo	Covered land	300	30750	22500	4875			81000	1706			82706	51956
	Uncovered land	105	1650	13500	4875			21600	1706			23306	21656

Rice	150	2250			6750	3750			7020	1500	8520	6270
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*refers to the capital inputted on fertilizer, pesticide, bamboo plantation covering etc.

The above table shows that the economic benefit from the shoot-species bamboo plantation by the application of land-covering technology is 8.3 times that from the rice cultivation, and even the economic benefit from the shoot-species bamboo plantation without applying the land-covering technology is 3.45 times that from the rice cultivation. Moreover, most bamboo are planted in the degraded land while the rice is generally planted in the most fertile land in the village. Thus the farmers give up planting rice and start planting shoot species bamboo. However for the sake of food security, the government keeps on reminding the farmers of not occupying farmland for growing bamboo and endeavors to maintain the diversity of the crop structure. Of course the change of the crop structure is also due to the reason that with the development of rural industry, more and more villagers start to be engaged in the industrial field. The younger generation, in particular, has increasing interests in industry but gradually loses interests in laborious farming work. In 1990, there were 28 people engaged in industrial field in the village and in 2000 there were 126, accounting for 28.6% of the total labor force in the village.

5.3.2 *The impact of bamboo shoots on the family livelihood.*

Through interviews, we learned that since 1995 bamboo shoot has become the most important source of cash income for villagers. Bamboo shoots also serves as an important source of vegetable. It has become the financial basis for new houses construction (90%), children's education (80%), industrial investment(80%) as well as the purchasing of durable consumables (85%).¹ The household possession rate of some common electrical appliances is Color TV 94.9%; Washing machine 84.6%; Telephone 96.2%; Refrigerator 75.6%; Motor car 87.2%; Air conditioner 9%; Car 7%; Computer 4%:

As a matter of fact, there are more than one Color TV, telephone, motor car in some households. If counted by the number of the electrical appliances, the possession rate would have exceeded 100%.

5.4 *The impact of Bamboo Shoot Sector on employment generations for local farmers*

5.4.1 *Bamboo shoot processing.* As mentioned previously, there are over 40 bamboo processing manufacturers in Lin'an with an annual production capacity about 140,000-160,000 tons. Most of the workers in these factories are locally employed. Surveys on two bamboo shoot processing manufacturers show that a bamboo shoot manufacturer with yearly production capacity 10,000 tons needs to hire around 100 long-term fixed workers and 400 temporary seasonal workers (working 3 months per year). Each year around 6,000 seasonal workers and 1,500 long-term workers are needed in bamboo shoot processing factories in Lin'an.

5.4.2 *Bamboo Shoot Sales and Marketing.* Each year about 180,000 tons fresh bamboo shoots (including various kinds of shoots species such as Ph. praecox, Ph. pebescens, Ph. nuda and Ph. vivax) are produced in Lin'an. It is estimated that around 5,000 farmers in Lin'an are engaged in the sales and marketing activities of bamboo shoots, serving as a bridge linking bamboo shoot growers (farmers), markets and manufacturers. In addition, there are 16

¹ 90%, 80%, 80% and 85% of the financial input for the 4 items, i.e. the new house construction, children's education, industrial investment and the purchasing of durable consumables are coming from bamboo shoots.

established bamboo shoot markets in Lin'an, which need to be run and managed by people, new employment opportunities are thus generated.

5.4.3 Boost the development of other sectors. Bamboo shoot sector development also boosts the development of many other sectors such as packaging, transportation, mechanical machinery and infrastructure construction, where new employment opportunities are generated for local people. It is initially estimated that the total annual production value of bamboo shoot (including fresh and processed bamboo shoots) is over 0.7 billion Yuan, of which 30% is generated from other sectors.

5.5 The importance of bamboo shoot industry among others in local industrial structure

The GDP of Lin'an in 2002 is 9,656 million Yuan, of which 1,210.6 million Yuan comes from agricultural sector. The production value of fresh bamboo shoot is 328.95 million Yuan, accounting for 27.1% of the total agricultural production value. As mentioned previously, around 60% farmers in Lin'an are involved in bamboo shoot production. In the bamboo-shoot producing areas where these farmers are inhabiting, 45.17% of the agriculture income comes from bamboo shoot, in which those income coming from bamboo shoot processing (350 million Yuan) is not included. We can conclude that despite the fact that the production value of bamboo shoot only constitutes about 7% of the total GDP of Lin'an, for local farmers, the bamboo shoot are their main source of income: 70% income of the 40% farmers come from bamboo shoot. The development of bamboo shoot sector strongly pushes the development of other rural sectors by accelerating the farmers' primitive capital accumulation and allowing them to be able to make extra investment in other fields. For instance, in Gaohong Town (Xiang), the development of bamboo shoot industry greatly boosts the development of other rural industries, particularly the energy-efficient light industry in that the ratio of this industry accounting for the total GDP increase quickly while that of bamboo shoot accounting for the total GDP is relatively decreasing in spite of its increasing total production value. We should say that this is the result of the optimization of the industrial structure and is therefore beneficial to the local sustainable development. Below is a table showing the changes of the GDP and the bamboo shoot production value of Gaohong Town over the last several years:

Year	GDP (million yuan)	Growth rate (%)	Bamboo shoot production value (million yuan)	Growth rate (%)	Ratio of bamboo shoots accounting for the total GDP (%)
1999	97.66		20.18		20.67
2000	108.3	10.9	21.68	7.4	20.02
2001	172.7	59.5	25.80	19	14.94
2002	195.19	13.02	28.20	9.3	14.45

6. The opportunities and challenges facing the Lin'an bamboo shoot sector

6.1 Future development strategy of bamboo sector (including bamboo shoot sector) set by the Lin'an government

In March 2003, an Overall Development Plan on the Acceleration of the Forestry Development was shaped by Lin'an government, in which development objectives of various items are detailedly specified, including forestry industry structure, ecological structure, forest resources

protection, scientific and technological input and policy support system etc. Eight Industrial Projects are included in the Forestry Industry Structure Construction, of which 2 projects are connected with bamboo: One Billion Yuan Project of Moso Bamboo (*Ph. Pebescens*) and Eight Hundred Million Yuan Project on Bamboo Shoot Industrialization.

As to the One Billion Yuan Project of Moso Bamboo (*Ph. Pebescens*), the objective set is that up to 2007, the area of Moso Bamboo plantation will increase from 20,000 ha in 2001 to 27,333 ha with the newly cultivated species focusing on bamboo species for dual uses – shoot species and timber species and the bamboo production value will increase from 490 million Yuan to 1 billion Yuan (including bamboo shoots). As to the Eight Hundred Million Yuan Project on Industrialization of Bamboo Shoot (not including Moso Bamboo Shoot), the objective set is that the production value of fresh bamboo shoots will increase from 330 million Yuan in 2001 to 510 million Yuan in 2007. The processing value (not including the Moso Bamboo shoot processing) will reach 320 million Yuan and the total production value of bamboo shoot will reach 830 million yuan. If plus the production value of Moso Bamboo Shoot, it is estimated that up to 2007 the production value of bamboo shoots will exceed 1.1 billion Yuan. On all accounts, the total bamboo production value in Lin'an will increase from 950 million Yuan in 2001 to nearly 2 billion Yuan in 2007.

The Overall Development Plan also elaborately stipulates the specific task of each Township, their corresponding scientific and technological capital inputs as well as preferential policy support so on and so forth.

There are many stipulations on policy support in favor of bamboo farmers in the Development Plan. For example, the contracting period of bamboo forests extends from the previous 30 years to 50 years, i.e. expires till the year of 2050; each year the government appropriates 1 million yuan for bamboo cultivation. For growing one ha bamboo, the farmers will obtain a subsidy of 1200 yuan from the government; for reclaiming one ha low-yield bamboo forests, the farmers will obtain a subsidy of 750; a 667 ha High-yield Moso Bamboo Demonstration Base for both shoot and timber uses and 50 demonstration households will be established; the technical service to bamboo farmers will be strengthened etc. All of these favorable stipulations are designed to boost the cultivation of the county's bamboo resources as a whole. Besides, there are also a series of preferential policies on enterprises and investments stipulated in the Development Plan.

From the above it can be predicated that the bamboo sector in Lin'an will see a new round of development in the years to come. New development opportunities are lying ahead for bamboo farmers in Lin'an.

6.2 Challenges facing bamboo shoot industry in Lin'an:

However, there are many constraint factors existing for further developing bamboo shoot industry in Lin'an:

6.2.1 Unfavorable impacts of climate and other natural disaster: Bamboo shoot production is largely affected by the local climate. For instance, from the summer of 2001 to spring of 2002, Lin'an suffered a severe drought which had never occurred over the last decades. It caused the reduced production of bamboo (*Ph. praecox*, *Ph. pubescens*, *Ph. nuda*): in 2001, the production volume of *Ph. praecox* and *Ph. nuda* was 114,798 and 29,375 tons while in 2002 they reduced to 107,150 and 200,000 tons separately.

Meanwhile, due to the long-term application of land-covering technology, bamboo forests degrade very quickly. And the large-scale bamboo afforestation limited the cultivation of bamboo into single species. 76.7% of the total 20,000 ha shoot species bamboo plantations is *Ph. praecox*. Plant diseases and insect pests become more and more serious.

6.2.2 The market price of bamboo shoot is declining year by year. The quick development of bamboo shoot sector makes the local farmers gradually alleviated from poverty and become well-off. With the speeding expansion of bamboo plantation and the quick increase of bamboo production, the average market price of the bamboo shoot is however declining from 10 yuan/kg to 5 yuan/kg. Even though now farmers still prefer to plant bamboo due to its higher profit returns than the other crops', how to take measures to counter this problem poses a severe challenge to the future development of bamboo shoot sector.

6.2.3 Lack of highly efficient and non-pollutant demonstration plantation base. Bamboo plantations in Lin'an are mostly small-scale and dispersely managed by individual household. Difficulties are existing in terms of information exchange, technical training and marketing. In particular, by far there are no high-yield, highly efficient and non-pollutant large-scale demonstration base. To further improve the management skill of farmers on bamboo plantation is a priority task.

6.2.4 The mono-species bamboo processing hinders the further exploration and expansion of the market. The bamboo shoot processing technology is not so advanced and the bamboo species for processing is very few. Over 85% of the Moso Bamboo Shoot are processed into water – boiled shoot; 80% of the fresh shoot of *Ph. Praecox* are directly sold to the market and over 90% of the shoot of *Ph.nude* are processed into dried bamboo shoots for sale. However, the production quantity of some well-received bamboo shoots products in the market like small –packaged multi-taste bamboo shoots and shoot strips are very small and market promotion activities are not sufficient.

The bamboo shoot market are not fully explored. The water-boiled bamboo shoots produced in Lin'an are mainly exported to one single market – Japan and the fresh bamboo shoot are mainly sold to big and middle cities like Shanghai and Hangzhou, while few are sold to the vast area in the north of Yangtse River.

6.3 Recommendations with an orientation towards sustainable development of bamboo sector

6.3.1. Strengthen research and development on new processing technology as well as new products. In Lin'an, several relatively big and well-managed bamboo shoot manufacturers honored as “Science and Technology leading enterprises” are set as new technology and new product bases. They are currently conducting joint research and development in cooperation with universities and research institutes targeting at designing and producing a batch of new products well received in the market in short period of time. In the meantime, a joint research on the technology of keeping the freshness and extending the freshness warranty period of bamboo shoot is going on.

6.3.2 Further open the bamboo shoot market. It is a phenomenon that the sales and marketing of bamboo shoots are mainly monopolized by locals while outlanders are marginalized. The government is prepared to release a series of policies to encourage outlanders to come to Lin'an to do bamboo shoot business and further explore the market potential. To foster abundance of

international sales and marketing professionals and establish sales and offshore marketing base are also on the working agenda.

6.3.3 Consolidate and develop Bamboo Shoot Specialized Cooperative. To make farmers more organized so as to get more opportunities to get access to technical training and markets and to further improve the management level of farmers on bamboo plantations and products. It should be advocated that the kind of Supplying and Marketing Contract ² be signed between manufacturers and bamboo farmers directly. Meanwhile, through the Specialized Cooperative, to enlarge the scale of the highly-efficient, high-yield and non-pollutant bamboo shoot production base, by which to improve farmer's bamboo plantation management level.

6.3.4 Adjust the bamboo plantation structure to avoid mono-species plantation. To diversify bamboo shoot and other bamboo products by cultivating multiple bamboo species for different functions such as timber species, shoot species, dual species for both timber and shoot, landscaping species and species for water and soil control of reasonable proportion. In terms of the size of bamboo, big-sized, middle-sized and small sized bamboo should be also proportionately planted. The main objective should be maximizing the unit production rather than enlarging the area of the bamboo plantation

² It is mentioned in previous part of this paper (4.2). It is agreed in the contract that the company guarantees to buy all bamboo shoots produced by bamboo farmers at a committed protective price. In this way, on the one hand, the farmers interests are protected; on the other hand, the raw material supplying of bamboo shoot manufacturers is guaranteed.