

ITTO PD 56/99 Rev.1 (I)
**Promotion of Utilization of Bamboo from Sustainable
Sources in Thailand**

Ex-Post Evaluation Report
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PART I EXECUTIVE SUMMARY

1. Background Information about the Project

A survey conducted in the pre-project ITTO PPD 4/98 Rev.1 (I) "Promotion of Tropical Non-Wood Forest Products in Thailand" identified the problem on rapidly declining bamboo resources due to excessive harvesting, including illegal harvesting of bamboo stands in the forests. Forest-dependent communities resorted to harvesting and trade of non-wood forest products (NWFPs) as a result of the total ban on logging in Thailand starting 1989. Appropriate propagation and plantation management techniques for shoot and pole production were generally not widely known by farmers. Similarly, rural-based bamboo-using enterprises had limited access to information and technologies on the efficient use of bamboo; hence no opportunities to improve the traditional products, more so produce higher value ones. This project was thus designed to promote sustainable bamboo plantation management and utilization as a means of generating livelihood and income for rural communities engaged in collecting, processing, storage and sale of bamboo products in Thailand.

This project was implemented by the Forest Management and Forest Products Research Division of the Royal Forest Department (RFD) based in Bangkok. Techniques on plantation management were demonstrated to farmers and other villagers by establishing experimental plots using five commercially important bamboo species for shoot and pole production at the Ban Mae Mae Community Forest in Chiang Mai Province and the other at the RFD Forest Products Research Center (FPRC) in Nakhon Ratchasima Province.

Research and development studies were conducted on the physical, mechanical and chemical properties of five commercially important bamboo species; the use of natural dyes for bamboo handicrafts; processing and packaging edible bamboo shoots; and developing high value products such as laminated bamboo flooring and bamboo-cement boards.

Training courses on plantation management, dyeing and production of furniture parts and handicrafts, and production of charcoal and bamboo vinegar (or light distillate) were conducted for 54 farmers and/or craftsmen at the Ban Mae Mae Community Forest, and at the Nakhon Ratchasima FPRC. A cottage industry for the production of bamboo furniture parts, including handicrafts, was established in Ban Mae Mae Community Forest.

The Project Staff participated in international workshops on tools and small machines used in bamboo handicraft making in China, and bamboo charcoal making in Japan. In addition, the project also organized a bamboo design contest for students of the Rangsit University. The project's culminating activity was the National Bamboo Conference held

in Chiang Mai from 24-26 April 2004 which was attended by about 300 farmers and other rural people engaged in the collection, storage and sale of bamboo products; scientists, and key people from bamboo-using industries, and relevant government offices.

The project was implemented for 48 months starting on 01 October 2000, including an extension period of 12 months until 30 September 2004. Total project cost was US\$ 775,196, with ITTO contributing US\$ 452,996 and the government of Thailand, US\$ 322,200.

2. Purpose of the Evaluation

The primary purposes of this evaluation were to provide a concise diagnosis to pinpoint the successful and unsuccessful outcomes, the reasons for the successes and failures, and the project's contribution towards the achievement of ITTO's Objective 2000, and to draw lessons that could be used to improve future similar projects.

The evaluation was conducted in such a way as to answer the questions identified in the ex-post evaluation checklist provided in the ITTO Manual for Project Monitoring, Review and Evaluation.

3. Scope of the Evaluation

This evaluation was conducted 29 months after the project completion and was done simultaneously with the evaluation of a related project ITTO PD 24/2000 Rev.1 (I) PD 24/00 Rev.1 (I) titled "Promotion of Sustainable Utilization of Rattan from Plantation in Thailand" also implemented by the RFD.

Project documents including the proposal, completion report, monitoring reports, final technical reports and publications were reviewed about one month prior to the meetings with the Project Staff at the RFD in Bangkok and project site visits on 5-14 February 2007. Familiarization with the project's logic model and its picture of success was done by revisiting the project objectives, intended beneficiaries and outcomes, and how these linked with the developmental objective. Questionnaires were prepared for the project's staff, consultants and beneficiaries and these were used as guides during interviews and discussions in meetings and site visits.

The project completion report was clarified during a meeting with 9 project staff at the RFD office in Bangkok on 5 February 2007, and later with 3 project extension workers and 7 beneficiaries in Chiang Mai and Nakhon Ratchasima. At the time of the evaluation, the Project Leader had retired; however, the Project Director and two assistant project leaders were available for meetings and visits to the demonstration plots at the community forest in Ban Mae Mae, the RFD FPRCs in Chiang Mai and

Nakhon Ratchasima, and the Bangsai Arts and Crafts Center of Her Majesty Queen Sirikit in Ayutthaya Province.

The following were the specific terms of reference covered in this evaluation report:

- assess the project's design and contribution to the achievement of the general objectives;
- assess the achievement of the project outputs and specific objectives;
- evaluate the impact and relevance of the project;
- determine the effectiveness of technology transfer to local communities for each project;
- assess the overall post-project situation;
- define and assess the unexpected effects and impacts, either harmful or beneficial, and present the reasons for their occurrence;
- analyze and assess the implementation efficiency including the technical, financial and managerial aspects;
- recommend follow-up actions to enhance utilization of the technologies and other results developed in the project;
- make an overall assessment of each project's relative success or failure to summarize the key lessons learnt, and
- identify any issues or problems which should be taken into account in designing and implementing similar projects in the future.

4. Conclusions of the Evaluation

4.1 Project Design and Contribution to the Achievement of the General Objective

The project design was drawn with the participation of various stakeholders from the academe, non-government organizations, community leaders and RFD staff during the workshop on "Promotion of the Utilization of Bamboo Sustainable Resources in Thailand".

An examination of the research-to-impact pathway in the project design showed that within the time and resources available, the project focused more on outputs rather than socio-economic outcomes. The rationale of the vertical logic was appropriate; however, some outputs had only short-term effects. The link between the project outputs with the higher order objectives could be improved by integrating a sustainability plan addressing, among others, uncertainties brought about by external factors.

4.2 Achievement of the Project Outputs and Specific Objectives

All outputs designed to achieve the project objectives were substantially complete within the first three years of implementation, except for the National Bamboo

Conference which was held on the fourth year. The one-year extension was also necessary to improve and publish reports and manuals.

The project had accomplished extra activities without additional cost to ITTO, namely: (i) a bamboo products design contest for university students, (ii) construction of a traditional bamboo house at the Ban Mae Mae Community Forest, and (iii) conduct of R&D studies on two high value products, i.e., bamboo-cement boards and laminated bamboo flooring. These activities added value to the overall project accomplishment.

Training activities have been sustained in Nakhon Ratchasima and Chiang Mai even after the project completion. To date, the experimental plots continue to serve as sources of bamboo propagation materials for the rural communities. Annually, bamboo planting materials are given out to the rural communities for free. Technical assistance in establishing and managing private plantations, as well as preparing planting materials, are conducted not only for farmers, but also for other civic groups and non-government organizations.

4.3 Impact and Relevance of the Project

Among the interventions in this project, livelihood activities on the trade of bamboo propagation materials, edible shoots and poles are the most widely accepted and adopted by the rural communities in Nakhon Ratchasima and Chiang Mai. Aside from using species introduced in this project, private plantation owners have also acquired plantation materials from other countries such as China, Taiwan and East Timor, however, through unregulated means. In most countries, shipment of imported seeds strictly requires a phytosanitary certificate or a seed analysis certificate as safeguard against introducing bio-invasive species and related problems that threaten the local bamboo industry.

At the time of the evaluation, locally propagated plantation materials from imported species were available from private plantations for Bt 200/seedling, but some for as much as Bt 3,000/seedling. A limited supply of plantation materials from local commercially important species is given free by the FPRCs, but could be bought from private plantations for Bt 50-200/seedling depending on the species' commercial importance.

The project activities at Ban Mae Mae have generated government support for the community. In 2006, the community received funds for the construction of some 50 traditional bamboo houses (about 20 m² big and similar to the model house put up during the project), which are currently rented out to tourists at Bt 500 for an overnight stay. Considering that Chiang Mai is a tourist destination and the potential of the Ban Mae Mae Community Forest to become a model for community-based forest enterprise development, a significant opportunity exists to develop this forest area into an

ecotourism zone. A follow-up project can be conducted for this purpose with the view of further promoting the use of NWFPs from sustainable sources.

4.4 Effectiveness of Technology Transfer to Local Communities

A number of beneficiaries of training courses and technical assistance on propagation techniques and plantation management for shoot and pole production have successfully translated their knowledge into additional income through the sale of planting materials, shoots, and poles. The Sakon Nakhon FPRC's robust technical capability on plantation management can be attributed to its trained and dedicated research and extension workers, the availability of land for the experimental plots and production of propagation materials.

Training courses on bamboo shoot processing and bamboo utilization technologies were successful in arousing interests among the participants; however, pilot production did not necessarily progress into commercial production. Creating economically viable activities that focused on bamboo shoots and bamboo furniture/furniture parts entails more than the community's access to the resource base and technological support. Marketing traditional bamboo products suffers from the stigma that bamboo is the poor man's timber. Training courses on basic skills for bamboo furniture making were quite effective, but the demand for traditional bamboo furniture remains low as these are generally perceived as unappealing and having low value. Hence, participants' interests on shoot processing, bamboo furniture and charcoal making were rather short-term and would need further interventions before these could translate to economically viable activities for the rural communities.

Improvement of stakeholders' access to technical information through manuals written in the local language is quite significant. The Executing Agency has recorded written requests for these manuals from both formal and informal organizations, such as managers of watershed areas who intend to establish bamboo plantations, the Thai Plywood Company, Ltd, chopsticks manufacturers, Pavilions Construction, charcoal makers, bamboo furniture exporters, other RFD FPRCs such as those in Sakon Nakhon, Loie, Sukhotai, Chiang Rai Provinces, other projects such as the Golden Bamboo Project of the Thai Royal Army Ministry, Bamboo Project for Panda Feed at the Chaing Mai Zoo, universities including King Mongkut's University of Technology and the Asian Institute of Management, National Housing Authority, National Science and Technology Development, and Agricultural Land Reform Office.

4.5 Overall Post-project Situation

The project achieved the intended outcomes at the project sites, albeit to a limited extent. It is noteworthy that promotion of sustainable bamboo production and utilization technologies has been integrated in the Executing Agency's in-place program on NWFPs. After the project's completion in 2004, demonstration plots and equipment

designed in the project have been replicated using RFD funds and installed at the newly relocated FPRC in Chiang Mai. These are utilized in regularly conducted training courses that have served as further catalysts for establishing more bamboo plantations in Chiang Mai and creating new livelihood opportunities from the sale of planting materials from commercially important species such as those studied in this project. Using RFD funds, a model house showcasing construction applications of bamboo was put up at the Nakon Ratchasima FPRC campus.

Both FPRCs at Nakon Ratchasima and Chiang Mai continue to attend to numerous requests for planting materials for high shoot-yielding species and those with quality poles. Good quality bamboo poles from managed plantations sell for Bt 75-240/piece vs. Bt 20-25/piece from unmanaged plantations. Using appropriate plantation techniques, farmers claim an overall increase in income by over 100% or so owing to increased harvest of up to 50 kg/rai in one day, where dry shoots sell for Bt 5-10/kg, and steamed shoots for Bt 14/kg, but can be as high as Bt 35/kg during the dry season. On the average, a farmer earns Bt 16,000/rai month from shoots and as high as Bt 30,000 depending on the species and quality.

On the utilization aspect, traditional bamboo furniture is generally perceived as poor man's furniture and not appealing even to local buyers. However, through the application of more advanced techniques and processing technologies and innovative designs, small- and medium-size shops export middle to high-end bamboo furniture to France, Germany and the Middle East. Furniture makers who participated in the project activities on plantation management and furniture making have upgraded their capabilities by acquiring power tools and imported electric dryers to meet bulk orders from the Middle East. Local bamboo handicrafts and furniture makers are generally aware of the government's One Tambon-One Product (OTOP)¹ Program and strive to acquire OTOP product certificates as a means to improve marketability and sales in competitive export markets. However, the local bamboo furniture industry still has to take advantage of the availability of the Furniture Testing Center as a means of upgrading and adding value to their products, and expanding their markets.

There is little motivation for rural communities to engage in bamboo charcoal production because of the not widely understood prohibition on charcoal production and trade. In Thailand, charcoal manufacturing concessions were cancelled in 2006. Most villagers are not aware, though, that such cancellation is meant to arrest the rapid destruction of mangrove forests largely attributed to charcoal production. At present, it appears that the regulation makes no distinction between charcoal from mangrove forests and those from sustainable sources such as bamboo plantations. Hence, there is a need to review and clarify policies and regulations on the trade of materials from

¹ In Thailand, the One Tambon-One Product (OTOP) Policy has facilitated the successful development of micro and small enterprises. The OTOP Five-Star Certification is given to enterprises with excellent quality products (processing methods and packaging), which are 100% made of local indigenous materials.

plantations. Further development of the bamboo charcoal vinegar or light distillate into higher value products for medicinal, fungicidal and other industrial applications should be looked into.

4.6 Unexpected Effects and Impacts

During this evaluation, a farmer-participant from Chiang Dao District, Chiang Mai province expressed his serious concern regarding the gregarious flowering of his *Dendrocalamus sericeus* plantations. Most bamboo species die after flowering. A widespread gregarious flowering of *Dendrocalamus asper* in natural forests and plantations all over Thailand more than 10 years ago led to significant losses for the bamboo farmers. This flowering phenomenon is by far the most challenging threat to the promotion of bamboo plantation management and sustainability in Thailand, and anywhere in the world. There is no definite prescription on how to handle such a phenomenon. The International Network for Bamboo and Rattan (INBAR) maintains a web page specifically on this topic and provides information on the number of years it takes for some species to flower.

The factors that influence bamboo's demise after flowering have not been established. The pattern of flowering in bamboo varies with species and the physiology of flowering remains little understood. Clear cutting does not appear to halt stand mortality, although some clumps may be induced to develop new shoots before finally dying altogether. Some species have been observed to recover after flowering².

4.7 Implementation Efficiency

The Executing Agency did not encounter serious problems on project financial management and administration. There was no document showing any deviation in the use of ITTO funds. Recommendations and decisions made during the three Project Steering Committee meetings were all satisfactorily addressed. The inputs of 3 International Consultants and 3 National Experts who were on short-term services, all with clearly defined terms of reference, were well documented.

On operations management, the Project Leader supervised the implementation of project activities and experienced some difficulties in R&D, as well as technology transfer activities. R&D activities were hampered by delays caused by repair works in the RFD laboratories. Technology transfer activities took longer than planned due to insufficient technical and marketing information as basis for purchasing bamboo processing machines. This situation warranted the involvement of a marketing/business consultant as early as the project's formulation stage, and throughout the implementation to ensure that technical outputs would be strongly linked with socio-economic gains.

² Tewari, D.N. 1992. A Monograph of Bamboo. International Book Distributors, Dehra Dun, India. 498p.

5. Recommendations

5.1 Project Design and Outcomes

In projects involving community-based enterprise development as a strategy for conservation and sustainability, the duration, scope and pilot site should be carefully selected for direct and more straightforward links between enterprise and conservation to exist. Multi-stakeholder participation is critical during project formulation, and equally important is the involvement of an expert on socio-economic aspects, business development and marketing in providing the balance towards achieving the intended outcomes.

5.2 Effective Technology Transfer

Aside from technological support, entrepreneurship and business skills development are vital components in enabling subsistence-oriented communities (such as most forest communities) to progress into enterprise-oriented entities.

5.3 Follow-up Actions

The Executing Agency, through its FPRCs, should immediately pursue an information and education campaign and coordinate with the appropriate regulatory bodies to put in place safeguards in importing bamboo propagation materials.

Likewise, the Executing Agency must promote awareness of mitigating measures to the apparent gregarious flowering of bamboo plantations. In the medium term, RFD can think of establishing a bamboo gene bank, and update its bamboo identification manual and bamboo resource database as these tools enable both the government and industries to make more accurate decisions.

The Executing Agency, in collaboration with other government programs and private industry partners, should embark on the further development and commercialization of value-added products from bamboo such as high-grade charcoal and its distillate, and the engineered bamboo products developed in this study (bamboo-cement boards and laminated bamboo flooring). In the short term, the Executing Agency and its collaborators should pilot the production of vacuum-fried bamboo chips (to be marketed as a rich source of dietary fiber) as the project had pointed out its technical and financial viability.

The Executing Agency, in partnership with the Ministry of Industry, can look into how the local bamboo furniture industry can benefit from the services of the Furniture Testing Center as a means of upgrading furniture designs and workmanship, encouraging innovations and expanding its export market. In its techno-transfer activities, the

Executing Agency should target wider diffusion of information and technologies by partnering with industry associations such as the Thai Furniture Industry Club and the Thai Furniture Industries Association, as well as other organized groups, aside from extending technical assistance to individuals.

On community-based enterprise development, the Executing Agency can consider developing the Ban Mae Mae Community Forest into an economically viable ecotourism zone owing to its rich wood and NWFP resources and biodiversity, its strategic location considering that Chiang Mai has a vibrant tourism industry, and the presence of the community's management committee that spearheads the conservation and protection activities in consultation with RFD. The plan should integrate the lessons learned in this project and the pre-project ITTO PPD 4/98 Rev.1 (I) "Promotion of Tropical Non-Wood Forest Products in Thailand"

The ITTO should continue to promote and support research and development studies on NWFPs with a view to improving forest management, as well as increasing the capacity of forest-dependent communities to conserve and enhance forest values. This project has confirmed that bamboo is just part of a big group of sustainable non-wood resources that can generate income for a large forest-dependent rural population. In turn ITTO member countries should take advantage of the rich body of useful information on bamboo provided by INBAR, and at the same time find ways to contribute to the attainment of the network's objectives.

PART II MAIN TEXT

1. Project Context

1.1 Background: Rationale and Objectives

This project was the first of two projects on non-wood forest products (NWFPs) that were based on the recommendations in the pre-project ITTO PPD 4/98 Rev.1 (I) titled "Promotion of Tropical Non-Wood Forest Products in Thailand".

The pre-project ITTO PPD 4/98 Rev.1 (I) titled "Promotion of Tropical Non-Wood Forest Products in Thailand" highlighted findings on the rapidly declining bamboo resources in Thailand. This was due to excessive harvesting that included illegal harvesting of bamboo stands in the forests. Most forest-dependent communities resorted to harvesting and trading NWFPs, including bamboo and rattan, for their livelihood as a result of the total ban on logging and export of log and lumber implemented by Thailand starting 1989. Although government and privately owned bamboo plantations had been established before this project, appropriate propagation and plantation management techniques for shoot and pole production were generally not widely known among farmers. Similarly, rural-based bamboo-using enterprises had limited access to information and technologies on the efficient use of available bamboo resources, which limited their opportunities to produce higher value products, as well as improve their traditional products. This project was thus designed to promote sustainable bamboo management and utilization as a means of generating livelihood and income for rural communities engaged in collecting, processing, storage and sale of bamboo products in Thailand.

The approved duration was 36 months but the project was completed in 48 months (01 October 2000 to 30 September 2004), or an extension of one year. Total project cost was US\$ 775,196 with ITTO contributing US\$ 452,996 and the government of Thailand, US\$ 322,200.

1.2 Outputs and Activities

Majority of the outputs designed to achieve the project objectives were substantially complete towards the end of the first three years of implementation, except for the slight delay on the experiments conducted in the RFD Laboratories which were being repaired then. The culminating activity of this project was the National Bamboo Conference held on the fourth year. The Project Staff needed the one year extension also to complete reports and prepare the manuals in publishable form in the English language. Additional activities and outputs (other than those in the project document) were implemented within the four-year period without additional cost to ITTO. The following accomplishment details were gathered/observed at the time of this evaluation:

1.2.1 *Establishment of Experimental Plots and Demonstration Centers*

Techniques on plantation management were disseminated to farmers and other villagers by establishing experimental plots planted to five selected commercially important species either for shoot or pole production in two selected demonstration sites. One site was at the Ban Mae Mae Community Forest in Chiang Mai Province (5 ha) and the other at the RFD FPRC in Nakhon Ratchasima Province (6.4 ha). Both have remained operational with that at the FPRC in Nakhon Ratchasima serving as an important source of propagation materials. It also continues to conduct regular training programs on the various uses of bamboo for rural communities, boy and girl scouts, and other interested groups.

After the project completion, bamboo production and utilization technologies were replicated (with funding from RFD) at the newly relocated RFD FPRC in Chiang Dao District, Chiang Mai. The new site has a wide land area for establishing bamboo plantations and planting materials, as well as for bamboo processing equipment and gadgets such as the brick-and-mud "beehive" charcoaling kiln similar to those found in Ban Mae Mae and Nakhon Ratchasima.

1.2.2 *R&D Studies Conducted at the RFD Laboratories*

The project implemented five research and development (R&D) studies, and prepared technical reports as follows:

- i. Mechanical, chemical and wood working properties of five bamboo species
- ii. Development of techniques for natural dyeing of bamboo handicrafts
- iii. Establishment of a cottage industry for the production of bamboo furniture parts, including handicrafts, in Chiang Mai
- iv. Development of a technique for bamboo charcoal production
- v. Development of processing technique for bamboo shoots

In addition, R&D studies on new and emerging products were implemented based on the recommendations of the International Consultant for Marketing specifically on:

- vi. Bamboo Flooring from Pai Tong
- vii. Production of Bamboo Cement Board

Both studies demonstrated the use of bamboo for higher value products aside from traditional applications that the rural communities were familiar with.

1.2.3 *Training Courses on Various Aspects of Bamboo Management and Utilization*

Training activities based on the results of completed research projects were held in Ban Mae Mae Community Forest and Nakhon Ratchasima. Within the project duration, a total of 54 farmers and/or craftsmen participated in the training courses on plantation management, production of furniture parts, handicrafts, and charcoal and bamboo vinegar (or light distillate) production. Aside from knowledge generated in the project, the Project Staff also shared techniques and information gathered from international training workshop and conference such as the INBAR-organized "International Training Workshop on Bamboo Handicraft Techniques and Its Tools and Small Machines" held on 8-21 October 2001 in Zhejiang and Sichuan, China; the short-term training on the utilization of bamboo charcoal on 18-25 November 2001 at the Kyoto University and Osaka, Japan, and the World Bamboo Conference in India on 28 Feb- 4 Mar 2004.

Moreover, the project also organized a bamboo design contest for students of the Rangsit University. The contest aimed to increase awareness on the uses of bamboo among the youth which resulted in innovative bamboo products such as a bracelet, wine container, wristwatch, bottle opener, radio and a singing doll.

1.2.4 *The National Bamboo Conference*

This culminating activity was held in Chiang Mai from 24-26 April 2004 and was attended by some 300 farmers and other rural people engaged in the collection, storage and sale of bamboo products, as well as scientists and key people from bamboo-based industries and relevant government offices. The proceedings of this conference had been prepared with the title "Proceedings of the National Conference on Sustainable Development of Bamboo Resources" with due acknowledgment of ITTO's support.

1.2.5 *Published Guides and Technical Reports*

Six technical manuals and 9 technical reports on bamboo production and utilization were produced as follows:

Technical Reports

Sustainable Management of Bamboo Plantations

Chemical Composition of Five Bamboo Species in Thailand

Physical and Mechanical Properties of Five Bamboo Species in Thailand

Bamboo Protection

Bamboo Dyeing

Improvement of Bamboo Charcoal Production Techniques

Bamboo Flooring from Pay Tong

The Effects of Bamboo Pretreatment on the Properties of Bamboo Cement Board

Women's Participation in the Ban Mae Mae Community Forest, Chiang Mai Province

Manuals (in Thai)

Bamboo Planting and Management

Bamboo Charcoal technique

Bamboo Weaving Techniques

Bamboo Furniture Making

Bamboo Protection

Bamboo Cement Board Manufacture

1.3 Compliance with the ITTO Objectives

This project was consistent with the objectives of the ITTA 1994 as stipulated in Article 1, namely: (a) Provide an effective framework for consultation, international cooperation and policy development among all members with regard to all relevant aspects of the world timber economy; (c) Contribute to the process of sustainable development; (f) Promote and support research and development with a view to improving forest management and efficiency of wood utilization as well as increasing the capacity to conserve and enhance other forest values in timber producing tropical forests; (g) Develop and contribute towards mechanisms for the provision of new and additional financial resources and expertise needed to enhance the capacity of producing members to attain the objectives of this Agreement.

1.4 Compliance with the ITTO Criteria

The project was submitted in accordance with the criteria set in Article 23 of ITTA as follows: a) The project is related to the production and use of industrial forest products; b) It should yield benefits to the tropical timber economy as a whole and be relevant to both producing and consuming countries; c) It should be related to maintaining and expanding the international trade in tropical timber; d) It should offer reasonable prospects for positive economic returns in relation to cost.

1.5 Relation to Action Plan and Priorities

The project was consistent with the organization's priorities in the field of **reforestation and forest management** in the **ITTO Libreville Action Plan**, as follows:

Goal 1: Support activities to secure the tropical timber resource base

2. Review current and potential productivity of major tropical forest types.
7. Encourage and assist members, as appropriate, to establish and manage forests for multiple use in close cooperation with local forest owners and communities living in forest areas.

Goal 2: Improve the tropical timber resource base

1. Develop the concept of forest biological health and sustainable production potential, particularly at forest stands and landscape levels. Incorporate these into guidelines for forest management plans

The project was also consistent with the organization's priorities in the field of forest industry in the **ITTO Libreville Action Plan**, as follows:

Goal 1: Promote the increase and further processing of tropical timber from sustainable sources

1. Assist in the promotion and transfer of new and/or improved techniques and technologies;
2. Assist in human resource development and institutional strengthening by designing and consulting national and international events such as specialist workshops and seminars and by the provision of fellowships
3. Encourage and assist members as appropriate to:
 - Formulate research and development proposals which assist with the piloting and commercialization of new processing and manufacturing technologies
 - Organize workshops/seminars on the use of new and/or improved techniques, technologies and the development, testing and adoption of guidelines

Goal 3: Improve the efficiency of processing of tropical timber from sustainable sources

3. Commission and publish analytical studies that identify critical knowledge and information gaps as a precursor to research and development activities on improved efficiency at all stages.
4. Assist in the promotion, transfer and adoption of new and/or improved techniques and technologies through publications and other media such as workshops, seminars and fellowships.

2. Evaluation Scope and Focus

The primary purpose of this evaluation was to provide a concise diagnosis to pinpoint the successful and unsuccessful outcomes, the reasons for successes and failures, and the project's contribution towards the achievement of ITTO's Objective 2000, and to draw lessons that could be used to improve future similar projects. The terms of reference for this evaluation were the following:

- i. assess the project's design and contribution to the achievement of their general objectives;
- ii. assess the achievement of the project's outputs and specific objectives;
- iii. evaluate the impact and relevance of the project;
- iv. determine the effectiveness of technology transfer to local communities for each project;
- v. assess the overall post-project situation;
- vi. define and assess unexpected effects and impacts, either harmful or beneficial, and present the reasons for their occurrences;
- vii. analyze and assess implementation efficiency, including the technical, financial and managerial aspects;
- viii. recommend follow-up actions in order to enhance utilization of the technologies and other results developed in the project;
- ix. make an overall assessment of each project's relative success or failure to summarize the key lessons learnt; and identify any issues or problems which should be taken into account in designing and implementing similar projects in future;
- x. prepare the evaluation report in accordance with the references for the Project Evaluation Report, as contained in the ITTO Manual for Project Monitoring, Review and Evaluation;
- xi. assess the projects' contribution to the relevant ITTA objectives (1994) and relevant ITTO Action Plans;
- xii. prepare one or more articles for possible publication in the ITTO Tropical Forest Update (TFU), in consultation with the editor, containing an overview of the projects and summarizing the lessons learned from the evaluation work. Appropriate photographs should be provided, if possible.

3. Evaluation Methodology

This evaluation was carried 29 months after the project completion. As an initial step, familiarization with the project logic model and its picture of success was done by revisiting the project objectives, intended beneficiaries and outcomes, and how these linked with the higher order objective of ITTO. The logical framework matrix (LFM) developed in the project document was used to a reasonable extent in this evaluation. Aside from the project LFM, a logic model consistent with the LFM and focusing more on people and outcomes (rather than outputs) was also drawn to link the accomplishments with the higher order objectives of the ITTO. Discussions in the succeeding sections of this report were based mainly on the logic models drawn.

The reference documents dispatched by ITTO included the proposal (or project document), monitoring reports, completion report, final technical reports and publications, and the ITTO Manual for Project Evaluation, Review and Monitoring.

Meetings with the Project Staff were held at the Royal Forest Department (RFD) in Bangkok starting on 5 February 2007. Personal interviews and discussions were conducted with the project beneficiaries during the site visits within the period 5-14 February 2007 (see Annex A).

3.1 Meeting with the Project Staff at the RFD in Bangkok

The Project Staff who participated in the evaluation meetings, their positions at the RFD's Forest Management and Forest Products Research Office, as well as their designation/participation in the project, were as follows:

PARTICIPANTS	DESIGNATION/ROLE IN THIS PROJECT/EVALUATION
Mr. Suchart Thaipetch Senior Forestry Officer and Director of the Forest Products Development Division	Project Director
Ms. Pannee Denrungruang Scientist, Chief of Non-Wood Forest Products Development Group, Forest Products Development Division	Asst Project Leader and Researcher on Chemical Properties
Mrs. Nuchanart Nilkhamhaeng Scientist, Forest Products Development Division	Asst Project Leader and Researcher on Dyeing
Mr. Pracheon Sroitongkham Technical Officer, Chief of FPRC at Nakhon Ratchasima, Forest Products Development Division	Project Researcher on Bamboo Plantation Management
Mr. Suthep Chiablaem (changed first name to Kittipum) Forestry Officer, Chief of FPRC at Chiang Mai, Forest Products Development Division	Project Researcher on Bamboo Plantation Management
Mr. Bounsong Sompoh Technical Forest Official, Forest Products Development Division	Project Researcher on Physical and Mechanical Properties
Ms. Paiwan Lek-u-thai and Ms. Mayuri Jitkaew Technical Forest Officials, Forest Products Development Division	Project Researchers on bamboo protection
Mr. Vallayuth Fueangvivat Technical Forest Official, Forest Products Development Division	Project Researcher on development of bamboo cement board
Mr. Jirapong Kuhakanchanam Technical Forest Official, Forest Products Development Division	Project Researcher on charcoal production

In addition, a very brief meeting was held with Mr. Visoot Somnuk, newly appointed Director of Forest Management and Forest Products Research Office (appointed in February 2006). Mr. Somnuk was not familiar with this project as he was still with the

Department of National Parks, Wildlife and Plant Conservation's (DNP's) Planning and Information Office which had no participation in the project implementation.

3.2 Visit to the bamboo demonstration plots at Ban Mae Mae Forest and the Mae-Mae Women's Bamboo Handicraft Group in Chiang Dao District, Chiang Mai Province

PARTICIPANTS	DESIGNATION/ROLE IN THIS PROJECT/EVALUATION
Mr. Pajon Sitdhigun Technical Forest Official, Chiang Mai Provincial	Ban Mae Mae Community Forest is included in his area of responsibility. Continues to monitor the bamboo demonstration plots up to present
Mr. Wong Kaewjaima Community Leader of about 500 dwellers of the Ban Mae Mae Community Forest; heads a 13-member Council that manages the Ban Mae Mae Community Forest in accordance with an agreement with the Royal Forest Department.	Ban Mae Mae Community Forest members are beneficiaries of the Project's technical assistance and training on plantation management (and propagation) for culm production; and techniques on basket weaving, charcoal and light distillate production, shoot production and processing. The Community is a recipient of a bamboo dryer, bamboo charcoaling kiln, and two bamboo splitting machines

3.3 Visit to the Chiang Mai FPRC, a bamboo furniture production shop, and bamboo plantations in the Chiang Dao District established with the technical assistance of the Project Staff

PARTICIPANTS	DESIGNATION/ROLE IN THIS PROJECT/EVALUATION
Mr. Somjit Manirat Bamboo furniture maker in Chiang Dao District	Beneficiary of technical assistance on bamboo protection, and plantation management and propagation; currently exports bamboo furniture to France, Germany and the Middle East
Mr. Somnieng Sriwichai Bamboo farmer/owner of 4,000 ha planted to <i>Bambusa multiplex</i> in Chiang Dao District	Beneficiary of technical assistance on bamboo plantation management for pole production; supplies furniture makers in Chiang Dao District
Mrs. Ampa Tienai Owner of a small handicraft shop in Ban Pa Bong, one of the outstanding OTOP cities in Chiang Mai	Member of a women's cooperative that supplies bamboo products to the Phuket market mostly for tourists
Mr. Cham Nong Ampai Owner of 0.5 hectare land planted to 3-year-old <i>Phyllostachyum</i>	Project beneficiary of technical assistance on plantation management for shoot production
Mr. Anuchart Buranapim Design Expert, Industry Promotion Center	Project National Expert on bamboo processing and weaving techniques. The Industry Promotion Center is a Project Collaborator.

3.4 Visit to the demonstration plots at the FPRC at Nakhon Ratchasima, and two privately owned bamboo plantations in Pakchong District established with the technical assistance of Project Staff

PARTICIPANTS	DESIGNATION/ROLE IN THIS PROJECT/EVALUATION
Mr. Kowit Somboon National Expert on Bamboo Plantation Management & Propagation, and former RFD Scientist on management and propagation	Recommends total cutting and replacement with new plantation stock using seeds to mitigate problem on gregarious bamboo flowering
Mrs. Muanwad Owner of two private plantations (total 6 ha) planted to <i>B. multiplex</i> and other species imported from China, Taiwan and East Timor	Project beneficiary of technical assistance and advisory services on bamboo plantation management and propagation for shoot and pole production

3.5 Visit to the Bamboo Weaving Center at the Bangsai Arts and Crafts Center, Ayutthaya Province, a project of the Queen where various bamboo products were viewed and photographed

Participant	Role in project
Mr. Sawfuwan Puyo Assistant of Trainor in Bangsai Arts & Crafts Center	Guided the Consultant and Project Staff during the tour around Bangsai Arts and Crafts Center's Workshops and Products Display Areas

4. Findings and Lessons Learned

4.1 Project Design and Contribution to the Achievement of General Objective

The framework of this project was built on the premise that forest communities empowered to manage their resource base and provided with enterprise options, can generate income and employment to reduce poverty while in turn providing incentives to conserve the resource.

This project was conceptualized by the executing agency after surveying four selected community forests as part of the pre-project ITTO PPD 4/98 Rev.1 (I) titled "Promotion of Tropical Non-Wood Forest Products in Thailand". A proposal was drafted by the pre-project's National Consultant and discussed with about 40 members of the academe, non-government organizations, community leaders and RFD staff during the workshop on "Promotion of the Utilization of Bamboo Sustainable Resources in Thailand". Hence, the project objectives, outputs and activities were designed and drawn with the participation of various stakeholders including representatives of rural communities where bamboo resources abounded.

At the time of this evaluation, increased awareness on bamboo production and utilization as a means of livelihood was limited to the communities at the project demonstration sites and their immediate vicinities. Using the project's experience in the Nakhon Ratchasima FPRC, demonstration plots and related activities were replicated (using RFD funds) at the newly relocated FPRC in Chiang Mai. This further enhanced the promotion of bamboo from plantations in Chiang Mai, and created new livelihood opportunities from the sale of seedlings of commercially important species aside from those studied in this project. The RFD Research Centers have been very effective in the promotion campaign because they are manned by trained extension workers familiar with bamboo plantation and propagation techniques, and who conduct training activities using actual bamboo processing equipment such as the sap displacement apparatus for bamboo preservation, brick-and-mud beehive charcoaling kiln, and wood working and finishing tools.

4.2 Achievement of the Project Outputs and Specific Objectives

Specific Objective 1: To study sustainable management of bamboo with a view to developing guidelines for improving sustainable harvesting of bamboo.

The following reported outputs were found completed and discussed with the Project Staff in relation to Specific Objective 1:

- Two demonstration plots: Ban Mae Mae Community Forest (5 ha) and Nakhon Ratchasima FPRC (6.4 ha)
- Manual on Bamboo Plantation Management (56 pages in Thai) covering five species, namely: *Bambusa blumeana* Schult, *Dendrocalamus strictus* (Roxb.) Nees, *Gigantochloa albocilata* Munro, *Bambusa* sp. and *Dendrocalamus asper* Back.
- Proceedings of a training course on sustainable management and utilization of bamboo held at Ban Mae Mae

The abovementioned outputs effectively increased awareness of communities in the area served by the Sakhon Nakhon FPRC and at the Ban Mae Mae Community Forest.

Specific Objective 2: To promote efficient utilization of bamboo with a view to generating income for the rural communities.

- Five manuals (in Thai) on bamboo utilization: Bamboo Charcoal Production Technique, Bamboo Weaving, Furniture Making, Bamboo Protection and Bamboo Cement Board Manufacture
- Proceedings of two training courses conducted by the Project Staff on the manufacture of bamboo furniture parts and handicrafts and on charcoal production; Proceedings of the National Bamboo Conference
- Reports (referred to as proceedings) covering Project Staff participation in the International Workshop on Bamboo Handicraft Techniques, Tools and Small

Machines in Zhejiang Sichuan in China, and Study Tour on Bamboo Charcoaling Techniques in Japan.

- Project Final Technical Report (141 pp) covering nine completed studies

Additional R&D studies on the development of bamboo flooring and bamboo-cement boards, which were not originally programmed but suggested by the International Consultant on Marketing, were included in the Final Technical Reports and Manuals.

The technical report entitled "Women's Participation in the Ban Mae Mae Community Forest" highlighted the important role of women in sustainable forest management. This was based on the project's experience with the Mae Mae Women's Handicraft Group.

4.3 Impact and Relevance of the Project

Having been made aware of the potential of bamboo propagation materials for both shoot and pole production as an excellent source of additional income, private plantation owners have acquired planting materials of commercially important species from other countries. Due to the risk of introducing bio-invasive species and related bio-safety concerns that can pose threats to the local bamboo industry, the RFD FPRCs should initiate an information and education campaign on the appropriate protocols regarding importation of plantation materials. Aside from technical knowledge, skills and extension services for commercial production of selected species, an important aspect of management is information on ecosystem dynamics where the valuable products are produced. In most countries, shipment of imported seed requires a phytosanitary certificate or a seed analysis certificate. Small lots of seed may be permitted without a phytosanitary certificate in certain conditions such as the seeds that are not in the list of endangered or prohibited genus/genera, do not require treatment, not parasitic and not genetically modified, and have passed packing and shipping requirements.

The project activities at Ban Mae Mae generated government support for the community. In 2006, the community received funds for the construction of 50 traditional bamboo houses (each about 20 m² big and similar to the model house put up during this project), which are currently rented out to tourists at Bt 500 for an overnight stay. Considering that Chiang Mai is a tourist destination and the Ban Mae Mae Community Forest has potential to become a model for community-based forest enterprise development, a significant opportunity exists to develop the latter into an ecotourism zone. A follow-up project can be conducted for this purpose and to further promote the use of NWFPs from sustainable sources. Based on the pre-project survey, the Ban Mae Mae Community Forest is rich in the following NWFPs: gums and resins (7 species), edible plants including mushroom (41 species), medicinal plants and spices (25 species), bamboo and rattan (6 species), edible insects (9 species), tannins (4 species) and other crops (3 species).

4.4 Effectiveness of Technology Transfer

Technology transfer conducted through the Nakhon Ratchasima FPRC has been quite effective and sustained because of the presence of bamboo processing facilities which have been well maintained even after the project's completion, as well as the availability of trained extension workers. The availability of land for the establishment of experimental plots and production of propagation materials is also a plus factor.

The production of manuals using the local language is appropriate as the intended beneficiaries of the project are the rural communities. Formal organizations have also sought copies of the manuals for their own official use and for use in their training programs. After the project completion, several request for copies of the manuals (in Thai) were recorded and attended to by the RFD. The requests came from:

- Managers of watershed areas who intend to establish bamboo plantations
- Other RFD FPRCs such as those in Sakon Nakhon, Loie, Sukhotai, Chiang Mai and Chiang Rai Provinces
- Golden Bamboo Project of the Thai Royal Army Ministry; Bamboo Project for Panda Feed at the Chaingmai Zoo
- Department of National Parks & Wildlife and Plant Conservation
- At least 12 universities including King Mongkut's University of Technology and the Asian Institute of Management
- National organizations such as the National Housing Authority, National Science and Technology Development, and Agricultural Land Reform Office
- Thailand Rubber Wood Business Association for bamboo as an intercrop in rubberwood plantations
- Thai Plywood Company, Ltd; Chopsticks Manufacturers, Pavilions Construction, Charcoal makers, Bamboo furniture exporters, Dealers of wood protection chemicals
- Other ASEAN countries such as Lao, Vietnam and Myanmar

Follow-up activities for most project outputs must be conducted to develop viable and sustainable community-based livelihood activities. The technical interventions in this project have been successful to a reasonable extent in initiating livelihood activities in the pilot communities, but other interventions are needed to attain sustainable positive socio-economic outcomes. The RFD can strengthen its NWFP program by encouraging the FPRCs to partner with other government programs focused on enterprise development and marketing. Aside from technical support, entrepreneurship and business skills development are vital components in enabling subsistence-oriented communities (such as most forest communities) to progress into enterprise-oriented entities.

4.5 Overall Post-Project Situation

The following describe the post-project situation in communities served by the Nakhon Ratchasima FPRC, and the Ban Mae Mae Community Forest.

The Nakhon Ratchasima FPRC reported an increase in the number of requests from the private sector for technical assistance in establishing bamboo plantations and propagation techniques for species that are both high shoot-yielding and quality pole-yielding from China, Taiwan and East Timor. There are many sources of plantation materials from imported species, which sell for Bt 200/seedling and can be as high as Bt 3,000/seedling.

Because of the availability of fresh bamboo shoots in the local market all year-round, there is still a marked preference for fresh shoots over bottled preserved ones. Similarly, the local demand for traditional bamboo furniture is low because traditional designs are generally perceived as too common and unappealing, thus low value even by rural people. Further, exporters of bamboo furniture are generally not aware of the performance requirements and quality standards for furniture despite the presence of the Ministry of Industry's Furniture Testing Center. Small- and medium-sized bamboo furniture makers interviewed during this evaluation did not know of any local furniture industry association, but were generally aware of the government's OTOP program. Cooperatives producing bamboo handicraft target the local market mostly for tourists in Phuket. At least two furniture industry associations exist, i.e., the Furniture Industry Club under the Federation of Thai Industries and the Thai Furniture Industry Association³.

At the time of this evaluation, the bamboo handicrafts offered for sale to visitors at Ban Mae Mae Community Forest were generally of low value and needed improvements in design and packaging. These indicate that the skills of the women's group have not been enhanced after the project's completion. The bamboo processing equipment provided by the project such as bamboo splitters and the bamboo dryer are still being used by the community members to produce bamboo baskets. In fact, the whole of Chiang Dao District is widely known for their bamboo basket making industry. Compared with the lowland communities, however, Ban Mae Mae Community Forest has the advantage of having a bamboo dryer utilized as a common service facility to dry bamboo poles and products especially during the rainy season. More importantly, the community has exclusive access to other commercially important NWFPs in the Ban Mae Mae forest such as sugar palm, medicinal plants, ulong tea, mushrooms, tiger grass for brooms, honey, coffee and fruits such as pomelo, lychee, lonkong and mango.

In general, there is little motivation for rural communities to engage in bamboo charcoal production because of the "perceived" prohibition in charcoal manufacturing. Charcoal manufacturing concessions were cancelled in 2006. Most villagers are not

³ Tesoro, F. O. 2004. Technical Report on Bamboo Marketing in Thailand. ITTO PD 56/99 Rev. 1(I) Promotion and Utilization of Bamboo from Sustainable Sources in Thailand. RFD Bangkok, Thailand. 28 p.

aware, though, that such cancellation is meant to arrest the rapid loss of mangrove forests largely attributed to charcoal production. It appears that no distinction is made between charcoal from mangrove forests and those from other sources such as bamboo. Hence, there is a need to review policies and guidelines on the trade of materials from plantations, as well as related activities. Further development of the vinegar or light distillate from bamboo into higher value products for medicinal, fungicidal and preservation applications should be explored. Aside from technical support, other interventions are needed to start up community-based enterprises. Hence, local policies will have an important role to play in this endeavor.

The RFD FPRCs do not have updated bamboo resource data covering their areas. Information on species, age and estimated area planted to bamboo in the natural forest and in private and government-owned plantations is critical for decisions to be made by government and business enterprises, and should be available at least in the six RFD FPRCs.

4.6 Unexpected Effects and Impacts

Most bamboo species die after flowering. During this evaluation, gregarious flowering of *Dendrocalamus sericeus* plantations was observed at Chiang Dao District. The flowering phenomenon is by far the most distinct characteristic of bamboo⁴. At the same time, the flowering of bamboo is also the most challenging threat to the promotion of bamboo plantation management and sustainability in Thailand, and anywhere in the world. The pattern of flowering in bamboo varies with species and the physiology of flowering is still little understood. Some 15 years ago the widespread gregarious flowering of *Dendrocalamus asper* in natural forests and plantations led to massive losses for bamboo farmers all over the country. Clear cutting does not appear to halt stand mortality, although some clumps may be induced to develop new shoots before finally dying altogether. Some species have been observed to recover after flowering⁵.

Many people believe that bamboos have a flowering gene because in many instances bamboos from an original propagule that have been transplanted in different environments were observed to flower in unison. External factors such as weather conditions or the environment as a whole, pests and diseases, altitude, and soil condition differ, suggesting that flowering is not controlled by external factors.

World-wide, the factors establishing the conditions that bamboo will die after flowering have not been ascertained. Heavy fertilization before and after flowering has been found to have positive effects. In fact, the perception that all bamboos die after flowering is not true because there have been many instances of survival even after complete flowering of all culms in some species. In other cases, some culms in a clump

⁴ Virtucio, F.D. and C.A. Roxas. 2004. Bamboo Production in the Philippines. E.M. Balatazar, L.E Asis and R. A. Daya (eds.). DENR-ERDB. 202 p.

⁵ Tewari, D.N. 1992. A Monograph of Bamboo. International Book Distributors, Dehra Dun, India. 498 p.

will flower and die but others will not. INBAR maintains a web page specifically on this topic and provides information on the number of years it takes for some species to flower. However, the information is limited to a few species and in general, there is no definite prescription on how to handle such a phenomenon.

In many cultures, flowering of bamboo is associated with the onset of floods, famine and earthquakes. In reality, bamboo flowers are food for rodents, hence flowering is associated with increase in rodent population. After consuming the bamboo flowers, rodents turn to other plants and crops and can therefore cause famine.

4.7 Efficiency of Implementation

The project management team was composed of the Project Director, a Project Leader and a technical staff who were all based at the RFD office in Bangkok. The Project Leader administered and managed the disbursement of funds, supervised the procurement of supplies, materials and equipment, and supervised the implementation of the various project activities. There was no document showing any deviations in the use of ITTO funds. Fund utilization was in accordance with the budget line items in the approved project document. The budget included pre-project costs amounting to US\$ 89,886.00, which was refunded to the ITTO.

The following additional activities/outputs were implemented without extra funding from ITTO:

- Creation of a bamboo home page under the RFD both in Thai and English
- Construction of a bamboo demonstration house at Ban Mae Mae Community Forest, Chiang Mai
- Conduct of a bamboo products design contest for the youth at the Rangsit University

On operations management, the Project Leader supervised the implementation of project activities and conducted meetings regularly. The delays in R&D projects were caused by repair works of the RFD laboratories. Technology transfer activities took longer than planned due to insufficient technical and marketing information as basis for purchasing the bamboo processing machines.

The project involved two out of the six FPRCs located in provinces where bamboo-using communities could be found. The involvement of the Heads of these centers in spearheading project activities in the demonstration sites proved to be beneficial in sustaining project activities such as the conduct of training courses for the village communities and giving out bamboo propagation materials. At present, the bamboo "beehive" charcoaling kiln installed at the Ban Mae Mae Community Forest and the 3 other units installed at the Nakhon Ratchasima FPRC are in good operating condition and utilized in training activities.

The project engaged 3 International Consultants and 3 National Experts on short term-services, all with clearly defined terms of reference. An appropriate technical staff was assigned to each Consultant and detailed discussions between the two were conducted before the end of the Consultants' engagement.

The conduct of studies on new and emerging bamboo products, aside from the improvement of traditional ones is deemed important and should be given more attention and resources in the future. The International Consultant on Marketing was involved for a very limited period to look into the marketing of new and emerging high-value products from bamboo other than furniture/furniture parts. Had he or a local expert on marketing engaged at the onset of the project and especially during the project formulation, the project outputs could have been enhanced. The development and packaging of bamboo snack (vacuum-fried bamboo chips) promoted as a rich source of fibers has a better potential of generating livelihood for the rural communities compared with simply preserved shoots.

Aside from the additional activities mentioned above, the Project Technical Committee approved the following amendments during the first PSC meeting:

- The implementation of Output 2.3 on the "Establishment of a cottage industry for the production of bamboo furniture parts" in February 2002 instead of 2003;
- Activity 2.5.1, i.e., Attendance of the Project Staff in the 14-day International Training Workshop on Bamboo Handicraft Techniques, Tools and Small Machines held on 6-19 October 2001 in Zhejiang Sichuan in Hangzou, China, instead of the Study Tour to China.

In addition to processing and packaging of bamboo shoots, a study on the market for new and emerging bamboo and bamboo-based products such as high-grade bamboo charcoal could have pointed out perceived barriers such as the prohibited export of charcoal. Relevant policies and implementing rules and regulations should be reviewed in the context of promoting utilization of wood and NWFPS from sustainably managed plantations.

On project monitoring, the Project Steering Committee (PSC) was composed of the Head of the Forest Research Office (for the Executing Agency), the RFD Director (as Country Representative), and the ITTO Representative. Due to the frequent reorganization of the RFD, it was represented by three different officials in each of the three PSC meetings. The Project Leader and Assistant Project Leaders though were the same throughout the project. A total of three PSC meetings were held within the project duration. Recommendations of the PSC were well documented and adequately implemented in the project.

PART III CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

1.1 Project Design and Contribution to the Achievement of General Objective

The problem addressed in the project was well founded as it was identified from a survey of four selected community forests in Thailand. The proposal preparation was participatory; however, the project design tended to address mostly technical outputs with less consideration for socio-economic and enterprise development outcomes.

The attainment of the developmental objective had been limited within the area of the project demonstration sites in Nakhon Ratchasima and Chiang Mai Provinces and their immediate vicinities. The presence of trained extension workers and prototype processing equipment in both FPRCs had been very beneficial in attaining the project objectives.

The Ban Mae Mae Community Forest can be an ideal demonstration site of forest-based community enterprise development on NWFPs. Aside from bamboo, the community has access to other commercially important NWFPs such as sugar palm, medicinal plants, ulong tea, mushrooms, tiger grass for brooms, honey, coffee and fruits such as pomelo, lychee, lonkong and mango.

1.2 Achievement of Project Outputs and Specific Objectives

All outputs were completed within the project duration. Additional R&D studies on the development of bamboo flooring and bamboo-cement boards as suggested by the International Consultant on Marketing were included in the Final Technical Reports and Manuals. The project also highlighted the participation of women in enterprise development.

The project accomplished extra activities without additional cost to ITTO, namely: (i) a bamboo products design contest for university students, (ii) construction of a traditional bamboo house at Ban Mae Mae Community Forest, and (iii) conduct of R&D studies on two high-value products, i.e., bamboo-cement boards and laminated bamboo flooring. These activities added value to the overall project accomplishment.

1.3 Impact and Relevance of the Project

The importation and propagation of bamboo planting stocks from Taiwan, East Timor, China and other neighboring countries pose bio-safety concerns. The RFD FPRCs should initiate an information and education campaign on the appropriate

protocols regarding importation of plantation materials, and coordinate with the appropriate authorities implementing phytosanitary rules and regulations.

Considering that Chiang Mai is a tourist destination, and the potential of Ban Mae Mae Community Forest to become a model for community-based sustainable forest management, a significant opportunity exists to develop it into an ecotourism zone. A follow-up study can be conducted for this purpose with the view of further promoting sustainably managed NWFPs from plantations and natural stands managed by a forest-based community.

1.4 Effectiveness of Technology Transfer

The presence of well-trained and dedicated extension workers and the availability of prototype bamboo processing equipment, land for experimental plots and propagation materials contributed to the successful information dissemination and technology transfer of the project's accomplishments. The manuals produced in this project continue to be sought by individuals, as well as in bamboo-based livelihood training courses conducted by other organizations and informal groups.

Follow-up activities for most project outputs must be conducted to develop viable and sustainable community-based livelihood activities. Although technical interventions in this project have been successful to a reasonable extent in initiating livelihood activities in the pilot communities, other interventions are needed to attain sustainable positive socio-economic outcomes. The RFD can strengthen its NWFP program by encouraging the FPRCs to partner with other government programs focused on enterprise development and marketing.

1.5 Overall Post-Project Situation

Due to project interventions, there has been an upsurge in the number of requests for advisory services and technical assistance in establishing bamboo plantations including those on imported species and those suitable for intercrop with trees such as mahogany. Similarly, the demand for training activities on propagation techniques for high shoot yielding species and those that produce excellent culms for furniture making has risen.

There is a stable supply of fresh shoots during the rainy season; however, the reduced production causes an increase in prices during the dry season. The local market for preserved shoots is not significant because of year-round availability of fresh shoots.

Bamboo furniture in traditional designs is generally perceived as low-cost and not appealing even to the rural people. Exporters of the product are not yet aware of performance requirements and quality standards for furniture despite the presence of the Ministry of Industry's Furniture Testing Center.

At the time of this evaluation, the bamboo handicrafts offered for sale to visitors at Ban Mae Mae were generally low value. This indicates that the skills of the women's group have not been enhanced after the project's completion. Thailand's OTOP program has been very beneficial in promoting quality products such as handicrafts and furniture from bamboo and other NWFPs. Information on sources of bamboo is critical for bamboo-based enterprises and should be available at least in the six RFD FPRCs.

In general, there is little motivation for rural communities to engage in commercial bamboo charcoal production. Charcoal manufacturing concessions were cancelled in 2006. Most villagers are not aware, though, that such cancellation is meant to arrest the rapid loss of mangrove forests largely attributed to charcoal production. It appears that no distinction is made between charcoal from mangrove forests and those from other sources such as bamboo. Hence, there is a need to review policies and guidelines on the trade of materials from plantations, as well as related activities. Further development of the light distillate from bamboo into higher value products for medicinal, fungicidal and preservation applications should be looked into. Aside from technical support, other interventions are needed to initiate community-based enterprises and local policies have an important role to play.

1.6 Unexpected Effects and Impacts

Most bamboo species die after flowering. During this evaluation, gregarious flowering of *Dendrocalamus strictus* plantations was observed in Chiang Dao District. Although not entirely unexpected, this phenomenon is by far the most challenging threat to the promotion of bamboo plantation management and sustainability in Thailand.

In many cultures, flowering of bamboo is associated with the onset of floods, famine and earthquakes. In reality, bamboo flowers are food for rodents, hence flowering is associated with increase in rodent population. After consuming the bamboo flowers, rodents turn to other plants and crops and can therefore cause famine.

The high humidity at Ban Mae Mae necessitates the use of artificial drying at almost all stages of processing until finishing. Product quality is substantially reduced if the bamboo material is not heat treated and insufficiently dried.

1.7 Efficiency of Implementation

The project resources were satisfactorily managed towards the completion of this project. The additional outputs, namely: bamboo home page, bamboo demonstration house and the conduct of bamboo products design contest, contributed to the attainment of the project objectives.

The involvement of the RFD FPRC Heads in spearheading project activities in the demonstration sites proved to be valuable in sustaining project activities such as the

conduct of training courses for the village communities and giving out bamboo propagation materials. Currently, the bamboo charcoaling kiln installed in Ban Mae Mae and the 3 other units installed in Nakon Ratchasima are in good operating condition and continue to be useful.

There was no document showing any deviation in the use of ITTO funds. Fund utilization was in accordance with the budget line items in the approved Project Document. The budget included pre-project costs amounting to US\$ 89,886.00, which was refunded to the ITTO.

The project engaged 3 International Consultants and 3 National Experts on short term-services, all with clearly defined terms of reference. An appropriate technical staff was assigned to each Consultant and detailed discussions between the two were conducted before the end of the Consultants' engagement.

The International Consultant on Marketing who was involved for a very limited period to look into the marketing of new and emerging high-value products from bamboo other than furniture/furniture parts, or a local expert on marketing should have been engaged at the onset of the project and especially during the project formulation. This could have enhanced the project outputs

Studies on new and emerging high-value bamboo products should be given more attention and resources in the future. One is the development and packaging of a bamboo snack (vacuum fried bamboo chips from bamboo shoots) which can be promoted as a rich source of dietary fibers, which has better potential to generate livelihood for the rural communities than bamboo shoot processing and bottling. Another is the production of high-grade bamboo charcoal and light distillate. A study on bamboo charcoaling may address the beneficiaries' lack of awareness that export of charcoal is generally prohibited in Thailand. This policy and its implementing rules and regulations should be reviewed in the context of promoting the utilization of wood and NWFPs from sustainably managed forests.

In addition to the additional activities earlier mentioned; the Project Steering Committee approved the following amendments during the first PSC meeting:

- The implementation of Output 2.3 on the "Establishment of a cottage industry for the production of bamboo furniture parts" in February 2002 instead of 2003
- The replacement of Activity 2.5.1 on the Study Tour to China with Attendance of the Project Staff to the 14-day International Training Workshop on Bamboo Handicraft Techniques, Tools and Small Machines held on 6-19 October 2001 in Hangzou, China

The Project Steering Committee (PSC) was composed of the Head of the Forest Research Office and the RFD and ITTO Representatives. Due to the frequent reorganization, the RFD was represented by three different officials in each of the three PSC meetings. The Project Leader and Assistant project Leaders though remained the same throughout the project. A total of three PSC meetings were held within the project duration. Recommendations of the PSC were well documented and adequately implemented in the project.

2. Recommendations

2.1 Project Design and Outcomes

In projects involving community-based enterprise development as a strategy for conservation and sustainability, the duration, scope and pilot site should be carefully selected such that direct and more straightforward links between enterprise and conservation exist. Multi-stakeholder participation is crucial during project formulation, and equally important is the involvement of an expert on socio-economic aspects, business development and marketing in providing the balance towards achieving the intended outcomes.

2.2 Effective Technology Transfer

Aside from technological support, entrepreneurship and business skills development are essential components in enabling subsistence-oriented communities (such as most forest communities) to progress into enterprise-oriented entities.

2.3 Follow-up Actions

The Executing Agency, in collaboration with other government programs and private The Executing Agency, through its FPRCs, should immediately pursue an information and education campaign and coordinate with the appropriate regulatory body to put in place safeguards in importing bamboo propagation materials.

Likewise, the Executing Agency must promote increased stakeholders awareness on mitigating measures for the gregarious flowering of bamboo plantations. In the medium term, RFD can think of establishing a bamboo gene bank, and update its bamboo identification manual and bamboo resource database as these tools enable both the government and industries to make accurate decisions.

The Executing Agency, in partnership with the Ministry of Industry, should embark on the further development and commercialization of value-added products from bamboo such as high-grade charcoal and light distillate, and the engineered bamboo products developed in this study (bamboo-cement boards and laminated bamboo flooring). In the

short term, the Executing Agency and its collaborators should pilot the production of vacuum-fried bamboo chips (to be marketed as a rich source of fiber) as the project has pointed out its technical and financial viability.

The Executing Agency, in partnership with the Ministry of Industry, can look into how the local bamboo furniture industry can benefit from the services of the Furniture Testing Center as a means of improving furniture designs and workmanship and expanding its export market. In its techno-transfer activities, the Executing Agency should target wider and more efficient diffusion of information and technologies by partnering with industry associations such as the Thai Furniture Industry Club and the Thai Furniture Industries Association, as well as other organized groups, aside from extending technical assistance to individuals.

On community-based enterprise development, The Executing Agency can consider developing the Ban Mae Mae Community Forest into an economically viable ecotourism zone owing to its rich wood and NWFP resources and biodiversity, its strategic location within Chiang Mai, which has a vibrant tourism industry, and the presence of a community of people that currently manages its conservation and protection activities in consultation with RFD. The plan should integrate the lessons learned in this project.

The ITTO should continue to promote and support R&D studies on NWFPs with a view to improving forest management, as well as increasing the capacity of forest-dependent communities to conserve and enhance forest values. This project has confirmed that bamboo is just a part of a big group of sustainable non-wood resources that can generate income for a large forest-dependent rural population. In turn ITTO member countries should take advantage of the rich body of useful information on bamboo provided by the INBAR, and at the same time find ways to contribute to the attainment of the network's objectives.

A N N E X A

ACTUAL TRAVEL vs ITINERARY EX-POST EVALUATION OF ITTO PD 56/99 & PD 24/00

Dr. Florence P. Soriano
4-15 February 2007 (12 Days)

Date & Day	Time	Activity	Remarks
4 February Sunday	10:30 AM	Depart Manila for BKK PR 730	As scheduled
	13:45	Arrive in Suvarnaphumi international Airport, (Maruay Garden Hotel, BKK).	OK
5 February Monday	09:00	Meeting with Director, Forest Management and Forest Products Research Office in the morning	OK
	09:30-12:00	Meeting of ex-post evaluation ITTO Project PD 56/99 Rev. 1(I)	OK
	13:30-16:00	Meeting of ex-post evaluation ITTO Project PD 24/00 Rev. 1(I) (Maruay Garden Hotel, BKK)	OK
Study tour to Bamboo project site from 6-9 February 2007			
6 February Tuesday	6:30	Leave Maruay Garden Hotel, BKK	Left at 0530
	8:15 – 9:25	Leave for Chiangmai Province by plane (TG 102)	OK
	09:30 - 16:00	Visit Demonstration plot and Mae-Mae Women's Bamboo Handicraft Group in Mae Mae Forest Community, Chiangdao District, Chiangmai Province. (Chiangdao Inn, Chiangmai Province)	OK
7 February Wednesday	08:30 14:30	Visit Chiangmai Forest Products Research Center and Bamboo Group	OK
	14:30 – 16:30	Back to Chiangmai International Airport	OK
	17:25 – 18:35	Leave for BKK (TG 115) (Maruay Garden Hotel, BKK)	OK
8 February Thursday	08:00	Leave for Nakhonrachasima Province by van	OK
	10:00	Arrive at Nakhonrachasima Forest Products Research Center, Klangdong District	OK
	10:00 – 16:00	Visit Demonstration plot and Extension of bamboo project	OK
	16:00	Leave for BKK (Maruay Garden Hotel, BKK)	OK
9 February Friday		Preparation of draft evaluation report at RFD. (Maruay Garden Hotel, BKK)	Conferred with Project Leaders, Pannee and Nuchanart

Study tour to Rattan project site from 10 and 12-13 February 2007			
10 February Saturday	05:30	Leave Maruay Garden Hotel, BKK for Domestic Airport	Left at 0500
	06:55-08:25	Leave for Songkhla Province by plane (TG 231) BKK-Hat-Yai -BKK	OK
	08:30	Arrive at Hat-Yai international airport	OK
	08:30-15:00	Visit rattan plantation at Hat-Yai district	OK
	15:00-16:00	Back to Hat-Yai international airport, Songkhla province	OK
	16:50-18:20	Leave for Bangkok (TG 240,) (Maruay Garden Hotel, BKK)	OK
11 February Sunday		Preparation of draft evaluation report. (Maruay Garden Hotel, BKK)	Also conferred with Ms. Wilawan of RFD on Resource Inventory of Rattan
12 February Monday	09:00-16:00	Visit a small rattan cooperative, which was established under the project at Baan Kumpangsan Moo 7, Jombung district, Ratchaburi Province by van. (Maruay Garden Hotel, BKK)	OK
13 February Tuesday	04:45	Leave for Domestic Airport	Ok
	06:00- 07:30	Leave for Sakon Nakhon Province by plane (BKK-Sakon Nakhon ;, P.B. Air)	OK
	08:30-17:00	Visit rattan shoot Cultivation invested by farmer. Visit Rattan Shoot Cultivation and Rattan plantation at Non-Wood Forest Products Research Centre, Sakon Nakhon province	Ok
	20:30- 22:00	Leave for Bangkok (Sakon Nakhon-BKK ;, P.B. Air) (Maruay Garden Hotel, BKK)	Ok
14 February Wednesday		Preparation of draft evaluation report at RFD. (Maruay Garden Hotel, BKK)	Travelled to Bangsai Arts & Crafts Center, Ayutthaya province to confer with Trainor/Expert on Rattan Weaving and Furniture making
15 February Thursday	0900-1200	Discussions and preparation of complete report with ITTO Project PD 56/99 Rev. 1(I) and Project PD 24/00 Rev. 1(I) at RFD.	Wrap up discussions on evaluation of both projects
	14:00-17:15	Depart BKK for Manila (PR 731)	Delayed flight for 2 hours; Departed 1600; Arrived MLA 1915