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Project Completion Report

ITTO PD 100/01 Rev. 3 (I)

**Capacity building for the development of a sustainable
rattan sector in China based on plantation sources
(2003-2009)**



**International Centre for Bamboo and Rattan (ICBR)
State Forestry Administration
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Prof. Jiang Zehui
Project Director, PD 100/01 Rev. 3 (I)
& Director General, ICBR

LIST OF ACRONYMS

CAF	Chinese Academy of Forestry
CNY	Chinese Yuan (Renminbi)
EA	Executing Agency
ECTF	Experimental Center of Tropical Forestry of CAF
FAO	Food and Agriculture Organization of the United Nations
ICBR	International Centre for Bamboo and Rattan
INBAR	International Network for Bamboo and Rattan
ITTO	International Tropical Timber Organization
MOFCOM	Ministry of Commerce of the People's Republic of China
PD	Project Document, Project Director
PMO	Project Management Office
PRC	People's Republic of China
PSC	Project Steering Committee
PTC	Project Technical Committee
RITF	Research Institute of Tropical Forestry of CAF
SFA	State Forestry Administration of the People's Republic of China
SCAU	South China Agricultural University
WWF	World Wide Fund for Nature

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PART I: EXECUTIVE SUMMARY

1. Project context, origin and main problems intended to solve

There were some problems in rattan plantation management in tropical China, such as improper selection of forest tree species and/or coverage under which rattans are planted, untimely planting, improper rotation length, unsuitable intensity and methods of harvesting and improper post-harvesting management practices. All of these have resulted in a low benefit from the management of rattan plantations.

Illegal harvest of rattan canes in natural reserves is somewhat serious for some commercial rattan. Establishment and management of rattan plantations will reduce the dependence on natural resources and increase the effectiveness of the conservation of rattan resources.

Some forestry companies, foresters and farmers who are interested in planting rattans reckon that planting rattans may not yield a short-term economic return and thus do not want to invest in rattan plantation management. So, development of edible rattan plantations could be a solution to solve this problem.

2. Project objectives and implementation strategy

The specific objective of the project was to demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China. This was achieved by establishing different plantation management models, organization of training course and dissemination of technical manuals/packages.

Some minor adjustments were made to the implementation strategies. They included: 1) the intensively managed and high-yielding rattan plantation included two management models: pure plantations for edible shoots production by newly planting and transforming the old cane-producing plantation to shoot-producing plantation, and dual purpose managed plantations for cane and shoot production; 2) the three planned technical manuals were put together to form one manual that contained all the planned contents except the components of "tissue culture" and "products development and market" following the recommendation made by the Project Steering Committee and Project Technical Committee meetings, and that

techniques for extraction and analysis of bioactive components of rattan shoots and production of bottled shoots were added; 3) two more demonstrations of rattan plantation management in secondary forests were established in south subtropical and tropical regions in Guangdong and Hainan provinces, respectively; 4) the participation in the ASEAN rattan conference held in the Philippines was replaced by attending the Global Rattan Workshop held in Hainan, China; 5) the regional rattan workshop planned for Asia was extended to cover the global rattan sector.

3. Critical differences between planned and realized project implementation

By the completion of the project, four outputs planned in the project document were successfully completed. They are: 1) three demonstration plots established at six sites in three different ecological zones, 2) a farmer friendly technical manual consisting of the originally planned three technical manuals for rattan cultivation, management and harvesting, and rattan cane/shoot processing published in Chinese and distributed in the six project sites and used in some local forestry training courses, 3) an international workshop on sustainable development of the global rattan sector organized in July 2006 and attended by 48 participants of 23 institutions from 11 countries, and 4) three national training courses organized from May 2008 to January 2009, with a total number of trainees of 109, or 242% of the number originally planned in the Project document.

In addition, the following extra outputs were produced: 1) a project website namely www.chinarattan.org was established, 2) two post-doctorates successfully completed their researches on rattan cane properties in 2007 with support from the project, 3) one master degree student was successfully graduated in 2008 from the Chinese Academy of Forestry with involvement in the implementation of the project and study on techniques for storage of rattan shoots, 4) one master degree student was successfully graduated in 2009 from the College of Horticulture, South China Agricultural University with involvement in the implementation of the project and study on antioxidant activities of rattan plants, 5) participation in the organization of three international training workshops on bamboo and rattan sponsored by the Ministry of Commerce and Ministry of Science and Technology of China and organized by the Executing Agency and the

International Network for Bamboo and Rattan (INBAR) from 2006 to 2008, 6) a 20 minutes PPT containing the project results that has been used for promotion of rattan plantation development for edible shoots production in several local forestry extension meetings or training workshops, and 7) a master degree student is studying preservation of rattan shoots with technical and financial support from the project.

4. Situation prevailing after project completion

The local farmers, foresters and communities now really have more knowledge of cultivation, management, harvest and utilization of economically important rattan species through the implementation of the project, and those who had no interest in managing rattan plantations before the project commencement now have shown their interest in rattan plantation management for shoots production. The local rattan growers, specialized seedling-producing households and rattan companies did benefit with diversified management schemes such as seedling raising, management of rattan plantations for shoot production.

The forestry research and development institutions and government departments received several practical guidelines and technical packages for sustainable management and utilization of rattan, and more human resources engaged in rattan research and development.

Other tropical forestry related institutions and individuals around the world were also benefited from the participation in the international workshop organized by the project and referring to the technical reports produced by the project.

The demonstration plantations are managed well and used for the existing rattan R&D projects. Funding in rattan R&D projects from the governments at different levels is continued. The project sustainability can be secured in the foreseeable future.

5. Main project outcomes

The project specific objective was fully achieved through establishment of demonstrations and dissemination of technical packages (technical manual and training courses). The tangible outputs of the project included 1) 14 demonstration plantations of 4 rattan species at six project sites with a total area of 32.585ha, 2) around 550 copies of the "Manual of management and utilization techniques for rattan plantations in China" distributed during the national training course and

local governments organized "SciTech Weeks", 3) 109 local foresters and forest farmers trained, and 4) 48 participants of the international workshop from 23 institutions of 11 countries across the world and a workshop proceedings of paper abstracts and a CD-ROM containing all the presentations.

From the provincial governments in southern China to the central government, more policy favors are given to the rattan sector development. More R&D projects are being funded by the governments and forest companies, and more people are engaged in R&D activities of the sector.

6. Lessons learned and recommendations

Lessons learned from project implementation included: 1) no local communities and/or famers were involved in the project formulation process, though their participation during the course of project implementation was active and the cooperation between the different parties was great; 2) the project document did not have updated information on the proposed project sites; 3) there was a lack of socioeconomic studies in the project which could be crucial to a capacity building project; 4) the proposed project duration was too short taking into account raising rattan seedlings normally need a year or so; and 5) rattan plantation management for shoot production is an entirely new development to China and a national budget allocation is needed to establish more pilot projects in order to disseminate these technologies.

Recommendations made by the project included: 1) local communities and/or famers must be involved in the project formulation process; 2) a component of socioeconomic studies should be included in such a R&D project related closely to rural development; 3) the background information about the proposed project sites and cooperating institutions must be updated timely, or the implementation strategies be adjusted in time within the limits of the project framework; 4) more pilot projects are needed to test and verify, and demonstrate the newly developed technologies to ensure the long-term sustainability of the sector concerned.

PART II: MAIN TEXT

1. Project Identification

1.1 Context

The following texts were excerpted from the project document of PD 100/01 Rev. 3(I).

1) Compliance with ITTA 1994 Objectives

The project mainly complies with two objectives, established in Chapter 1, Article 1 of the International Tropical Timber Agreement, 1994:

Objective (c): To contribute to the process of sustainable development.

Objective (f): To 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 forests.

The on-farm demonstration and training on sustainable management and utilization technologies for rattans that are inter-planted in timber producing forests will improve forest management and the efficiency of utilization of forest resources. The sustainable management and utilization of rattans, the most important NTFPs in tropical China, will undoubtedly contribute to the sustainable development of the forestry sector in this region.

2) Compliance with ITTO Action Plan

The project meets the basic priorities of ITTO LIBREVILLE ACTION PLAN (1998 - 2001); in particular it meets the priorities in the field of reforestation and forest management as follows:

Goal 1: Promote increased and further processing of tropical timber from sustainable sources.

Action 2: Commission and publish analytical studies that identify critical knowledge and information; and Action 3: Assist in the promotion and transfer of new and/or improved techniques and technologies.

The project will publish technical manuals for sustainable management of rattan plantations and set up models for multiple-use of forest resources in co-operation with local foresters and farmers in forest areas.

Action 5: Assist human resource development and institutional

strengthening by designing and conducting regional and international events such as specialist workshop and seminars and by the provision of fellowships; and

Action 6: Encourage and assist Members, as appropriate, to - organize workshops/ seminars on the use of new and/improved techniques, technology and the development, testing and adoption of guidelines.

The project will organize three training workshops on sustainable rattan management and many other relevant new and/or improved technologies to enhance the technical and human capacities to manage tropical forests of which rattans are a main component.

Also, this project is relevant to the following sectoral policies and programs.

(1) Establishment and expansion of natural reserves: 11% of the nation's territory is classified as natural reserves. Most rattan resources are distributed within those reserves, limiting the production of rattan canes in the country.

(2) Natural Forest Conservation Program (NFCP): A nation-wide natural forest conservation program was officially commenced in 1998 and logging of natural forests has not since been permitted. The natural forests in the upper reaches of the Yangtze River, the most important rattan cane producing areas in China, are within these conserved forests.

(3) Western China Development Strategy: The national strategy developing western China encourages action plans that will benefit the social and economic development of western China.

(4) Establishment of the International Centre for Bamboo and Rattan (ICBR). Directly affiliated to the State Forestry Administration (SFA), ICBR was established in July, 2000 as a non-profit research and development organization dedicated to carry out research and development projects on conservation, cultivation and management of bamboo and rattan resources, as well as its utilization.

(5) The conservation of rattan germplasm and improvement of rattan resources have been listed as one of the national key research and development programs in the "Tenth Five-Year Plan".

(6) The selection and improvement of planting materials for western China is also a key research area set up in the SFA's "Tenth Five-Year Plan".

1.2 Origin and problem

It is estimated that the demand for rattan canes for processing and manufacturing industries in China is 40,000-50,000 tons annually. However, the total annual yield of rattan canes is less than 10,000 tons. Since the late 1990s, most rattan producing countries in Asia have restricted the export of rattan canes. As a result, China has suffered from a shortage of raw materials for processing and manufacturing of rattan products. There exists an urgent need for China to develop its own rattan plantations on a large scale to increase the availability of rattan canes. A preliminary study showed that about 2 million ha of tropical forest plantations and secondary forests are suitable for inter-planting rattans in tropical China.

With emphasis on taxonomy, germplasm collection, resources inventory, nursery techniques, tissue culture, plantation management, properties of rattan canes and nutrition contents of rattan shoots, research on rattans in the past in China has been comprehensive and fruitful. It is now the right time to apply these research results to contribute to the development of rattan plantations in China.

There were some problems in rattan plantation management in tropical China, such as improper selection of forest tree species under which rattans are planted, selection of unsuitable forest tree coverage, untimely planting, improper rotation length, unsuitable intensity and methods of harvesting and improper post-harvesting management practices. All of these have resulted in a low benefit from the management of rattan plantations.

In the mountainous areas of south China's Guangxi province, the local foresters and farmers did not know which rattan species can be planted in the vast secondary forests and in some forest plantations. The past planting trials with *Daemonorops margaritae* in secondary forests in this province revealed that *D. margaritae* can grow up to 3 meters annually and showed great promise for plantation management. It was worth selecting as plantation species in these areas.

Some forestry companies, foresters and farmers who are interested in planting rattans reckon that planting rattans may not yield a short-term economic return and thus do not want to invest in rattan plantation management. So, development of edible rattan plantations could be a solution to solve this problem.

Illegal harvest of rattan canes in natural reserves is somewhat serious for

some commercial rattan species such as *C. simplicifolius*, *D. margaritae*, *C. yunnanensis*, etc. This illegal harvest has meant most of the species are not able to grow up to the minimum length for fruiting, which has limited the natural regeneration of these commercial species. Establishment and management of rattan plantations will reduce the dependence on natural resources and increase the effectiveness of the conservation of rattan resources.

2. Project objectives and implementation strategy

2.1 Project objectives

The development of the project is to support capacity building for sustainable rattan development in China in order to increase the social and economic contributions of the rattan sector to the country. This is accomplished through demonstrating different rattan plantation management schemes, and disseminating technologies for sustainable management of rattan plantations.

The specific objective of the project is to demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China.

No adjustment was made the specific objective in the course of the implementation phase.

2.2 Implementation strategy

The project design is based on the need to develop and disseminate appropriate technologies for management and utilization of rattans in order to expand rattan plantation management practices. This need has been identified through recent investigations into the areas in southern China where scattered rattan plantations are distributed, and in-depth reviews of the status of development and application of technologies for cultivation and plantation management of rattans during the past 30 years. It is realized that rattan cultivation and plantation management technologies are well studied in China. However, there have long been problems in integrating these technologies and applying them to the production practices.

As mentioned in section 1.2 (Problems to be addressed), the natural and socioeconomic situations of areas that are suitable for rattan plantation management in tropical China vary from one region to another. Accordingly, this

project planned to organize three training courses to overcome the general lack of knowledge of the local people on cultivation, management and utilization of rattans, set up three demonstration plots of rattan plantation management, organize national training courses and study tours, and participate in regional/international workshops on rattans as follows:

1) Establishment of three demonstration plots.

a) *Intensively managed and high-yielding rattan plantation (plot 1)*

High yields with short rotation lengths are the major concern in forestry development in the southern coastal areas of Guangdong, Fujian and Guangxi provinces where the economy is comparatively well developed, and the strategy of "high input-high output" is usually adopted in forest plantation management. The demonstration plot in these areas will bring together all the intensive management techniques developed during previous cultivation studies, with the establishment of an irrigation system in order to make possible the expected high-yield with reduced rotation length.

During the course of project implementation, this demonstration was represented by establishing edible rattan plantations with employment of all the intensive management techniques developed during the previous cultivation studies, and new studies on management techniques for edible rattan plantation management. The new studies included: (1) a spacing trial, a fertilization trial and an irrigation trial for *D. margaritae* in full sunlight, two family tests of *D. margaritae* and *Calamus simplicifolius* and one family test of *C. nambariensis* var. *xishuangbannaensis* Inter-planted with *Eucalyptus urophylla* tree seedlings; (2) a transformation of a 14-year old *Calamus tetradactylus* plantation under 24-year old *G. arborea* plantation from cane production to shoot production; (3) a newly established *D. margaritae* plantation demonstrating dual management purposes for shoots and canes production under a 24-year old *Gmelina arborea* plantation; and (4) a 2.7ha of *D. margaritae* plantation and a 1.3 ha of *C. viminalis* plantation interplanted in an avocado plantation.

Harvesting trial, analysis of nutrient contents and bio-active elements of shoots, storage and preservation of shoots and processing of bottled shoots were also conducted during the project implementation. The later

five research components were additions to the project document.

b) Rattan plantation management in secondary forests in mountainous limestone areas (plot 2)

It is estimated that about half of the areas suitable for rattan planting are distributed in the mountainous limestone areas of south and southwestern Guangxi province and the southern part of Yunnan province. These areas are largely covered with natural secondary forests and forest plantation management is less developed as very few tree species are suitable for planting/cultivation. Occupied by more than one third of the country's minorities, these areas have been the target areas of the Nationwide "Aid-the-Poor" Project. The selection of these areas as one of the project areas will provide the local people with alternatives for generating incomes through the management of rattan plantations.

One or two commercial species selected for this demonstration could be intercropped in strips in secondary forest. Rattan plants were planted in double lines at spacings of 3m x 3m inside the planting strips 5m wide and separated by an intermission strip 4 m wide. Large trees and trees with high commercial value in the planting strips were kept at the sites for shade and to offer support to the rattans.

During the project implementation, the demonstration on rattan plantation management in secondary forests in mountainous limestone areas was conducted as planned. In addition, two more demonstration trials were established: one in a secondary forest of south subtropical region and another in a natural secondary forest, an acacia plantation and pine plantation in tropical region. The later included two trials: a trial of tree canopy adjustment in the natural secondary forest and a trial of additional fertilization in the natural forest and the two plantations.

c) Sustainably harvested rattan plantation (Plot 3)

One of the existing problems that jeopardize the sustainable management of rattan plantations in China is the "cutting all the canes at one time" practice, without further management measures such as tending and application of fertilizer after harvesting. This practice not only wastes a large amount of immature rattan canes, but also decreases the number of harvests during a given management period, resulting in low

benefits from the management of the rattan plantation. With the establishment of the demonstration plot, this project will demonstrate to the local people how rattan plantations can be sustainably harvested. The main purpose of this demonstration was to determine the impact of harvesting regimes technique on economic return of rattan plantation management.

This demonstration plot was established at the Experimental Center of Tropical Forestry (ECTF) of the Chinese Academy of Forestry (CAF) in Pingxiang City, Guangxi Province. Six to eight year old plantations of *D. margaritae*, *C. simplicifolius* and *C. tetradactylus* were used to produce meaningful results within three years during project implementation.

The harvest intervals were 3 years for *C. tetradactylus* and 4 years for *D. margaritae* and *C. simplicifolius*. The standards set for stems to be harvested are as follows: for *C. tetradactylus*, all stems longer than 4.0m were harvested, and for *D. margaritae* and *C. simplicifolius*, all stems longer than 5.0m were harvested. To secure a sustainable harvest, fertilizer was applied after harvesting at a rate of 1.0 kg of compound fertilizer plus 3.0 kg of manure per clump per year. The experiences learned from Malaysia and Indonesia through study tours were considered in the establishment and maintenance of the demonstration plantations.

Moreover, as planned in the project document, three management manuals, one for each of the demonstration plantations, were proposed to publish and widely distribute in the project areas to make up for the insufficiency of the technology transfer and diffusion through demonstration and training.

In addition to the above, under this project component, we conducted a socioeconomic study on rattan sector in Hainan Province, carried out studies on growth performance of rattan plantations in Guangxi Province, supported three postgraduates to study the techniques for storage and preservation of rattan shoots, as well as bioactivities of rattan shoots in Guangdong, and supported two postdoctoral researchers to study the rattan cane properties in Beijing.

2) Study tours to Malaysia, Indonesia and Thailand, and participation in ASEAN regional rattan conference.

Among the rattan growing countries, Malaysia is the first country to establish large-scale commercial rattan plantations of the commercially important species in SE Asia, since 1980 in Sabah. It has the largest area of commercial rattan plantations, especially of the plantations of *Calamus manan* which is considered by many to be the best large-diameter cane, established under natural forests and rubber plantations in Sabah and Sarawak as well as in Peninsular Malaysia. Those rattan plantations have played an important role in the supply of raw materials for the development of rattan industry in Malaysia. The study tour to Malaysia could help the project staff improve their knowledge of cultivation and management of rattan plantations. The visiting group was proposed to have four members (the Project Director, Assistant project director, and two key staff members from two participating institutions). The proposed areas/ organization of visit included: Forest Research Centre of Sabah, Sabah Foundation (Innoprise Corporation Sendiran Berhad), and the Forest Research Institute of Malaysia. The study tour was planned to last for four days. The Project Director did not join the tour due to an agent engagement, and the tour consisted of three project key staffs and lasted for 6 days.

Indonesia has long been well known as the biggest rattan exporting country in the world. It is reported that rattan contributes 6.5 % of the revenue coming from forestry product industry in Indonesia as well as ~80% of rattan global market. With ITTO's support, the Government of Indonesia is going to implement a project on development of production and utilization of rattan through participation of rattan small holders and industry (ITTO PPD108/01 Rev. 3(I)). A four-day study tour to Indonesia was proposed to visit the Directorate General of Land Rehabilitation and Social Forestry, the Ministry of Forestry and some ITTO funded project sites to help the three project members improve their knowledge of participatory management of rattan resources, harvesting, product design and diversification and marketing of Indonesian rattan industry. The actual tour lasted for 6 days.

Thailand has traditionally used rattan shoots as daily diet and rattan shoot has now become more popular dishes in Thailand, especially in the North and

Northeast parts. Recently, with the financial support from ITTO (ITTO PD24/00 Rev. 1 (I)), foresters in Thailand developed techniques for producing canned rattan shoots. Studies by Chinese scientists also indicated that some of the nutrient contents of rattan shoots are even higher and beneficial to human body than those of vegetables and fruits that had been used for producing canned healthcare foodstuffs/products. It was anticipated that with the support of the basic research results and of the proposed study tour to Thailand, the project could better benefit the local people in improving their knowledge of and techniques for using rattan shoots for producing foodstuffs in China. The visiting group was planned to have two project staff members (the Assistant Project Director and one key staff member from a participating institution) and to visit the Royal Forest Department, rattan shoot production and processing demonstration plots in Sakon Nakhon Province (Northeast Thailand) and rattan cane production and rattan weaving demonstration plots in Krabi Province (South Thailand), all the sites of the ITTO funded project "Promotion of sustainable utilization of rattan from plantation in Thailand (PD 024/00 REV.1 (I)). With an extension of 5 days, the three project staff members visited more places than the planned.

With the financial support from ITTO, the Forest Products Research and Development Institute of the Philippines implemented a Pre-Project (PPD 51/02) "Application of Production and Utilization Technologies for Rattan Sustainable Development in the ASEAN Member Countries" in 2002-2003. Under this Pre-project, An ASEAN Regional Conference on Rattan Sustainable Development was planned to be organized in the Philippines. We found that it is worthwhile for the project staff to attend this important event and to link this project to relevant activities being conducted in other Asian countries for information sharing and possible cooperation. Therefore this project planned to send two key staff members to participate at the conference. During the implementation of the project, this activity was replaced by attending an FAO/INBAR jointly organized global rattan workshop in Hainan Province of China.

3) Regional workshop/seminar on rattan for Asia

A 7-day regional workshop/seminar on rattan for Asia was proposed in the second calendar year of the project in Guangzhou with field visits to rattan

products processing companies in Guangzhou and rattan plantations in Hainan or in Guangxi provinces to provide an interactive platform for participants to review progress on issues related to R&D of rattan sector in Asia and to discuss future directions and strategies for the new millennium. Twenty participants (10 from China and 10 from Asian countries) were planned to participate in this workshop/seminar. The attendance of a wide range of audience could provide many networking opportunities for the exchange of views and ideas.

During the project implantation, the geographical area of the workshop was expanded from the Asian region to the globe, and venue was changed and the number of participants largely increased.

4) Organization of national training courses

Three training courses were proposed by the project, one on rattan tissue culture and nursery technologies, one on silviculture, plantation management and cane/shoot harvesting and processing, and one on products development and marketing for rattans.

During the course of project implementation, the components of tissue culture, products development and marketing were eliminated according to the suggestions made by the Project Steering Committee and Project Technical Committee meetings, and some aspects such as natural resources management, extraction of bioactive elements of rattan shoots and their potential uses were added in the training course texts.

The originally conceptualized and adjusted implementation strategies of the project are summarized as bellow (Table 1).

2.3 Identified assumptions and risks

The main assumptions and risks identified in the project formulation process included non-cooperation of local governments and farmers in the establishment of demonstration plots and the conduct of training courses, unavailability of rattan seeds and qualified consultants, and low growth rates of test species, etc.

Table1 The originally conceptualized and adjusted project implementation strategies

Project components	Conceptualized strategy	Adjusted strategy
<p>1. Establishment of three demonstration plots</p> <p>a) Intensively managed and high-yielding rattan plantation (plot 1)</p> <p>b) Rattan plantation management in secondary forests in mountainous limestone areas (plot 2)</p> <p>c) Formulation and distribution of management manuals</p>	<p>1) An edible rattan plantation at one site with three trials of spacing, fertilization and irrigation</p> <p>1) One plantation established at in mountainous limestone areas</p> <p>1) Three manuals covering all common technologies for rattan plantation management</p>	<p>1) Three edible rattan plantations at three sites, one with three trials of spacing, fertilization and irrigation; two with fertilization trial only</p> <p>2) Two family tests for three species for edible rattan planting</p> <p>3) A transformation of an old rattan plantation from cane producing to shoot producing</p> <p>4) Two edible rattan plantations intercropped with a tree and a fruit species, respectively at two sites</p> <p>5) Supporting postgraduate and postdoctoral studies</p> <p>1) Three plantations established in secondary forests at three sites, one in mountainous limestone area, one in south subtropical region and one in tropical region, the later consisted of two trials: tree canopy adjustment and additional fertilization</p> <p>1) Three manuals were combined into one manual without changes in contents proposed</p>
<p>2. Study tours to Malaysia, Indonesia and Thailand, and participation in ASEAN regional rattan conference</p> <p>a) Study tours</p>	<p>1) Three tours covering 12 days and having 9 visitors</p>	<p>1) Three tours covered 23 days and had 10 visitors</p>

Project components	Conceptualized strategy	Adjusted strategy
b) Participation in ASEAN conference	1) Two project staff members participated without presentation	1) Replaced by attending a global rattan workshop due to SARS hit 2) Ten people attended the workshop and 5 presentations made
3. Regional workshop on rattan for Asia 1) Organization b) Publication	1) A 7-day workshop having 15 participants from Asian countries 1) Abstract proceedings published	1) A 5-day workshop for the globe attended by 48 participants from 10 countries across the world 1) Abstract proceedings published and disseminated before the workshop was convened
4. Organization of training courses a) Course texts b) Organization	1) Included tissue culture and marketing components 1) Three courses proposed in Guangxi, Guangdong and Hainan provinces 2) 45 participants in total	1) Tissue culture and marketing components eliminated following recommendations made by PSC and PTC 1) One organized in Guangxi and two in Guangdong 2) 109 participants attended

3. Project Performance

3.1 Specific objective

The specific objective of the project, in fact, is two-fold: 1) to demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and 2) to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China.

The sustainable management techniques for rattan plantations had been demonstrated through the establishment of three demonstrations at six sites in three different ecological zones (Hainan, tropical area; Guangdong, south-subtropical area; Guangxi, subtropical limestone area) in South China.

The guidance and training on rattan plantation management had been

provided to farmers and foresters at local communities in South China through organization of three national training courses, on-farm training while raising seedlings and establishing plantations, and dissemination of technical manual and training materials and/or technical papers in the projects areas and other regions while taking part in "SciTech Weeks" organized by local governments.

3.2 Outputs and related activities

The four outputs planned in the project document were successfully achieved and presented bellow with briefing the main activities and adjustments made during the course of project implementation.

1) Output 1: Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.

The main activities relevant to this output were: 1) establishment of three demonstration plots - intensively managed and high-yielding rattan plantation (Plot 1), rattan plantation management in secondary forests in mountainous limestone areas (Plot 2) and sustainably harvested rattan plantation (Plot 3); 2) growth monitoring and harvesting (shoots and canes), 3) study tours to Malaysia, Indonesia and Thailand, and 4) participation at the ASEAN regional conference on rattan sustainable development held in the Philippines.

a) *Establishment of three demonstration plots (plantations)*

Plantation establishment employs a series of procedures or operations such as site selection, experimental design, field layout, raising seedlings, site preparation, application of base fertilizer and planting. Those activities were all completed in accordance with the study plans which were submitted to ITTO as annexes of the project progress report. Here presents the details of the three demonstration plots.

(1) Intensively managed and high-yielding rattan plantation (Plot 1)

As planned in the project document and the first Yearly Plan of Operation (YPO), this demonstration was represented by establishing edible rattan plantation with employment of all the intensive management techniques developed during previous cultivation studies. Irrigation systems were set up in order to make possible the

expected high-yield with reduced rotation length. This demonstration was originally planned to set up in the Nanhua State-owned Farm (NHSF) in Xuwen County of Guangdong Province. Unfortunately, NHSF stopped managing rattans in 2003; the EA had to spend a lot of time to find the replacement. Finally the Jiuwantan Forest Farm (JWTFF), Huadu District, Guangzhou City of Guangdong Province was selected as the project site for this demonstration.

In JWTFF, the following trials were conducted.

- Spacing trial: It was carried out in a randomized block design with 4 replicates. Three spacings of 1.0 X 1.0m, 1.0 X 0.5m and 0.5 X 0.5m were used and the plot size was 10.0 X 10.0 square meters. The test species was *D. margaritae*.
- Irrigation trial: This trial was to bring the trial plots under an irrigation system with an amount of water equal to 180mm of rainfall per month during the dry seasons. The test species was *D. margaritae* and the trial design was a randomized block design with 4 replicates. The trial treatments (frequency of watering) were: once a day (= 6mm of rainfall a day), twice a week (=21 mm of rainfall at a time), once a week (=42mm of rainfall at a time) and no watering as the control. The size of plot was 10.0 X 10.0 square meters, and the planting spacing was 1.0m X 1.0m.
- Fertilization trial: This trial had four treatments as follows: applications of 1) bio-fermented manure, 2) compound fertilizer of N, P and K, 3) combination of N, P and K fertilizers, 4) and non-fertilizing as the control. Fertilization was done once every three months. The dose of fertilizers applied per seedling at a time was calculated at a rate of 1.3g of N, 2.0g of P and 2.0g of K per seedling. The test species was *D. margaritae*, and this trial was conducted in a randomized block design with 4 replicates. The size of plot was 10.0 X 10.0 square meters, and the planting spacing was 1.0m X 1.0m.

The above trails were established in June 2004 in full sunlight. An irrigation system was set up at the same time. However the irrigation trial was terminated three months later as the seedlings in

non-irrigation trial plots tended to die.

The above trial plantations totaled 0.9 ha in area. An irrigation system with use of mountain spring water was set up for the above trial plantations.

- Family test: In May 2005, a family test for *D. margaritae*, *C. simplicifolius* and *C. nambariensis* var. *xishuangbannaensis* was established to determine the shoot productivity of different species and families. The test was also carried out in a randomized block design with 4 replicates, taking the individual families as the "trial treatments" (that is species were neglected). Inter-planted with *Eucalyptus urophylla* tree seedlings, the rattan seedlings were spaced at 1.0m X 1.0m. The total area of these trial plantations was 1.33 ha. It was a pity that the test was destroyed by mudslide caused by road construction in 2007.

Also in 2004, 2.6 ha of *D. margaritae* plantation demonstrating dual purpose management of rattan plantations for shoots and canes production were planted at a spacing of 2.0m x 1.0m under a 24-year old *Gmelina arborea* plantation was established at the Experimental Centre of Tropical Forestry (ECTF) of the Chinese Academy of Forestry (CAF), Pingxiang City of Guangxi Province. This was an extra trial. The reason why we added this trial was because when we planned the third demonstration (see detail below) we found in some *G. arborea* plantations trees were scattered and the plantation sites were relative flat. We thought it would be good for testing rattans for shoot and cane production.

At ECTF we also found a 14-year old *Calamus tetradactylus* plantation under 24-year old *G. arborea* plantation was abandoned because the small canes of *C. tetradactylus* were not profitable. So, we tried to transform 2.0 ha of *C. tetradactylus* plantation from cane production to shoot production by clear cut in April-May 2004. This trial again was not planned in the project document.

In response to the request from a private forest farm owner, the project also tried a small scale planting of *D. margaritae* in his farm called Longxiang Forest Farm (LXFF) located in Xiegang Town,

Dongguan City of Guangdong Province. In June 2004, the fertilization trial conducted at JWTF was duplicated at LXFF. No irrigation trial was conducted there as the farm had a well established irrigation system. In May 2005, a family test each for *D. margaritae* and *C. simplicifolius* was carried out at this site. The experimental designs were the same as those employed at JWTF. The total plantation area was 0.8 ha.

During the project extension period, in May 2007, 2.7ha of *D. margaritae* was interplanted at a spacing of 2.0m x 1.5m in a *Persea americana* (English name: avocado) plantation spaced at 6.0m x 8.0m, located in the Shadui Forest Farm (SDFF), Xinhui District, Jiangmen City of Guangdong Province. Only the bio-fertilizer applied in JWTF was used. In June 2008, seedlings of *C. viminalis*, a commercial edible rattan species that the project introduced from Thailand, were interplanted in the same avocado plantation at the same spacing and with the same fertilizer applied. The *C. viminalis* plantation occupied an area of 1.3ha.

(2) Rattan plantation management in secondary forests in mountainous limestone areas (Plot 2).

This demonstration plot was originally planned to set up at the Nonggang Nature Reserve (NGNR) in Longzhou County of Guangxi Province. However, when we visited NGR carrying out site selection we were informed that NGR had no plan for rattan plantation management. We found the only place that could be used as experimental site was the scientific research area of the reserve in which the dense tree canopy was not allowed to open up, that is, thinning of trees and/or shrubs is not permitted, which could not ensure the success of plantation establishment, and, the NGR authority showed little interest in establishing rattan plantations and active participation might not be expected.

Site selection was continued in Guangxi Province until May 2005 when a project site was selected in Fuqin Village of Pozao Town in Pingguo County under the supervision of the Forestry Bureau of Pingguo County (PGFB). Representing the limestone area in the

south subtropical region, this site belonged to the "village collective land", and was covered with shrubs and a few tree species. A digging-hole method was applied for site preparation and farm manure was used as base fertilizer at a rate of 1.0kg per plant. 2.0ha of *D. margaritae* plantation were established at a spacing of 3.0m x 3.0m to try the dual purpose management of rattan plantation for shoots and canes production. However, planting trial at this site was terminated because the new plantings were seriously damaged by domestic livestock.

In April 2006, another project site representing the limestone area in Guangxi was selected in Mingtang Village of Daxing Town, Du'an County under the supervision of the Forestry Bureau of Du'an County (DAFB). 3.0ha of *D. margaritae* plantation and 1.8ha of *D. jenkinsiana* were established without fixed spacing because the site was located in a hill being typically karst landform. The average planting density was 1000 seedlings per hectare. The site is covered with grasses, shrubs and a few tree species and bamboos.

Before the above two sites were set up, from 2003 to 2005, we established two related demonstration sites in Hainan and Guangdong provinces, representing rattan plantation management under tropical and south sub-tropical secondary forests, respectively.

In Hainan Province, we selected the Nanmeiling Forest Production Base (NFPB) in Baisha County as the project site. At this site, three trials were conducted which were described as follows.

- Establishment of rattan plantations in natural tropical secondary forest: A total of 10.0ha of plantations of *D. margaritae*, *C. simplicifolius* and *C. nambariensis* var. *xishuangbannaensis* were established in September-October 2003. The spacing adopted was 3.0m x 4.0m. An N-P-K compound fertilizer was applied at a rate of 100 kg per hectare.
- Experiment on additional fertilizer application: This experiment was carried out in a split-plot design with 4 kinds of fertilizers as the main plots and 3 rates of fertilizer application as the sub-plots (as shown in Table 2 below). There were 3 replicates in the

experiment and the plot size was 240 square meters.

Table 2 Fertilizers and rates of application in the fertilization experiment

Rates of fertilizer application (kg/ha)			
N	P ₂ O ₅	K ₂ O	Compound fertilizer of N, P &K
0	0	0	0
50	50	50	50
100	100	100	100

This experiment was set up in natural secondary forests and pine and acacia plantations in which *D. margaritae* was interplanted from 2001 to 2003. Additional fertilization was continued once year for three years (2003-2006) after weeding. The total area of the experimental was 2.592ha.

- Experiment on tree canopy adjustment: A randomized block design with 4 replicates was used in the experiment. The 4 treatments of canopy adjustment were to thin the forests to have 75%, 50% and 25% of coverage of tree canopy plus the original tree canopy. This experiment was only done in the natural forests with which *D. margaritae* was intercropped by NFPB in 2001 and 2002. The size of plot was 480 square meters. The total area is 1.536ha.

In Guangdong Province, we established a family test of *D. margaritae*, *C. simplicifolius* and *C. nambariensis* var. *xishuangbannaensis* under a secondary forest at JWTF. It could be treated as a rattan plantation management model in the south subtropical region. Seedlings were spaced at 3.0m x 3.0m with a total planting area of 2.0 ha.

(3) Sustainably harvested rattan plantation (Plot 3).

This demonstration plot is located at ECTF as planned in the project document. The harvesting of canes was started in early 2003. A 13-year old plantation of *D. margaritae* interplanted in a 20-year old *G. arborea* plantation and a 13-year old plantation of *C. simplicifolius* interplanted in 19-year old *Pinus massoniana* (mason pine) plantation were used as the demonstration plantations. The total area of the two

trial plantations was 0.027ha. These two plantations were ever harvested at ages of 5, 6, 7 and 8 years before the project commenced. The second harvesting by the project took place in early 2003 and the third in November-December 2006. After harvest, the length, fresh weight and air-dried weight of the harvested canes were recorded. As a result, a series of data on these parameters for combinations of rotation lengths of 5+8, 6+7, 7+6 and 8+5 years, and 5+11, 6+10, 7+9 and 8+8 years had been gathered. The third harvested canes were mainly used for study on cane properties to support two postdoctoral researches and to meet other projects' needs.

The second and third harvests produced some important extra outputs of the project. Dr. Yang Jinchang, one of the project's key staff members, used the results of the second harvest to complete part of his doctoral dissertation. Two postdoctoral fellows from CAF who joined the project in 2006-2007 completed their postdoctoral researches on rattan properties with technical, financial and material supports from the project.

In addition, in 2004 we also studied the effect of different planting densities on the growth performance of *D. margaritae* to see if planting density would affect the selection of rotation length. Comparison of the growth performance of *C. simplicifolius* plantations established with tissue cultured seedlings and seedlings was also carried out in order to find if the selection of tissue cultured seedlings for plantation management is economically feasible.

b) *Growth monitoring and harvesting of shoots and canes*

Survival rates were recorded for the newly established plantations, both for shoots and canes productions, three months after planting. Measurement of growth of seedlings was conducted in an interval of three months during the first year and then six months in the following years for edible shoot plantations; while for the other demonstration plantations, measurement of growth performance was done once a year.

Harvesting of canes of the ever-harvested, 13-year old plantations of *D. margaritae* and *C. simplicifolius* was firstly done in early 2003, before

the project commencement, while the second harvest was taken place in November-December 2006 (detailed in the above section *Establishment of three demonstration plots*). The harvested canes were not sold so that the economic return was unknown.

Harvesting of shoots of the newly established edible rattan plantations was started in JWTF in February 2006, 20 months after planting, when about 30% of seedlings had a length of stem of 30-40 cm and each mother plant produced at least one new shoot. A technical paper on this topic was presented at the ITTO/CAF jointed organized "International conference on sustainable development of non-timber forest products and services" held in September 2007 in Beijing, China.

Harvesting of shoots was continued in the following years. The harvested shoots were mainly used for analysis of nutrients, test of bio-activities and storage and preservation studies, in addition to the "consuming trials" which were conducted by inviting relevant people to taste the shoots. This resulted in another extra output of the project. One postgraduate successfully obtained her master degree from the Chinese Academy of Forestry with involvement of studies on storage techniques for rattan shoots in 2008, and another was successfully graduated from the College of Horticulture, South China Agricultural University with involvement of studies on bioactivities of rattan shoots in 2009. The third postgraduate is being studying preservation techniques for rattan shoots at CAF.

c) *Study tours to Malaysia, Indonesia and Thailand*

Study tours to Malaysia, Indonesia and Thailand were proposed to complete in the first calendar year (August 2003 - July 2004) of the project. However, as China was hit by SARS in 2003 and early 2004, and later on the relevant institutions and people to be visited had no time to help us organize the planned tours before January 2005, this activity had to be postponed until June 26, 2005 when the first tour to Thailand was made possible. Organization of these study tours lasted for one and half a year until October 2006 when the last tour to Indonesia was completed.

The study tour to Thailand was comprised of three project staff members and lasted for 9 days beginning on June 26, 2005. This made

the project staff members possible to visit not only the planned sites but also more places such as Baan Kumphangsaen in Jombung District of Ratchaburi Province where a successful community on furniture and weaving production was supported by ITTO, rattan demonstration plot and nursery at Songkhla Forest Experimental Station and *C. manan* plantation in natural forest at Tone Nga Chang Wildlife Sanctuary and raw rattan material processing factory and rattan production company at Angthong Province and Bang Sai Art and Craft Centre in Ayutthaya Province. This tour was more fruitful than expected. A report on the study tour was published at the project website and submitted to ITTO as Annex III of the fourth project progress report.

The study tour to Malaysia was consisted of three project staff members and lasted for 6 days and the members visited all the places proposed. A report on the study tour was published at the project website and submitted to ITTO as Annex IV of the sixth project progress report.

The study tour to Indonesia was comprised of four project staff members and lasted for 8 days and the members visited all the places proposed. A report on the study tour was published at the project website and submitted to ITTO as Annex III of the seventh project progress report. The Chinese version of the report was published in a bamboo and rattan specialized technical journal "World Bamboo and Rattan".

d) Participation in ASEAN regional rattan conference

With the financial support from ITTO, the ASEAN regional rattan conference entitled "Regional conference on sustainable development of rattan in Asia" was held on January 22-23, 2004 in the Philippines. Two staff members of this project were invited to attend the conference; however we could not participate in this important event because of SARS hit. The EA therefore requested ITTO to allow the project staff to participate in a rattan seminar in Malaysia planned by INBAR and FAO in May-June 2007 as a replacement, and then ITTO approved the EA's request. INBAR and FAO changed the date and venue of the seminar and ultimately organized it with the title of "Global Rattan Workshop" on January 8-11, 2008 in Haikou City, Hainan Province of China. The project sent ten participants to attend the workshop and made five presentations.

2) Output 2: Three technical manuals for rattan cultivation, management and harvesting, and rattan cane processing published.

The main activities included literature review and information search, formulation, publication and distribution of the manuals.

a) Literature review and information search

Lasted for around five years, this activity had been undertaken from the project commencement to the publication of the manual in May 2008, this made the project possible to include the results of the demonstrations.

During this period, the project organized a 5-day project technical committee (PTC) meeting (the second PTC meeting) in April 2005. One of the purposes of the meeting was to hear the suggestions and/or recommendations on the formulation of the manuals and the organization of the national training courses from the PTC members.

The PTC meeting recommended that 1) the "cultivation" and "management" aspects should be combined to form one manual, and the "harvesting" and "rattan cane processing" to form another; and 2) in consideration of the unbalanced development of rattan sectors in different provinces in South China, the national training courses should contain all technical aspects and be organized in different geographical areas with linkages to the key rattan development programs/projects in different provinces. Some PTC members further suggested that it would be more practical to put the three manuals together to make readers easy to learn and to avoid the possible increase of publication costs.

b) Formulation of the manual

Following the recommendations/suggestions made by the second PTC meeting and in consultation with the projects manager of ITTO, the planned three technical manuals were combined to form a manual containing all the information about rattan resources management and utilization based on the comprehensive literature review and the results of the three demonstrations - from status of resources, nursery operation, plantation management to harvesting and processing of canes and shoots. Thus, the manual had three parts (the equivalent of the three originally planned manuals): rattan seed technology and nursery operations, rattan

plantation establishment and management, and harvesting and processing of rattan canes and shoots.

The formulation task was conducted by key project staff members from the Chinese Academy of Forestry (CAF).

c) Publication and distribution of the manual

The manual was published in May 2008 and around 550 copies were distributed in all the project sites as planned plus some locally organized "SciTech weeks". It was well used as training materials in the project organized national training courses, and in some way in the international training workshops organized by the Executing Agency from 2006 to 2008.

3) Output 3: Three national training courses, one on rattan tissue culture and nursery technologies, one on silviculture, plantation management and cane/shoot harvesting and processing, and one on products development and marketing for rattans organized.

The main activities related to this output mainly involved employment of project consultants in the process of "course planning and formulation of course texts", preparation of training materials and organization of training courses.

a) Course planning and formulation of course texts

During the process of course planning and formulation of course texts, the project employed Dr. Lee Ying Fat of the Sabah Forest Research Centre, Malaysia as the international rattan management consultant for three months from April to June 2006. Dr. Lee visited to the project for two weeks in April 2006 to assist the project staff members in the identification of needs for training and preparation of the outlines of the technical manuals. He also worked with the project staff in Guangdong and Hainan provinces during his visit. He and the Assistant Project Director coauthored a paper entitled "A review of current research and development on rattan" which was presented during the "International workshop on sustainable development of the global rattan sector" held in July 2006 in Beijing.

The project also employed Dr. Wang Kanglin of the Kunming Institute of Botany, Chinese Academy of Sciences as the national counterpart of

the international for three months from April to June 2006. He also visited to the project for many times (totaled a month) during his service period to assist the project staff members in the identification of needs for training and preparation of the training course texts. The paper "Rattan resources and management in China" which he coauthored with the Assistant Project Director was presented during the "International workshop on sustainable development of the global rattan sector" held in July 2006 in Beijing.

The two consultants took their jobs as the project consultants during their annual leaves, which was in accord with the relevant ITTO guidelines.

According to the suggestions made by the second PTC meeting and by the projects manager of ITTO, which stated that 1) the "tissue culture" issue was so academic and complicated that for local farmers it might not be understandable and practical, and 2) the "market" issue was not a trainable issue; so they should be eliminated from the training texts. The EA further consulted with the project consultants and the later all agreed with those suggestions. As a result, the training texts contained the following contents: 1) a brief introduction to rattan resources, 2) seed technology and nursery operations, 3) plantation establishment and management, 4) harvesting and processing of rattan canes and shoots, 5) techniques for storage and preservation of rattan shoots, 6) techniques for development of shoot-based products (canned and dried shoots), and 7) techniques for determination of bioactive ingredients and their potential for utilization. These texts were represented by printed and electronic PowerPoint texts.

c) Organization of national training courses

Following the recommendations made by the second PTC meeting, the project organized three national training courses from May 2008 to January 2009. These courses were divided into two sessions: the in-door lecture session and the field visit. The number of trainees was 109, or 242% of the number originally planned in the Project document.

The first course was organized in Du'an and Pingxiang of Guangxi from 18-23 May, 2008 and attended by 42 trainees from three counties of

Du'an, Pingguo and Jingxi. The deputy county magistrate responsible for agriculture and forestry sector attended the opening session and delivered a welcome address and the county's TV station broadcasted the training course in its evening news of May 19.

The second course, with approval of ITTO projects manager, combined the two courses planned for Guangdong and Hainan as only two participants from Hainan were available for participation in the course. The second course was organized from June 29-July 4, 2008 in Huadu District of Guangzhou where the project site is located, and was attended by 23 trainees from 8 forestry extension stations in Guangzhou, Guangdong Province and one rattan company in Hainan Province, among them the VIP members included Mr. Cheng Liang, Deputy Director General of ICBR, Mr. Xie Zuozhang, Deputy Director of GMFA and Dr. Xu Daping, Director of RITF and Mr. Huang Jiming, Deputy Director of Forestry Bureau of Huadu District of Guangzhou.

In response to the request from the forestry authorities in the northern Guangdong where foresters wanted to try rattan planting for edible shoots production, the project organized a training course as before in Lechang city from February 12-15, 2009. The training course was attended by 44 trainees from different forest farms, divisions of the county's forestry bureau and its affiliated extension stations.

4) Output 4: One regional workshop/seminar on rattan cultivation, management, utilization and marketing for Asia held.

The main activities related to this output mainly included workshop announcement, collection of abstracts of presentations, editing and publishing of abstract proceedings and organization of the workshop.

a) *Workshop announcement*

The project made the first announcement and call for papers (English and Chinese versions) in April 2005. It was produced in hardcopy and in electronic copy which was published on the project's website. The first announcement attracted many people from different corners around the world and the 2nd PSC meeting accepted the EA's request for expanding the workshop geographical coverage from Asia to the globe. The second announcement, following the recommendation made by the 2nd PSC

meeting stating that “the title of the workshop should include key stakeholders such as ITTO, INBAR and ICBR”, was publicized in electronic copy only on the project’s website in December 2005 and then on INBAR, ITTO and ICBR websites in January 2006, which was then reproduced by some NTFP related research and development institutions’ websites and international donor agencies’ websites.

b) Collection of abstracts of presentations

With the publicizing of the 2nd announcement, the project received 19 papers/PPTs by the end of June 2007. By the time the workshop was organized, the project received two more papers from the Malaysian delegates.

c) Editing and publishing of abstract proceedings

Editing of the abstract proceedings was undertaken by Dr. Huang Shineng, Assistant Project Director and Dr. Lee Ying Fah, the Project’s International Consultant, and publication of the abstract proceedings was completed before the workshop was convened as planned in the project document.

d) Organization of the workshop

The workshop was proposed to be held in the second calendar year of the project in Guangzhou with field visits to rattan products processing companies in Guangzhou and rattan plantations in Hainan or in Guangxi provinces. It was also proposed to have 15 participants (5 from China and 10 from Asian countries). The first PSC meeting recommended the project to “seek the joint organization of the regional workshop/forum on sustainable development of rattan with INBAR”. INBAR and ICBR staff suggested that the workshop should be held in Beijing. The two announcements did attract a lot of rattan experts around the world and the project received more than 50 requests for financial supports. The workshop therefore extended its geographical coverage from Asia to the globe, and was successfully held at ICBR on July 23-27, 2006 and attended by 48 participants of 23 institutions from 10 countries of Asia, Africa and Latin America with the financial support from the project. A CD-ROM containing all the presentations was produced.

3.3 Schedule, starting date and duration of the project

The project's planned duration was three years starting from August 1, 2003. However, as some activities were delayed, the Executing Agency requested for a 2.5-year extension and the ITTO approved. The following were the project schedules.

The workplan was revised for the first time when it was sent to ITTO in July 2003 after the Project Agreement between ICBR and ITTO was signed on May 19, 2003 and June 10, 2003. The project was run effectively on August 1, 2003 and ICBR received the first installment of project funds on August 28, 2003. The project work carried out before the Agreement was signed showed that some amendments needed to be made to the planned locations of demonstration plots and to the scheduled activities in order to make the outplanting of rattan seedlings fit in with the planting season. The project workplan was revised for the first calendar year of the project, as shown in Table 3. Study tours and conference participation scheduled for the first calendar year were not completed in two years and some activities were delayed due to the untimely availability of project funds; the workplan had to be revised for the second and the third calendar year, as shown in Tables 4 and 5. The project requested for one year of extension and the associated workplan is shown in Table 6. Again, the conference participation was not completed during the first one year of extension period and the organization of training courses needed more data support from the demonstrations, the project was extended for one more year. The workplan for the second one-year extension is given in Table 7. As the EA needed some time to finalize the project completion report, technical reports and financial auditing report, the EA again requested for the other six months extension.

Table 3 The revised work breakdown structure and its monthly schedule for the first calendar year

Specific Objective:	Responsible Parties	Monthly Schedule												
		Jul 03	Aug	Sept	Oct	Nov	Dec	Jan 04	Feb	Mar	Apr	May	Jun	
To demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China.														
Output 1.1 Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.														
Activity 1.1.1 Site selection, experimental design and field layout (Plots 1 - 3)	ICBR, JWTF, ECTF & NFPB													
Activity 1.1.2 Raising seedlings (Plots 1 & 2)	JWTF, ECTF & NFPB													
Activity 1.1.3 Site preparation (Plots 1-3) and installation of irrigation system (Plot 1)	ECTF, JWTF & NFPB													
Activity 1.1.4 Plantation establishment (Plots 1 & 2)														
Activity 1.1.5 Growth monitoring (Plot 1-3) and harvesting of shoots (Plot 1)	ICBR, ECTF & JWTF													
Activity 1.1.6 Harvesting of rattan canes (Plot 3)	ICBR, ECTF													
Activity 1.1.7 Study tours to Malaysia, Indonesia and Thailand	ICBR													
Activity 1.1.8 Participation at the ASEAN rattan conference	ICBR													
Output 1.2 Three technical manuals for rattan cultivation, management and harvesting, and rattan cane processing published.														
Activity 1.2.1 Data collection and information search	ICBR													
Output 1.4 One regional workshop/seminar on rattan cultivation, management, utilization and marketing for Asia held.														
Activity 1.4.1 Announcement of the workshop/seminar	ICBR													

Note: ICBR-International Centre for Bamboo and Rattan; JWTF-Jiuwantan Forest Farm of Huadu District, Guangzhou; ECTF-Experimental Center of Tropical Forestry, CAF; NFPB-Nanmeiling Forest Production Base of Baisha County, Hainan Province.

Table 4 The revised work breakdown structure and its monthly schedule for the second calendar year

Specific Objective:	Responsible Parties	Monthly Schedule												
		Aug 04	Sept	Oct	Nov	Dec	Jan 05	Feb	Mar	Apr	May	Jun	Jul	
To demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China.														
Output 1.1 Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.														
Activity 1.1.5 Growth monitoring (Plot 1-3) and harvesting of shoots (Plot 1)	ICBR, JWTF, ECTF & NFPB													
Activity 1.1.6 Harvesting of rattan canes (Plot 3)	ECTF & ICBR													
Activity 1.1.7 Study tours to Thailand, Indonesia and Malaysia	ECTF, JWTF, NFPB & ICBR													
Output 1.2 Three technical manuals for rattan cultivation, management and harvesting, and rattan cane processing published.														
Activity 1.2.1 Data collection and information search	ICBR													
Activity 1.2.2 Formulation of the manuals	ICBR													
Output 1.3 Three national training courses, one on rattan tissue culture and nursery techniques, and one on cultivation, plantation management, cane and shoot harvesting, processing and marketing for rattans organized.														
Activity 1.3.1 Course planning and formulation of course texts	ICBR, consultants													
Activity 1.3.2 Selection of participants	ICBR													
Output 1.4 One regional workshop on rattan cultivation, management, utilization and marketing for Asia held.														
Activity 1.4.2 Collection of abstracts of presentations/posters...	ICBR													
Activity 1.4.3 Editing and publication of abstract proceedings	ICBR													
Activity 1.4.4 Organization of the workshop/seminar	ICBR													

Table 5 The revised work breakdown structure and its monthly schedule for the third calendar year

Specific Objective:	Responsible Parties	Monthly Schedule															
		Aug 05	Sept	Oct	Nov	Dec	Jan 06	Feb	Mar	Apr	May	Jun	Jul				
To demonstrate the sustainable management techniques for rattan plantations in three different ecological zones and to provide guidance and training on rattan plantation management for local farmers and foresters at local communities in south China.																	
Output 1.1 Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.																	
Activity 1.1.5 Growth monitoring and harvesting of shoots	ICBR, CAF, etc																
Activity 1.1.6 Harvesting of rattan canes	ICBR, CAF, etc																
Activity 1.1.7 Study tours to Thailand, Indonesia and Malaysia	ICBR, CAF, etc																
Output 1.2 Three technical manuals for rattan cultivation and management, and harvesting processing of rattan cane and shoot published.																	
Activity 1.2.1 Data collection and information search	ICBR, CAF, etc																
Activity 1.2.2 Formulation of the manuals	ICBR, CAF, etc																
Activity 1.2.3 Publication of manuals	ICBR, CAF, etc																
Output 1.3 Three national training courses, one on rattan tissue culture and nursery techniques, one on cultivation and management, and one....																	
Activity 1.3.1 Course planning and formulation of course texts	ICBR, consultants																
Activity 1.3.2 Selection of participants	ICBR, CAF, etc																
Activity 1.3.3 Organization of training courses	ICBR, CAF, etc																
Output 1.4 An international workshop on the global rattan sector held.																	
Activity 1.4.1 2 nd workshop announcement publicized	ICBR, CAF etc																
Activity 1.4.2 Collection of abstracts of presentations/posters...	ICBR, CAF etc																
Activity 1.4.3 Editing and publication of abstract proceedings	ICBR, CAF etc																
Activity 1.4.4 Organization of the workshop/seminar	ICBR, CAF etc																

Table 6 The proposed work breakdown structure and its monthly schedule for the first one-year extension

Outputs/Activities		Monthly schedule											
		Aug 06	Sept	Oct	Nov	Dec	Jan 07	Feb	Mar	Apr	May	Jun	Jul
Output 1.1 Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.													
Activity 1.1.5	Growth monitoring (Plot 1-3) and harvesting of shoots (Plot 1)												
Activity 1.1.6	Harvesting of rattan canes (Plot 3)												
Activity 1.1.7	Study tour to Malaysia, Indonesia and Thailand												
Activity 1.1.8	Participation in a rattan seminar to be organized by INBAR/FAO in Malaysia in May-June 2007.												
Output 1.2 Three technical manuals for rattan cultivation and management, and harvesting processing of rattan cane and shoot published.													
Activity 1.2.1	Data collection and information search												
Activity 1.2.2	Formulation of the manuals												
Activity 1.2.3	Publication of manuals												
Output 1.3 Three national training courses, one on rattan tissue culture and nursery techniques, one on cultivation and management, and one....													
Activity 1.3.1	Course planning and formulation of course texts												
Activity 1.3.2	Selection of participants												
Activity 1.3.3	Organization of training courses												
Output 1.4 An international workshop on the global rattan sector held													
Activity 1.4.3	Editing and publishing of workshop proceedings												

Table 7 The proposed work breakdown structure and its monthly schedule for the second one-year extension

Outputs/Activities		Monthly schedule					
		Aug 07	Sept 07	Oct 07	Nov 07	Dec 07	Jan 08
Output 1.1 Three demonstrations for the development and dissemination of sustainable rattan plantation and management techniques in three different ecological zones established.							
Activity 1.1.8	Participation in a rattan seminar to be organized by INBAR/FAO in Malaysia in May-June 2007.						
Output 1.2 Three technical manuals for rattan cultivation and management, and harvesting processing of rattan cane and shoot published.							
Activity 1.2.3	Publication of manuals						
Output 1.3 Three technical manuals for rattan cultivation, management and harvesting, and rattan cane processing published.							
Activity 1.3.2	Selection of participants						
Activity 1.3.3	Organization of training courses						
Output 1.4 An international workshop on the global rattan sector held							
Activity 1.4.3	Editing and publishing of workshop proceedings						
Management (recommended by the 4th PSC meeting)							
M 1	Preparation of a presentation for and participation in the NTFP conference to be jointly organized by ITTO and CAF in September 2007						
M 2	Preparation of a 15-20 minutes PPT on the outcomes of the project for dissemination at the ITTO session in May 2008						
M 3	Preparation of a completion report and the final financial audit report, in compliance with ITTO guidelines						

3.4 Total amount of expenditures and analysis of applied inputs

The planned overall costs were 983,582 US Dollars, of which the ITTO contribution was 504,369 US Dollars. The actual amount of expenditures, together with a total of 60,576.7 US Dollars of two counterpart funds provided by the Guangzhou Municipal Forestry Administration (GZMFA) and the continued in-kind contributions of 100,500 US Dollars equivalent from the Chinese government during the extended project period, was 1,044,158.7 US Dollars.

The inputs applied during the 5.5 years of project period were considerable. In addition to the planned project cost and personnel, the project received two counterpart funds from GZMFA as mentioned above and continued in-kind contributions from the Chinese government during the extended project period in terms of financial support. Regarding the human resources inputs, the EA employed several part-time scientists, engineers and technicians without payment of wages to conduct the related project activities. Among them the following were worth mentioning. Ms. Zheng Yi of RITF, and Dr. Wang Yurong and Dr. Lu Wenhua of Research Institute of Wood Industry of the Chinese Academy of Forestry, joined the project in September 2005. The former studied techniques for storage of rattan shoots towards her master degree and the later two conducted their post-doctoral researches on anatomy and property of rattan canes. Mr. Dai Honghai of ICBR's Department of International Cooperation, and Dr. Maxim Lobovikov, Ms. Wu Junqi, Ms. Jin Wei and Ms. Ren Hong of INBAR, worked for the project for a month in July 2006 to help organize the international workshop. Ms. Zhang Junjun of RITF joined the project in September 2007 to conduct research on preservation of rattan shoots for her master degree. Dr. Huang Xuemei and Mr. Niu Guocai of the College of Horticulture of South China Agricultural University joined the project in August 2008 to conduct studies on antioxidant activities and analysis of bio-active components of rattan shoots.

The establishment of the three demonstration plots at six project sites and organization of the three national training courses and the international workshop had been energetically supported by the central and local governments, official and cooperating institutions. The contribution of 1.2 million CNY from GZMFA to construct a short-cut road to and a three layer office building at the project site in JWTF, made the project much easier to implement the project activities.

4. Project Outcome, Target Beneficiaries Involvement

4.1 Extent of achievements of the project specific objective

The project specific objective was fully achieved through the establishment of

six project sites for the three demonstration plots in three different ecological zones (tropical, south subtropical region and subtropical limestone areas), organization of three national training courses and field guiding operations and distribution of a farmer-friendly technical manual containing easy-to-apply techniques for rattan plantation management.

4.2 Situation existing at project completion

1) Tangible outputs of the project

The tangible outputs of the project included 1) the existing 14 demonstration plantations of 4 rattan species at six project sites with a total area of 32.585ha, 2) the "Manual of management and utilization techniques for rattan plantations in China", 3) the 109 local foresters and forest farmers participated in the three training courses, and 4) the 48 participants from 23 institutions of 11 countries across the world, 5) a workshop proceedings of paper abstracts and a CD-ROM containing all the presentations, and 6) two master degree holders.

2) Sectoral policies and programs

At the national level, the National Special Fund for Introduction of Advanced Agricultural Science and Technology ("948 Program" for short) has been funding rattan related projects since 2000 such as "Introduction of high quality bamboo and rattan species and their advanced cultivation techniques to the limestone areas in south China (2004-2008)", "Technical innovation and demonstration for comprehensive utilization of introduced plant species in tropical China (2007-2008)", etc. The National Development and Reform Commission funded program "Engineering construction of germplasm pool for conservation of bamboo, rattan and flowering plant species (2001 up to now)" has been implementing. A national key R&D program of the "Eleventh Five Year Plan (2006-2010), "Development and demonstration of key technologies for cultivation, utilization and industrialization of bamboo and rattan resources (2006-2010)", is being undertaken. The research on management techniques

for pollution-free cultivation of rattan plantations for shoots production and storage of rattan shoots, a research subject initiated with the ITTO funding through this project, was listed as a major part of the program. The Standardization Administration of China (SAC) has funded two projects on formation of two national standards for rattans: "standard for terminology for rattans (2007)" and "standard for harvesting and treatment of seeds of major commercial rattan species (2007)".

At the ministerial level, the State Forestry Administration (SFA) has been treated bamboo and rattan as the most important non-timber forest products in national forestry development programs. Since 2000, SFA has been financing projects on formulation of ministerial standards for cultivation, management and utilization of rattans such as "technical procedure for harvesting of plantations of major commercial rattan species (2007)" and "standard for defects and classification of rattan canes and its derivatives (2007)". Also at the provincial level, the government of Guangdong Province, where rattan is one of the most important NTFPs, funded a project on formulation of a provincial standard for technical procedure for cultivation of major commercial rattan species and the standard was issued in 2008 as DB44/T 509-2008.

3) Situation of physical environment of the project

Although there was no activity planned for studying the relative influence of individual, social environmental and physical environmental determinants of the project, our experiences gained from the project implementation showed that the relationship of different stakeholders in rattan sector of China was further strengthened through the organization of PTC meetings and national training courses as well as dissemination of technical packages. As a result of the capacity building project, one of the tangible outputs is that the sector now has more activists, from the grass roots farmers to the high ranked research personnel, as compared to the pre-project situation.

Regarding the physical environment of the project sites, no harmful

influences were found but an increase in plant diversity was achieved with introduction of rattan species into the secondary forests, and a potential of income generation by managing edible rattan plantations is expected.

4.3 Target beneficiaries' participation and their uses of the project results

The attempt of the project to develop techniques for edible rattan plantation management did attract a number of farmers and rattan firms who expected a short-term income from managing rattan plantations. For example, the farmer who asked us to establish demonstration trial in his forest land (see section 3.2) had shared the edible rattan shoots he produced with his friends and relatives, and the forestry authorities in northern Guangdong asked us to organize the training course on rattan and wanted to try rattan planting for edible shoots production in their administrative areas.

The forestry workers, technicians and extension workers in and around the project sites were enthusiastic on the participation in the training courses, resulting in an increase by 142% in terms of the number of trainees as compared to the number planned in the project document.

The project staff members had been actively involved in the implementation of project activities, and the project did attract a number of foresters to run the project, and enlarge the rattan community in China. For instance, the two postgraduates and two post-doctoral research fellows who did nothing with rattan before are now doing rattan as their careers.

The government departments at different levels did get more basic information on rattan to support their policy-making for forestry development. The most obvious examples were that the central government listed the edible rattan research as a major part of national key R&D program in the "Eleventh Five-Year Plan", and the GZMFA has been funding the project to expand the planting of edible rattans since the project commencement.

The other tropical forestry related institutions and individuals were also active in participating in the project implementation. The numbers of international

participants of the project organized international workshop on rattan who asked for funding from the project were 50, or five times of the originally planned number in the project document. And finally the project funded 23 international participants to attend the workshop, with an increase by 130%.

Regarding the uses of the project results by the target beneficiaries, we have seen some potential. The forestry authorities in northern Guangdong asked us to provide them with rattan seedlings to try edible rattan planting. The Hainan Hongqi Rattan SciTech Co., Ltd who sent senior managers to attend the second training course on rattan is now planning to establish edible rattan plantations at a scale of 666 ha per year from 2009 and has employed the Assistant Project Director as their senior consultant. The WWF offices/projects in Laos and in Cambodia have contacted us for exploring the possibilities of cooperation in research on edible rattan cultivation and investigation into rattan shoot market.

4.4 Project sustainability

The rattan R&D is still a priority program in the Eleventh Five-Year Plan of China. The governments at different levels have been financing rattan R&D projects. The demonstration plantations established by the project are being managed well for production of canes and shoots, which are used for R&D purposes in the newly projects the EA and its cooperating institutions are conducting, and for production of seeds to meet the expansion of plantations to be established by local farmers and firms, such as the above mentioned Hainan Hongqi Rattan Science and Technology Co., Ltd. The project can be sustained in the foreseeable future.

5. **Assessment and analysis**

5.1 Analysis of the project rationale and identification process

The project aimed to support the capacity building of the rattan sector in China so as to promote the development and management of rattan plantation resources. It fully met the sector's needs taking into account more than 90% of the raw materials are based on importation from the neighboring countries. Analysis

of the sector's stakeholders showed that the stakeholders included six parties in the order of degree of attentiveness: the rattan growers (usually farmers and forest farms), the raw material collectors (local farmers and waged casual labors), the government departments (usually policy and decision makers), rattan-related R&D institutions, the traders (middlemen in rural markets, and importers and exporters in international markets), the furniture and other rattan-based products manufacturers and the end users. The later three did not care too much the development of rattan plantations. The analysis and identification of stakeholders were adequate.

The stakeholder participation of in the project formulation process was inadequate as no local farmers and communities (growers and harvesters) were involved in the process though some consultations with them occurred before the project formulation. Even so, the participation of local communities and farmers during the course of project implementation was active, and the cooperation between the different parties involved in the project was great.

5.2 Problem definition, project objectives and implementation strategy

The problem definition and the project objective were correct. The problems analyzed were the main ones existed before the project commenced. As a whole, the rattan sector in China remains having those problems in some way as the project did not cover all the rattan producing areas, and all the interests of the stakeholders. For example, Yunnan Province, one of the two most important rattan producing provinces in China, was not covered by the project, and the traders, furniture and other rattan-based products manufacturers and end users were not involved in the project implementation.

In general, the choice of the implementation strategies was correct. The unthoughtful aspects were that the involvement of tissue culture and marketing components in the proposed manuals, the selection of project sites without updated information of the proposed sites, and the lack of proposed socioeconomic studies. All those were considered during the project

implementation.

5.3 Critical differences between planned and actual project implementation

There were no critical differences between planned and actual project outputs, and all the proposed project activities were implemented. In order to successfully implement the project, some minor adjustments were made to the implementation strategies, and consequently more achievements were made than expected in the project document.

5.4 Evaluation on the (in)adequacy of time and project inputs

The proposed duration of three years was too short for the project as raising rattan seedlings normally needs a year or even longer. The financial and human power inputs became insufficient after the project duration was extended, the numbers of project sites increased and the research aspects added.

5.5 External influences and mitigating measures

The external influences that we anticipated and then realized during the course of project implementation were the unavailability of qualified consultants and untimely availability of cooperating institutions. We did not find retired and qualified candidates of consultants in the field of rattan R&D and then hired unretired consultants to do their jobs during their annual leaves as approved by ITTO. The untimely availability of international organizations to be visited caused the delay of project activities, the mitigating measures we took was to ask ITTO for project extension.

5.6 Participation of project beneficiaries

It can be said that the participation of target beneficiaries in the implementation of the project was more active than expected. 109 of grass roots farmers, forestry workers, technicians and extension workers, college students and government officials in and around the project sites had learned more knowledge of the development and management of rattan resources through participation in the three national training courses. Some of them had showed their interests in growing rattans, especially for edible shoots production. The

project staff members had learned the newly developed techniques for edible rattan plantation management. The rattan R&D in China now has more people's participation through degree education, technical and financial support to the postdoctoral researches, and employment of scientists from the non-rattan related institutions by the project.

The government departments at different levels really had more basic information on rattan to support their policy-making for forestry development. This can be seen from the increased number of rattan R&D projects in recent years.

Information exchanges in rattan R&D between the rattan-related institutions and individuals across the world had been achieved through the organization of the international workshop. It is no exaggeration to say that it's the first international workshop as it had participants from Latin America. The numbers of participants were more than two times the originally planned numbers.

5.7 Analysis of project sustainability

The rattan R&D is still a priority program in the Eleventh Five-Year Plan in China, and the EA is being funded by the Central Government to conduct a number R&D projects. Forestry R&D institutions in South China are also financed by local governments to conduct rattan R&D projects. Some forestry extension stations in Lechang City in northern Guangdong showed their interest in planting edible rattans and a small trial plantation will be established, and the third national training course was organized in January 2009. It seems that the project can be sustained in the foreseeable near future.

5.8 Roles and responsibilities of the involved institutions

There were ten institutions involved with the project implementation except those providing consultancy services. Those institutions had clear roles and responsibilities and division of labors as follows.

1) International Centre for Bamboo and Rattan (ICBR), Beijing: ICBR was the Executing Agency of the project and responsible for the overall project management, especially financial implementation and organization of the

international workshop and PSC meetings.

2) Research Institute of Tropical Forestry (RITF) of CAF, Guangzhou of Guangdong Province: RITF was responsible for the establishment of all demonstration plots, formulation of technical manual and training materials, project documentation and organization of national training courses and study tours as well as PSC and PTC meetings.

3) Experimental Center of Tropical Forestry (ECTF) of CAF, Pingxiang City of Guangxi Province: ECTF provided the forest sites for demonstrating the sustainably harvested rattan plantation and intensively managed and high-yielding rattan plantation, and maintained the demonstration plantations.

4) Jiuwantan Forest Farm (JWTF) of Huadu District, Guangzhou City of Guangdong Province: JWTF provided the forest sites for demonstrating the intensively managed and high-yielding edible rattan plantation and rattan plantation management in secondary forests in mountainous areas; maintained the demonstration plantations and assisted in the organization of the second national training courses.

5) Nanmeiling Forest Production Base (NFPB), Basha County of Hainan Province: NFPB provided the forest sites for demonstrating the rattan plantation management in tropical secondary forests, managed the rattan nursery, and maintained the demonstration plantations.

6) Longxiang Forest Farm (LXFF) of Xiegang Town of Dongguan City of Guangdong Province: LXFF is the only private forest farm who took initiative to ask the project to establish edible rattan plantations. It was responsible for plantation establishment, maintenances and harvesting of rattan shoots.

7) Pingguo Forestry Bureau (PGFB), Pingguo County of Guangxi Province: PGFB provided forest sites for demonstrating the rattan plantation management in secondary forests in mountainous limestone areas. The 2ha plantation was no longer treated as a project site a year after establishment due to the serious trampling by livestock.

8) Du'an Forestry Bureau (DAFB), Du'an County of Guangxi Province: DAFB

provided the forest sites for demonstrating the rattan plantation management in secondary forests in mountainous limestone areas, maintained the demonstration plantations and assisted in the organization of the first national training courses.

9) Shadui Forest Farm (SDFF) of Xinhui District, Jiangmen City of Guangdong Province: SDFF provided a project site of 4.2 ha for demonstrating edible rattan plantation management in fruit gardens.

10) Lechang Forestry Bureau (LCFB), Lechang City of Guangdong Province: LCFB assisted in the organization of the third national training courses.

However, no specialized emailing network was established for the project and no meeting was organized for gathering of all the involved institutions and individuals.

6. Lessons learned

6.1 Lessons learned from project identification and design

a) The development objective could only be attained in the project area. This project demonstrated different rattan plantation management schemes, and disseminated technologies for sustainable management of rattan plantations to support capacity building for sustainable rattan development in China. However, those goals cannot be realized by only implementing them in limited areas and in such a short time period. For example, Yunnan Province, one of the two most important rattan producing provinces in China, was not covered by the project.

b) In general, the analysis of problems existed in the rattan sector in China and stakeholder identification were appropriate. However, no local communities and/or farmers were involved in the project formulation process.

c) The project document did not give updated information on the proposed project sites. For example, the Nanhua State-owned Farm (NHSF) in Xuwen County of Guangdong Province, one of the proposed project sites selected for demonstrating intensively managed and high-yielding rattan plantation (Plot 1) stopped managing rattans when the project in 2003, another proposed project site - the Nonggang Nature Reserve (NGNR) in Longzhou County of Guangxi

Province selected for demonstrating rattan plantation management in secondary forests in mountainous limestone areas (Plot 2) - had no productive task, so the EA had to select other project sites during the course of implementation.

d) The project design and implementation strategy were generally rational. However, there was a lack of socioeconomic studies in the project proposal. Capacity building needs more knowledge of socioeconomic issues than technical background.

e) The proposed project duration was too short, taking into account raising rattan seedlings normally need a year or so. Some project activities were therefore delayed and the EA had to ask for extending the project period.

f) This project also developed new technologies for management of edible rattan plantations. Rattan plantation management for shoot production is an entirely new development to China and a national budget allocation is needed to establish more pilot projects in order to disseminate these technologies.

g) The project sustainability depends on the active involvement of different stakeholders. For this project itself, it seems possible to sustain it in the foreseeable future and the EA is conducting several rattan R&D projects and more and more R&D projects are being funded by governments at different levels. However, how to convince the manufacturers, traders and even end users to get involved in the investment in the development of rattan plantations remains a big challenge in the near future.

6.2 Operational lessons

1) Project organization and management

(1) The project had a Project Steering Committee (PSC) comprised of representatives of the Chinese Ministry of Commerce, the State Forestry Administration, INBAR, ITTO, ICBR and the Chinese Academy of Forestry (CAF) as well as the Project Director. The PSC members met once a year during the first four years to examine the annual budget, the Yearly Plan of Operation, project plans for extended periods and the activity reports. The

lessons we learned from the organization of the PSC meetings were that the PSC members could not be the same for every PSC meeting, which made them difficult to know all about the different periodic progresses of the project. Moreover, that three of the four PSC meetings were organized in Beijing also made the PSC members impossible to visit the project sites in South China (Hainan, Guangdong and Guangxi provinces).

(2) The project had a Project Technical Committee (PTC) consisted of project consultants, project director, assistant project director, director of the project management office, and several project key staff members. The PTC members met two times in 2003-2006 to review the technical achievements and to advise the subsequent project plans and activities.

(3) The project had a project management team comprised of project director, assistant project director, director of the project management office, financial officer and 2-3 key technical staff. However, as the head office was located at ICBR in Beijing, only a few project management team members could meet regularly to plan the work and review the progress, other team members in the three liaison offices at the three project sites in South China could only communicate with the head office staff by phones or emails.

2) Flow of funds

The funds provided by ITTO were transferred to ICBR, the Executing Agency in six instalments. ICBR allocated those funds to different implementing institutions based on the project activities. The in-kind contributions were directly made to the implementing institutions by the central and local governments of China. The project finance was implemented in accordance with the ITTO guidelines and generally accepted accounting principles.

3) Roles and responsibilities of the institutions involved in the project implementation

It was felt that communications with each other among the involved institutions and individuals were not unimpeded.

4) Project documentation

(1) The project prepared and published around 35 reports including project progress reports, field trip reports, study tour reports and technical reports and/or PowerPoint presentations to document the project results. Some technical papers are being prepared and to be gradually published.

(2) The project prepared a farmer friendly technical manual consisting of the originally planned three technical manuals for the use of training courses and distribution to local communities and forestry institutions in Hainan, Guangdong and Guangxi provinces.

(3) The project also produced a CD-ROM containing all the papers and PPT presentations of the international workshop.

5) Monitoring, evaluation and project planning

(1) The Project Technical Committee (PTC), comprised of at least one consultant (international or national), 2-3 national rattan experts and 2-3 project key technical staff members, monitored the project twice during the first three years.

(2) No evaluation was planned for the project.

6) External factors influencing the project implementation

(1) The proposed project cooperating institutions changed their management purposes and the project spent more time to find the replacements of project sites.

(2) Some project activities that needed external assistance were delayed as the institutions and individuals needed were not available as the project planned, or changed their work plans. The EA had to ask ITTO for extension to complete those activities.

(3) Communication with the international workshop participants from developing and less developed countries was a time consuming task. This resulted in a postponement of the workshop for more than a year.

7. Conclusions and Recommendations

7.1 Conclusions and recommendations

1) Identification

The project complied with the ITTA 1994 objectives and met the basic priorities of ITTO Libreville Action Plan (1998-2001). It was also relevant to several sectoral policies and programs in China as stated in the project document. It can be further proved that research and development of edible rattans the project initiated were listed in a national key R&D program of the "Eleventh Five-Year Plan" three years after the project commenced. The project obtained two counterpart funds from Guangzhou Municipal Forestry Administration who governed one of the project sites also further proved that the project was located during the project period. This can be understood that the project met the local forestry development needs.

At present, the large-scale management of rattan plantations in China seems unrealistic in state-owned forest farms; it had largely been replaced with small-scale plantings by rural farmers. So, any rattan R&D projects should meet the needs of the development of the local market economy and be well suited to the characteristics of the household management systems.

2) Design

Capacity building has been one of the pressing concerns in the development of rattan sector in China. The project was designated to solve this problem through on-farm demonstrations, technology diffusion through training and distribution of technical packages and development of new technologies. It also involved degree education and supported post-doctoral researches which could be regarded as a short-cut way to build the institutional capacity that helps facilitate development and foster long-term sustainability of the rattan sector.

In general, the project design was rational. It took into account the key problems that urgently needed solutions and the project successfully

achieved the planned objectives. However, it was a pity that the project had not the component of socioeconomic studies. We therefore recommended a socioeconomic study be included in any R&D projects relating to the rural development.

3) Implementation

The project was implemented smoothly. The implementation strategies were adjusted in time according to the reality the project experienced. The cooperation with the local forestry authorities and rural farmers and communities is closely and friendly. Supports from the governments at different levels had been energetically during the course of project implementation.

The project made more achievements as compared to those planned in the project document. The most outstanding achievement was the human resources development. Ten institutions got involved in the project implementation. The numbers of trainees of the national training courses and participants of the international workshop were over 2 times bigger than the originally planned numbers. Two doctor degree holders and one master degree holder were involved in rattan research and development and one postgraduate is conducting rattan research towards a higher degree. The rattan research and development institutions and individuals were further empowered after the project completion.

The environmental conditions of a project may change any time after commencement, it is important for project managers to adjust the implementation strategies in time to ensure the success of the project implementation.

4) Organization

The project had a good organizational structure. It was led by a Project Director under the overall supervision of the Project Steering Committee and implemented by project staff members in different implementing institutions and in close cooperation with local forestry authorities. Based on our lessons

learned, a stable make-up of the PSC and project team members is needed.

5) Management

The project coordination and management were excellent taking into account more than ten cooperating institutions were involved in the project implementation. All the management activities were conducted in accordance with the Project Agreement, ITTO Guidelines and the generally accepted management regulations for R&D projects of China.

7.2 Comments on the potential for replication and for scaling up

There exist potentials for replication and scaling up of the project. A similar project should be designed for Yunnan Province, one of the two most important rattan producing provinces in China, and/or elsewhere in Asia where appropriate. More pilot projects are needed to scale up the project and further test and verify and demonstrate the newly developed technologies for edible rattan plantation management in South China.

8. Responsible for the Report

Name: Jiang Zehui

Position held: Project Director

Signature:

Date: April 30, 2009

Annex 1 Project financial statement

Project Financial Statement (ITTO's contribution, in US\$)

Project No: PD 100/01 Rev. 3 (I)

Period ending on: January 31, 2009

Project title: Capacity building for the development of a sustainable rattan sector in China based on plantation sources

Components	Approved total	Up-to-date committed by E. A. but not spent	Up-to-date spent	Spent + committed in period	Remaining value	Explanation of remaining values
	(A)	(B)	(C)	(D) (B+C)	(A)-(B+C)	
10. Project personnel	107,600	5,720.25	101,879.75	107,600.00	0	
20. Sub-contracts	52,000	13,559.77	38,440.23	52,000.00	0	
30. Duty Travel	150,640	-26,281.37	176,921.37	150,640.00	0	
40. Capital Items	80,200	10,633.91	69,566.09	80,200.00	0	
50. Consumable Items	47,780	-21,423.05	69,203.05	47,780.00	0	
60. Miscellaneous	22,600	-4,336.91	26,936.91	22,600.00	0	
80. ITTO Monitoring, evaluation and administration cost	43,549				43,549.00	
90. Re-fund of pre-project costs	--					
100. Grand total	504,369	-22,127.40	482,947.40	460,820.00	43,549.00	

Annex 2 Project Cash Flow Statement

Project Cash Flow Statement (ITTO's contribution)

Project No: PD 100/01 Rev. 3 (I)

Period ending on: January 31, 2009

Project title: Capacity building for the development of a sustainable rattan sector in China based on plantation sources

Components	Reference	Date	Amount	
			In US\$	Local currency
A. Funds received from ITTO				
a) 1st installment 1USD=8.264 RMB	29	2003.08.27	70,000.00	578,508.00
b) 2nd installment 1USD=8.2644 RMB		2005.05.	70,000.00	578,508.00
c) 3rd installment 1USD=8.2644 RMB		2005.05	80,000.00	661,152.00
d) 4th installment 1USD=7.796 RMB		2006.07	80,000.00	623,680.00
e) 5th installment 1USD=7.796 RMB		2006.07	80,000.00	623,680.00
f) 6th installment 1USD=7.031RMB		2008.03	80,820.00	568,245.42
Total funds received:			460,820.00	3,633,746.42
B. Expenditures by Executing Agency				
10. Project personnel				
11. International consultants			12,100.00	92,371.60
13. National experts			13,125.00	155,696.40
14. Casual labors			76,654.75	593,000.00
19. Component total			101,879.75	841,068.00
20. Sub-contracts				
21. Setting up irrigation system			11,000.00	90,908.40
22. Publishing manuals			11,378.18	80,000.00
23. Publishing proceedings			9,158.64	65,000.00
24. Workshop/seminar room			6,903.41	55,000.00
29. Component total			38,440.23	290,908.40

Components	Reference	Date	Amount	
			In US\$	Local currency
30. Duty Travel				
31. International travels				
311. DSA			27,935.00	223,479.90
312. Transportation			38,683.01	307,300.00
32. Domestic travels				
321. DSA1 (training, field trips)			41,873.48	319,370.00
322. DSA2 (PSCM, Seminar)			3,078.27	23,580.00
323. Transportation			65,351.61	503,040.00
39. Component total			176,921.37	1,496,769.90
40. Capital Items				
41. Farm tools			1,800.00	14,691.52
42. Disinfectant			8,415.84	68,000.00
43. Digital projector			9,350.25	75,550.00
44. OA equipment (PCs, etc.)			20,000.00	165,288.00
45. Vehicles (for on-site use)			30,000.00	235,541.60
49. Component total			69,566.09	559,071.12
50. Consumable Items				
51. Fertilizers			43,015.70	345,000.00
52. Fuels and utilities			26,187.35	173,000.00
59. Component total			69,203.05	518,000.00
60. Miscellaneous				
61. Office supplies			14,150.19	109,600.00
62. Auditing			6,000.00	49,586.40
63. Sundry			6,786.72	52,831.88
69. Component total			26,936.91	312,018.28

Components	Reference	Date	Amount	
			In US\$	Local currency
80. ITTO Monitoring, evaluation and administration cost				
81. ITTO Monitoring and Evaluation				
82. ITTO Administration cost				
89. Component total				
Total expenditures to-date			482,947.40	4,017,835.70
Remaining balance of funds (A-B)			-22,112.40	-384,089.28

Note:

- 1) Expenditures in US Dollars were converted on the basis of the changed exchange rates from 1USD=8.2644CNY in August 1, 2003 when the first installment of funds was received to 1USD=7.031CNY in March 2008 when the final installment of funds was received by the EA.
- 2) Calculations based on the above changed exchange rates resulted in a difference in the balance of funds. The remaining balance of funds now is -384,089.28 CNY, or 54,627.97USD using the exchange rate when the final installment of funds received from ITTO (1 USD=7.031 CNY in March 2008), instead of -22,112.40USD.
- 3) The fund savings from employing consultants at lower prices, purchasing some cheaper equipment than planned, and sub-contracting with firms and/or people at lower costs for the conduct of project activities were spent to make up the over-expenditures in budget headings for duty travel, consumable items and miscellaneous as the project was extended for 2.5 years with continuation of project activities including the extra ones and changes in exchange rates, more people were trained in three courses and others like postgraduate education and postdoctoral research. All these resulted in a budget deficit of 22,112.40USD. This has been covered by the counterpart contribution of the local government and other sources of project funds.

