

China

Ex-Post Evaluation of Japanese Technical Cooperation Project
“The Japan – China Cooperation Science and Technology Center
for Forest Tree Improvement Project”

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0. Summary

The project aimed at human resource development for the breeding of forest trees through measures such as the breeding of superior tree species and the plan of forest tree breeding. As the project purpose is in line with development policy and development needs, its relevancy is high. After project implementation, the counterparts acquired the capacity for forest tree breeding and the planning of breeding. As this project had several achievements, such as the advancement of techniques, systematic and sustainable forest tree breeding and contributions to forest tree breeding in southern provinces by developing technical training for forest tree breeding, its effectiveness and impact is high. There was no problem with the inputs, including equipment and experts. Nevertheless, an extension in the project period resulted in both a longer implementation term of cooperation and a larger project cost and, hence, the efficiency of the project is fair. No major problems have been observed in the structural, technical, financial aspects of the executing agencies, and therefore the sustainability of the project effects is high. The skills for forest tree breeding and the superior tree species are expected to be utilized in the future.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location



Woods for pest-resistant ability of poplar

1.1 Background

At the time of the establishment of the People’s Republic of China (1949), forest coverage was less than 10% of the country. The Chinese government has increased forest areas since then. In the first half of the 2000s, China was one of the counties with a large forest area. Nevertheless, the country has vast territory and its forest coverage was below 20%. After a flood of the Yangtze River valley in 1998, further efforts were made for the protection of natural forest and an increase in afforestation. In order to carry out afforestation efficiently in various environments over its vast territory, it’s very basic to breed superior tree species.

In consideration of the need for forest tree breeding, JICA implemented a technical cooperation project (Hubei Province Tree Improvement Project) from 1995 to 2001. Although

Hubei province is located in the southern part of China, its complex geographical environment and wide variety of flora, tree species originating in the northern area also can be planted here. Thus, Hubei province was selected as the project site. Since it takes a long time before forest tree breeding produces results, it was desirable to utilize breeding materials for forest tree breeding and advanced techniques for genetic improvement of forest tree, both of which were produced by the aforementioned project, and to promote forest tree breeding. Protection of the natural forest and an increase in afforestation created a strong demand for superior seeds and seedlings and, for this reason, diffusing techniques for forest tree breeding outside of Hubei province was an important policy agenda.

Under this situation, the Chinese government requested technical cooperation for the advancement of techniques for forest tree breeding and the dissemination of these techniques in the southern provinces. This project (The Japan – China Cooperation Science and Technology Center for the Forest Tree Improvement Project) was originally planned to be implemented from October 2001 to October 2006, but for better sustainability of the project effects, the period of cooperation was extended to October 2008.¹ While the Japan – China Cooperation Science and Technology Center for Forest Tree Improvement (JCCSTCFTI) implemented the project, the Center for Forest Tree Breeding in Hubei Province (CFTB-HP) and the Center for Breeding of *Pinus massoniana* against *Bursaphelenchus xylophilus* in Anhui Province (CBPMBX-AP) did the research.

1.2 Project Outline

Overall Goal		(Original Project) Bases for forest tree breeding are established in southern provinces of the People’s Republic of China, through extension of technologies developed by the Project (Extended Project) Forest tree breeding is implemented systematically in Anhui and Hubei Provinces and plans for forest tree breeding are being formulated in some other provinces in the southern region. Super Goal: Plans for forest tree breeding are formulated and breeding is implemented in some other provinces in the southern region.
Project Objective		(Original Project) The Japan-China Cooperation Science and Technology Center for Forest Tree Improvement acquires technical capacity to sustain forest tree breeding. (Extended Project) The Japan-China Cooperation Science and Technology Center for Forest Tree Improvement acquires the capacity to conduct forest tree breeding in an independent and planned manner.
Output(s)	(Original) Output 1	Techniques for recurrent selection breeding ² are developed (Hubei Province).
	(Original) Output 2	Techniques for resistance breeding are developed (Anhui and Hubei Provinces).
	(Original) Output 3	Techniques for introduction breeding are developed (Hubei Province).
	(Original) Output 4	Techniques for genetic resources preservation are developed (Hubei Province).
	(Original) Output 5	Techniques for improving seedling production are developed (Hubei Province).

¹ This project has a Project Design Matrix for both the original period and the extended period. Both periods had different goals. For this reason, this ex-post evaluation analyzes the original period and the extended period separately where necessary.

² Recurrent selection is one of the breeding techniques which establishes certain species with desirable genes by repeating selection and hybridization.

	(Original) Output 6	Techniques for forest tree improvement are disseminated among technical staff of southern provinces by training programs (Hubei Province).
	(Extended) Output 1	The plan for forest tree breeding in Hubei Province has prospect to be implemented systematically.
	(Extended) Output 2	In Anhui Province, breeding of <i>Pinus massoniana</i> ³ against <i>Bursaphelenchus xylophilus</i> ⁴ has prospect to be implemented systematically.
Inputs		<p>Japanese Side: (Original Project)</p> <ol style="list-style-type: none"> Experts: 36 persons 11 persons for Long-Term, 25 persons for Short-Term 29 Trainees received (Counterpart Training in Japan) No Trainees for Third-Country Training Programs (total) Equipment 107 million yen Local Cost 137 million yen Others (incl. dispatch of related missions) <p>(Extended Project)</p> <ol style="list-style-type: none"> Experts: 8 persons 3 persons for Long-Term, 5 persons for Short-Term 9 Trainees received (Counterpart Training in Japan) No Trainees for Third-Country Training Programs (total) Equipment 16.21 million yen Local Cost 52.57 million yen Others (incl. dispatch of related missions) <p>Chinese Side: (Original Project)</p> <ol style="list-style-type: none"> 18 Counterparts Land and Facilities, Project office and Laboratory, Nursery, Experimental forest, Tree seed orchard, Forest for conservation of genetic resources, etc. Local Cost 239.02 million (RMB 17 million) <p>(Extended Project)</p> <ol style="list-style-type: none"> 13 Counterparts Land and Facilities, Project office and Laboratory, Nursery, Experimental forest, etc. Local Cost 48.89 million (RMB 3.2 million)
Total cost		990.64 million yen
Period of Cooperation		(Original Project) October 2001 - October 2006 (Extended Project) October 2006 - October 2008
Implementing Agency		State Forestry Administration (including General Administration of State Forest Farms, Tree Seeds and Seedling State Forestry Administration), Center for Forest Tree Breeding in Hubei Province, Center for breeding of <i>Pinus massoniana</i> against <i>Bursaphelenchus xylophilus</i> in Anhui Province, Forestry Bureau of Hubei Province ⁵ , Anhui Province Forestry Department
Cooperation Agency in Japan		Ministry of Agriculture, Forestry and Fisheries, Forestry Agency, Forestry and Forest Products Research Institute ⁶
Related Projects		Japanese Technical Cooperation “Hubei Province Tree Improvement Project”, Japanese ODA Loan “Hubei Province Afforestation Project”

³ *Pinus massoniana* is an evergreen needle - leaved tree under *Pinus*, *Pinaceae*.

⁴ *Bursaphelenchus xylophilus* is a type of vermin which proliferates, eats and moves in tree trunks of *Pinaceae* and causes decay.

⁵ At the time of project completion. The agency was named Hubei Province Forestry Department after 2011.

⁶ At the end of project completion. At the commencement of the project, the cooperation agency in Japan included the Forest Tree Breeding Center which merged with the Forestry and Forest Products Research Institute in 2007.

1.3 Outline⁷ of the Terminal Evaluation⁸

1.3.1 Achievement of Overall Goal

The terminal evaluation report mentioned the conditions for the achievement of the overall goals. In order to achieve these, besides the development of the physical infrastructure, the State Forestry Administration was expected to play a leading role in the utilization of techniques, human resources and the practical knowledge of training of CFTB-HP and CBPMBX-AP.

1.3.2 Achievement of Project Objective

The terminal evaluation report mentioned that the achievement of the outputs was satisfactory and that the project objectives were to be attained within the original period (until October 2006). It was concluded that professional knowledge, experience and skills for forest tree breeding techniques were improved by this project.

1.3.3 Recommendations

The terminal evaluation report mentioned short-term recommendations to be implemented within the original period (until October 2006) and long-term recommendations after project completion. The recommendations were as follows:

- Short-term recommendations: completion of activities, synthesis of technical transfer etc., the establishment of managerial organization to implement the Hubei province plan for forest tree breeding, the establishment of implementation system for a training program for the southern provinces, a future plan for JCCSTCFTI, the formulation of overall goals and super goals
- Long-term recommendations: Continuation of technical development, the implementation of the Hubei province plan for forest tree breeding, the expansion of breeding species against *Bursaphelenchus xylophilus* in Anhui province, the expansion of forest tree breeding in the southern provinces, the establishment of organizational systems for forest tree breeding, support after the project completion both by China and Japan

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corp. / Akinori Nishio, JAFTA

2.2 Duration of Evaluation Study

Duration of the Study: September 2011 – October 2012

Duration of the Field Study: January 4 – January 17, 2012 and May 6 – May 15, 2012

2.3 Constraints during the Evaluation Study

Quantitative targets were not selected for the project objectives and overall goals. For this reason, the attainment of targets is evaluated based on qualitative evaluation information. As the 12th Five year plans for forestry development in Hubei and Anhui provinces was not disclosed at the time of the ex-post evaluation, judgment is based on interviews with the counterparts.

⁷ This ex-post evaluation analyses both the original project and the extended project. The terminal evaluation was not conducted for the extended project. For reference, this report mentions the results of the terminal evaluation of the original project.

⁸ Conducted in April 2006

3. Results of the Evaluation (Overall Rating: A⁹)

3.1 Relevance (Rating: ③¹⁰)

3.1.1 Relevance with the Development Plan of China

At the time of project planning (2001), the long-term plan for the recovery and protection of the environment was the National Program for the Construction of an Ecological Environment, which was approved in 1999. The plan pursued the protection of an ecological environment and aimed at more than 26% Forest Coverage Rate by 2050. The Seed Law was approved and implemented in 2000 and stipulated that the Chinese government supported the protection of gene resources and the breeding of superior species.

At the time of project completion (2008), the National Program for the Construction of an Ecological Environment remained an important policy in the forestry sector and the Seed Law also was effective. The plan for the forestry sector at the time of the project completion put more emphasis on quality improvement of seed and seedlings. The 11th Five-year Plan for the forestry sector¹¹ planned an increase in the use of superior seeds from 43% in 2005 to 50% in 2010 and 65% in 2020. The development of supply stations for seeds and seedlings changed its focus from quantity to quality. The Hubei province 11th Five-year Plan for Forestry Sector Development (planning period: 2005-2010) emphasized the establishment of a comprehensive breeding site to integrate research, production, and marketing. From the view point of the protection of forest resources, the Anhui province 11th Five-year Plan for Forestry Sector Development (planning period: 2005-2010) attached great importance to the prevention of *Bursaphelenchus xylophilus* and regarded the breeding of species against *Bursaphelenchus xylophilus* as a priority implementation project.

Cooperation by this project in forest tree breeding was crucial for efficient and high-quality afforestation as well as for the development of human resources for the task. It contributed to the achievement of policy agenda (such as an increase in the forest coverage rate and quality improvement of seeds and seedlings) at the times of both project planning and project completion.

3.1.2 Relevance with the Development Needs of China

At the time of project planning (2001), forest area in China was 134 million ha¹². The forest coverage rate improved from 12.7% in the 1980s to 13.9% in the 1990s and further improvement was aimed for. Based on this policy, six large key projects were formulated in 2001. The policy direction of the sector leaned more towards the protection of natural forest and an increase in afforestation, and developed efficient planting in a wide variety of natural environments. This was the background for forest tree breeding and development of human resources to carry out the task. There were forests damaged by *bursaphelenchus xylophilus* in 14 provinces/regions/cities at the time of project planning and the problem was particularly severe in Anhui province. Pine trees accounted for 40% of the forest area in Anhui province and the damage of *Bursaphelenchus xylophilus* reached 9,840 ha per year.

At the time of project completion (2008), forest area in China was 195 million¹³. The forest coverage rate had surged to 20.4% but this was still below the policy target. In 2008, all of the six large key projects had moved into new phases or remained on-going by the extension of their project periods and this created the demand for high quality seeds and seedlings. At the time of project completion, damage of *Bursaphelenchus xylophilus* had been reduced to 5,300 ha (approx. 80,000 mu in 2008) per year. Anhui province made great efforts to control *Bursaphelenchus xylophilus* by cutting down and smoking out affected trees and damaged areas

⁹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

¹⁰ ③: High, ②: Fair, ①: Low

¹¹ The formal name of the plan is the 11th Five-Year Forest Plan and the National Plan for Long- and Medium-Term Forestry Development.

¹² Based on JICA internal documents

¹³ Based on the 7th Survey on China's Forest Resources (2004-2009)

showed a decreasing trend. At the times of both project planning and project completion, efficient afforestation in a wide variety of environments still created several needs for the breeding of superior tree species and capacity development for forest tree breeding. This project implemented activities in line with these needs.

3.1.3 Relevance with Japan's ODA Policy

At the time of project planning (2001), Japan's former Official Development Assistance Charter (former ODA charter), which had been proved by the cabinet in 1992, referred to the close relationship between Japan and East Asia and emphasized assistance to the Asian region. In addition, the charter had the policy of supporting the efforts of developing countries for environmental protection. In line with the former ODA charter, the Country Assistance Program for China, which was prepared in 2001, regarded assistance in solving environmental issues as a priority. In particular, it stated that assistance for protection and afforestation would be made for preservation and recovery of the ecosystem. In the JICA country assistance plan for China in FY 2000, preservation of the environment was one of the priority areas in assistance.

The project contributed to the protection of forests and afforestation through assistance for genetic improvement of forest tree and, thus, it was consistent with Japan's ODA policy.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness and Impact¹⁴ (Rating: ③)

3.2.1 Project Outputs

As mentioned in "1.1 Background", the period of cooperation was extended in this project. Analysis of effects was based on the achievement of outputs and project objectives at the end of the original project period (as of October 2006) for the original project, and the achievement of outputs and project objectives at project completion (as of October 2008) for the extended project. Outputs not achieved at the time of project completion were reassessed using information from the time of the ex-post evaluation.

3.2.1.1 Project Outputs

(1) Original project

Six outputs were set out as the immediate effects of the original project. The achievement of the outputs at the end of the original project period was as follows:

1) Original project - Output 1 "Techniques for recurrent selection breeding are developed (Hubei Province)"

Output 1 for the original project had three indicators (1. Formulation of specification sheet for superior trees, 2. Selection of superior trees for the next generation, 3. Preparation of a mating plan). As the achievement of the indicators show that the information and materials for recurrent selection breeding were collected and that the mating plan progressed, Output 1 was achieved. As for Indicator 1, specification sheets were made for superior trees of 132 *Cunninghamia lanceolata*, for 248 *Pinus massoniana* (including 145 clones¹⁵), and for 63 clones of poplars. Data such as tree heights, breast height diameter, amount of flowers, and material quality were mentioned in the sheets. As for Indicator 2, 32 *Pinus massoniana*, 50 *Cunninghamia lanceolata*, 3 clones of poplars with good material quality and 3 clones of fast-growing and pest-resistant poplars were selected as superior trees for the next generation. As for Indicator 3, mating plans were prepared and adequate breeding materials had been collected by the end of the project.

¹⁴ "Effectiveness" is rated taking into account "impact".

¹⁵ Clone is a group with the same gene organization generated by asexual reproduction.

- 2) Original project - Output 2 “Techniques for resistance breeding are developed (Anhui and Hubei Provinces)”

Output 2 for the original project had two indicators (1. Establishment of a testing site for poplars, 2. Selection of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*). As the achievement of the indicators show that both the establishment of a testing site for poplars and the selection of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus* progressed, Output 2 was achieved. For indicator 1, 2 testing sites for 20 lines of poplars resistant to longhorn beetle and 2 testing sites for crossbreeds were established. As for Indicator 2, *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*, 251 lines, were selected and 1 conservation forest, 3 testing sites and 2 seed orchards were established. Given the period for completion in the original project, Indicator 2 was appropriate. However, the selection of pest-prone lines was not sufficient for the spread of pest-prone seedlings and the establishment of pest-prone clones was also required. There was a possibility that the counterpart agency could not achieve this task. For this reason, the extended project continued activities for the establishment of pest-prone clones.



Photo 1: Pest-prone *Pinus massoniana* Lines

- 3) Original project - Output 3 “Techniques for introduction breeding are developed (Hubei Province)”

Output 3 for the original project had three indicators (1. Selection of clones of fast initial growth poplar and larch, 2. Establishment of a regional test site, 3. Formulation of specification sheet for the superior trees of *Eucommia*). As the achievement of the indicators shows that the selection of superior clones suitable for species origin, Output 3 was achieved. As for Indicator 1, 50 lines of fast initial growth larch and 50 fast growing clones were selected from a regional test site in Jiashi county, Hubei province. From the testing site of a research center in Qianjiang, 7 superior clones adaptive in the Jiangnan plain and 10 fast initial growth clones adaptive in hilly and mountainous areas were selected. As for Indicator 2, 17 regional test sites (total 24.3 ha) for poplar (including crossbreed of *Populus suaveolens* and *Populus nigra* as well as *Populus nigra*) were established. Based on interviews at the Center for Forest Tree Breeding in Hubei Province, a specification sheet on superior trees of *Eucommia* was completed within the period of cooperation of the original project.

- 4) Original project - Output 4 “Techniques for genetic resources preservation are developed (Hubei Province)”

Output 4 of the original project had three indicators (1. Completion of genetic structure research for *Pinus massoniana* and natural forests of *Quercus*, 2. Establishment of conservation forest and development of conservation techniques for *Liriodendron tulipifera* and *Sassafras variifolium*, 3. Research on the genetic variations and morphological characteristics of *Liriodendron tulipifera* and *Sassafras variifolium*). As the achievement of the indicators show that research activities produced useful results within the period of cooperation of the original project, Output 4 was achieved. The



Photo 2: Regional Forest of *Liriodendron tulipifera*

counterparts acquired the skills for genetic resources analysis through participation in this research. As for indicator 1, genetic structure research of *Pinus massoniana* and natural forests of *Quercus* showed that the genes of *Pinus massoniana* had a relatively wide variation and that the genes of *natural forests of Quercus* had a wider variation than *Quercus* in general and *Dicotyledon*. As for Indicator 2, techniques to improve the regional survival rate of *Liriodendron tulipifera* and *Sassafras variifolium* were identified and forests for ex-situ conservation were established. As for Indicator 3, research on genetic variation and morphological characteristics was completed in forest for in-situ conservation of *Liriodendron tulipifera* and *Sassafras variifolium*.

- 5) Original project - Output 5 “Techniques for improving seedling production are developed (Hubei Province)”

Output 5 for the original project had two indicators (1. Formulation of standards for seedlings of *Cunninghamia lanceolata* and *Pinus massoniana*, 2. Development of techniques for the improvement of seed production). As the achievement of the indicators suggests that results could be utilized for forest tree breeding, Output 5 was achieved. As for Indicator 1, seedling standards and manuals for seedling nurturing techniques for *Cunninghamia lanceolata* and *Pinus massoniana* were prepared. As for Indicator 2, interviews at CFTB-HP showed that techniques to promote flowering and to improve the efficiency of seed collection (such as hormone management, ring stripping and training) were identified and that experiments were conducted on them. In order to improve the efficiency of seed collection, a miniature seed orchard was established.

- 6) Original project - Output 6 “Techniques for forest tree improvement are disseminated among technical staff of southern provinces by training programs (Hubei Province)”

It is difficult to clearly distinguish Output 6 from Indicator 3 of the project objectives. In consideration of the characteristics of indicators, this ex-post evaluation report analyzes the managerial organization and the implantation process for training in Output 6 as well as the effect of training in Indicator 3 of the project objectives.

Output 6 for the original project had two indicators (1. Development of training curricula and materials, 2. Establishment of managerial organization for training). As the achievement of the indicators suggests that the operational arrangements for training were fulfilled, Output 6 was achieved. As for Indicator 1, a five-year plan for training was prepared at project commencement and reviewed as required. During the period of cooperation for the original project, 58 types of training materials which covered a wide variety of topics (such as the progress trend of forest tree breeding in China and Japan, techniques for forest tree breeding, the breeding of certain forest tree etc.) were prepared. As for Indicator 2, Hubei province was the main venue for training and the counterparts planned and coordinated training programs. Depending on the course contents, counterparts, dispatched experts or researchers in China (university professors, etc.) acted as lecturers. Since the counterparts of this project accumulated an adequate level of capacity for training, training programs for relevant persons in the forestry sector in Hubei province were implemented under the Japanese ODA Loan “Hubei Province Afforestation Project”. Training materials (13 types) were prepared and 164 persons participated in two training sessions in total.

- (2) Extended project

Two outputs were set as the immediate effects of the extended project. The achievement of the outputs at the end of the project period was as follows:

- 1) Extended project - Output 1 “The plan for forest tree breeding in Hubei Province is expected to be implemented systematically”

Output 1 for the extended project had three indicators (1.Preparation of forest tree breeding

plans per breeding district¹⁶, 2. Establishment of implementation plan by fiscal year, 3. Human resource development for the implementation of forest tree breeding plans). As the achievement of the indicators suggests that the counterparts became more knowledgeable about planning through the preparation of various plans, Output 1 was achieved. As for Indicator 1, in accordance with the Hubei Province Forest Tree Breeding Plan, which is explained in Indicator 2 of “3.2.1.2 Achievement of Project Objectives”, the project divided Hubei Province into six breeding districts and established forest tree breeding plans for them separately. The wider variety of tree species in these plans implies that CFTB-HP had acquired the appropriate planning capacity. As for Indicator 2, an implementation plan by fiscal year was also made. Through the preparation of forest tree breeding plans by breeding district and the implementation plan by fiscal year, the staff of CFTB-HP obtained practical experience of planning. The forest tree breeding plans by breeding district included not only the tree species relevant to this project but also other species (such as *Pterocarya stenoptera* and Cork Oak). This proves that the counterparts gained a more sophisticated planning capacity.

- 2) Extended project - Output 2 “In Anhui Province, breeding of *Pinus massoniana* against *Bursaphelenchus xylophilus* expected to be implemented systematically”

Output 2 for the extended project had two indicators (1. Prospect for establishing clones of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*, 2. Preparation of a breeding plan for *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*). Inoculation tests¹⁷ on the clones of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus* had not been completed at project completion and Indicator 1 had not yet been achieved. For this reason, Output 2 was partially uncompleted. Nevertheless, the inoculation tests had been conducted by the time of the ex-post evaluation and resistant clones had been identified. Indicator 1 had been achieved by the time of the ex-post evaluation. Indicator 2 had been achieved by project completion as the five-year action plan had been put together by that time.

3.2.1.2 Achievement of Project Objectives

(1) Original project

The Project Objective of the original project was “the Japan-China Cooperation Science and Technology Center for Forest Tree Improvement acquires technical capacity to sustain forest tree breeding” and there were the following three indicators for the assessment of achievement.

- 1) Original project - Indicator 1 “Staff of the Japan-China Cooperation Science and Technology Center for Forest Tree Improvement develops its capacity to conduct research autonomously”

The counterparts of the project led the whole process of research covering planning, implementation and reporting. As a number of published research papers suggest that they had obtained the capacity to autonomously conduct sophisticated research, Indicator 1 was achieved. Research plans were made every year during project implementation and the counterparts published 29 research papers in academic journals during the planned period of the original project. In 2005, Hubei province awarded a prize named Winner for the advance of science and technology for “Genetic improvement of Japanese larch and techniques for the nurturing of planted forest breeding”, the subject of which was highly relevant to the project.

¹⁶ A breeding district is an area based on the natural environment (climate, soil quality, flora) and administrative boundaries.

¹⁷ This project inoculated *Bursaphelenchus xylophilus* into *Pinus massoniana*, to confirm outbreak and identify resistant clones.

- 2) Original project - Indicator 2 “By the establishment of a forest tree breeding plan, effective forest tree breeding is expected to be accelerated and implemented sustainably for major species”

The Hubei Province Forestry Bureau approved the Hubei Province Forest Tree Breeding Plan during the planned period of the original project and, thus, Indicator 2 was achieved. With the cooperation of dispatched experts, the counterparts of this project completed the provincial plan. Planning covered various items including assessment of the current status, target setting for forest tree breeding, directions of breeding for certain species, and the managerial organizations to implement breeding. The period was from 2007 to 2016. The provincial plan set the direction for the breeding of major tree species in Hubei province and provided guidance for the systematic implementation of forest tree breeding. The provincial plan recommended that breeding districts shall be confirmed combining with both the natural environment and administrative boundaries according to the existing research results. The extended project prepared forest tree breeding plans for the breeding districts.

- 3) Original project - Indicator 3 “Persons-in-charge for forest tree breeding and mid-level technical staff participated in training from southern provinces”

Indicator 3 was achieved as the number of participants and the content of training were desirable. As the number of participants does not provide sufficient information on project effects, the evaluation results reflected not only the achievement of the target for trainees but also the opinions of participants regarding the content of training. During the project period of the original project, 13 training sessions took place and 624 trainees participated in the training programs. At project planning, the target for the number of trainees had been 500 persons. The contents of training included trends in forest tree breeding and practical techniques for forest tree breeding. Trainees came mainly from the southern provinces but some from the northern and western provinces were also allowed to participate. A few from private companies providing seedlings were allowed in the training program. Based on the questionnaire survey in this ex-post evaluation¹⁸, 90% of respondents replied that they had obtained new knowledge (see Table 1). About the contents of the training, 90% of the respondents chose “Very useful” or “Useful to some extent”. This result shows that most respondents recognized value of the training (see Table 2). The answers suggest that, for majority of the trainees, the training was new and useful.

Table 1: New knowledge obtained from training

Question: “Did you obtain new knowledge from training?”

	Yes	To some extent	No	Total
Respondents	95 persons	9 persons	0 person	104 persons
%	91.3%	8.7%	0.0%	100.0%

Source: Questionnaire survey in the ex-post evaluation

Table 2: Usefulness of knowledge obtained from training

Question: “Was knowledge obtained in training useful?”

	Very useful	Useful to some extent	Not so useful	Not at all	Total
Respondents	14 persons	83 persons	7 persons	0 person	104 persons
%	13.5%	79.8%	6.7%	0.0%	100.0%

Source: Questionnaire survey in the ex-post evaluation

¹⁸ Out of all trainees (624 persons), 216 persons were selected by random sampling, 104 persons returned questionnaire sheets (respondent rate: 48.1%).

The original project has largely achieved its target indicators of project objectives.

(2) Extended project

The Project Objective of the extended project was “the Japan-China Cooperation Science and Technology Center for Forest Tree Improvement acquires the capacity to conduct forest tree breeding in an independent and planned manner” and there were the following three indicators for assessment of achievement.

- 1) Extended project - Indicator 1 “Staff of the Japan-China Cooperation Science and Technology Center for Forest Tree Improvement develops its capacity to conduct projects for forest tree breeding autonomously”

As, by the end of the project, research plans included the breeding of other species not assisted by this project, Indicator 1 was achieved. The counterparts of the project obtained techniques such as selection breeding and the analysis of gene resources and DNA. Through these techniques, the counterparts prepared research plans for the breeding of species such as *Metasequoia glyptostroboides*, *Camellia oleifera* and *Ginkgo biloba*, none of which were researched by the project

- 2) Extended project - Indicator 2 “Hubei province conducts projects for systematic and sustainable forest tree breeding autonomously and the research for forest tree breeding is expected to be developed for major species in a planned way”

Planning for forest tree breeding showed progress, though a budget had not been allocated by the time of project completion. For this reason, Output 2 was achieved to some extent. At the time of the ex-post evaluation, a budget had been allocated for the breeding of some species as part of the breeding district plans and, thus, the contents of the plans can be presumed to have been appropriate (see Indicator 2 of the extended project in “3.2.2.1 Achievement of the Overall Goal”). Staff at CFTB-HP prepared six forest tree breeding plans by breeding district up to the project completion (see Output 1 of the extended project in “3.2.1.1 Project Output”). Each of the forest tree breeding plans by breeding district selected 5-10 tree species and recommended actions for breeding projects, the assessment of market demands and the natural environment of the corresponding breeding district. No plan was implemented before project completion as the Hubei province did not allocate a budget for these plans.

- 3) Extended project - Indicator 3 “Anhui province autonomously conducts systematic and sustainable breeding of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*”

Based on answers of the counterpart agencies from the questionnaire and interviews, the Anhui Province Forestry Department approved the five-year action plan mentioned in the Output 3 of the extended project in “3.2.1.1 Project Outputs.” There was some prospect of a continuous allocation of budget. For this reason, Indicator 3 was achieved. From the long term perspective, the test on the *Bursaphelenchus xylophilus*-resistant clones, which was assisted by this project, aimed at a substantial supply of resistant materials.

The extended project has largely achieved the target indicators of project objectives.

3.2.2 Impact

In general, the impact of this project would be that the counterpart agencies obtain better capacity and systematically continue forest tree breeding, and that techniques and planning methods for forest tree breeding are spread outside the counterpart agencies, especially in southern provinces. The former impact means a greater sophistication in forest tree breeding and the later impact, the geographical extension of forest tree breeding. Both of the impacts are equally important as effects of this project. Assessment of the impacts also reflects the use of the outputs of this project.

3.2.2.1 Achievement of Overall Goal

The Overall Goal of the original project was “Bases for forest tree breeding established in the southern provinces of the People’s Republic of China, through the extension of technology developed by the Project” and this had two indicators. Indicator 1 assesses the contribution to forest tree breeding outside the counterpart agencies, and Indicator 2 deals with the progress of technical development within the counterpart agencies.

(1) Original project

1) Original project - Indicator 1 “Forest tree breeding is boosted in southern provinces”

The questionnaire survey with trainees confirmed that knowledge obtained from training was applied to daily practices and shared with colleagues. The training presumably contributed to the improvement of daily practices. There were several contributions to forest tree breeding such as more efficient seedling production, shorter periods for breeding and the implementation of forest tree breeding in the light of regulations. On the use of knowledge in daily practice, those who answered “Frequently use” or “Use” accounted for more than 80% of the respondents (see Table 3).

Table 3: Use of knowledge in work

Question “Do you use knowledge obtained from training in your work?”

	Frequently use	Use	Use little	No at all	Total
Respondents	21 persons	67 persons	13 persons	3 persons	104 persons
%	20.2%	64.4%	12.5%	2.9%	100.0%

Source: Questionnaire survey in the ex-post evaluation

On knowledge sharing with colleagues, those who answered “Frequently teach” or “Teach Occasionally” accounted for approximately 80% of the total (see Table 4). In particular, knowledge of conventional techniques (grafting and planting a cutting, recurrent selection breeding, etc.), regulations in the forest sector and trends in forest tree breeding in China, were shared with colleagues. In addition, the major means of transfer of knowledge were presentations on training contents and advice on colleagues’ daily practices.

Table 4: Sharing knowledge from training with colleagues

Question “Do you teach your colleagues knowledge obtained from training?”

	Frequently teach	Teach Occasionally	Seldom teach	Not at all	Total
Respondents	22 persons	65 persons	11 persons	6 persons	104 persons
%	21.1%	62.5%	10.6%	5.8%	100.0%

Source: Questionnaire survey in the ex-post evaluation

The questionnaire survey asked about how training contributed to daily practice. Contributions included more efficient seedling production by grafting and planting cuttings (Zhejiang province, Fujian province, Sichuan province and Jiangxi province), implementation of forest tree breeding in light of the regulations of the forestry sector (Hubei province and Fujian province), a shorter period for forest tree breeding (Zhejiang province) and improvement of afforestation programs (Hubei province). Interviews¹⁹ with trainees confirmed more contributions such as the selection of superior lines of Japanese larch (Hubei province), the breeding of vegetables using DNA analysis (Hubei province), prevention of damage caused by *Bursaphelenchus xylophilus*, and the improvement of seedling production for rare species

¹⁹ Out of the respondents of the questionnaire survey, two trainees were interviewed directly and, in addition, two were contacted by e-mail. Additional questions were asked about the expansion of forest tree breeding in detail.

(Jiangxi province).

CFTB-HP continued a training program for technicians in Hubei province and has conducted five large-sized training sessions since project completion. For the forest tree breeding project financed by the State Forestry Administration, the counterpart agency periodically provides technical assistance to superior species production sites for forest tree in Hubei province. Also, CBPMBX-AP trained technicians in Anhui province and has conducted five training sessions since project completion.

2) Original project - Indicator 2 “Technical development for forest tree breeding is accelerated”

Research activities relevant to the project have been on-going since project completion and research subjects have become more sophisticated. Research has been awarded prizes several times and this suggests that the project has obviously contributed to technical developments in forest tree breeding.

After project completion, CFTB-HP continued research in five subjects relevant to the project and published eight research papers in academic journals. In 2010, the Chinese Society of Forestry awarded a prize for research on the breeding of tree species with high carbon fixation.

After project completion, CBPMBX-AP published four research papers in academic journals. In 2009, a study on the establishment of a *Pinus massoniana* seed orchard with high density won a prize from Anhui province.

The overall goal of the original project was largely achieved for its target indicators.

(2) Extended project

The Overall Goal of the extended project was “Forest tree breeding is implemented systematically in Anhui and Hubei Provinces and plans for forest tree breeding are being formulated in some other provinces in the southern region” and had three indicators. While Indicator 1 and Indicator 2 deal with systematic and sustainable forest tree breeding in the project areas, Indicator 3 assesses improvement of plans and institutions for forest tree breeding outside the counterpart agencies.

1) Extended project - Indicator 1 “In Hubei province, forest tree breeding is developed in accordance with the implementation plan reflecting institutional, organizational, financial and technical considerations”

The forest tree breeding plans by breeding district were completed before project completion but no budget was allocated to the implementation of the plans. At the time of the ex-post evaluation, the State Forestry Administration was providing funding for several species (*Cunninghamia lanceolata*, *Larix kaempferi*, *Metasequoia glyptostroboides*, etc.). With this funding, the breeding of the corresponding mentioned in the forest tree breeding plans by districts was being implemented.

2) Extended project - Indicator 2 “In Anhui province, breeding of *Pinus massoniana* against *Bursaphelenchus xylophilus* is conducted in accordance with the implementation plan reflecting institutional, organizational, financial and technical considerations”

At the time of the ex-post evaluation, CBPMBX-AP was continuing forest tree breeding in accordance with the action plan prepared by this project. After a primary inoculation test and a secondary inoculation test were implemented in the period of the original project, an inoculation test on clones was carried out after project completion. In addition, a second inoculation test on clones was carried out. The actual number of tests (four) was beyond the initial plan (three – primary, secondary and on clones) but the purpose of the most recent inoculation test was changed to the assessment of change in resistance with tree age. By using some of the selected

resistant clones, a seed orchard for a clone of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus* was established in March 2011.

3) Extended project - Indicator 3 “Forest tree breeding plans are formulated in several southern provinces”

At the time of the ex-post evaluation, a plan for forest tree breeding was formulated for a whole county, not by province. In interviews with the State Forestry Administration, planning which paid good attention to breeding districts was referred to as an impact on forest tree breeding by the project. The current plan for forest tree breeding was based on tree species and breeding districts were selected for each species.

However, the impact on planning and institutional building in each province was limited. Interviews with the State Forestry Administration revealed that, in accordance with the national plan, each province handled forest tree breeding within long- and medium- development plans for the forest sector, but no province formulated a plan solely for forest tree breeding. No activity of the extended project was directly involved with the diffusion of project results over other provinces. It was difficult to diffuse project effects over other areas without relevant activities. After the completion of the project, there was no opportunity to contribute to planning capacity and institutional building in other provinces through training.

The overall goal of the extended project was largely achieved for the target Indicators 1 and 2, though Indicator 3 showed little progress after project completion. It was difficult for CFTB-HP to influence planning and institutional arrangements for forest tree breeding outside Hubei province. Therefore, the overall goal of the extended project was partially not achieved.

3.2.2.2 Other Impacts

Based on the questionnaires answered by the counterpart agencies and the interviews with project officials, there was no negative impact observed on the natural and social environments. The interviews with project officials suggested the following positive impacts:

(1) Use in afforestation

One of the project results is to provide superior species for practical afforestation. According to CFTB-HP, in Hubei Province, afforestation of the poplar (*Populus suaveolens* and *Populus nigra*) selected by this project was approximately 50,000 mu (3,300 ha) in total between 2008 and 2012. While *Populus suaveolens* was planted in the mountainous area in the western part of Hubei province, *Populus nigra* was planted in the plains of the province. A provenance test on *Populus nigra* was conducted in Chongqing city and Hunan province, an area with a similar climate outside Hubei province. In addition, the afforestation of *Liriodendron tulipifera* was started in 2012 and the afforestation area had reached 500 mu (approximately 33 ha) at the time of the ex-post evaluation.

(2) Use of outputs

3 clones for Poplar suitable to be planted in mountainous areas of high altitude region in Hubei Province was examined and approved by the Hubei Province Review Committee for superior species in 2011.

Data in the genetic structure research²⁰ of *Pinus massoniana* and natural forest of *Quercus* was also stored in the database for genetic resources established by the Chinese Academy of Forestry.

At the time of the ex-post evaluation, state forest farms were utilizing seedling standards and the manuals for the seedling nurturing techniques²¹ of *Cunninghamia lanceolata* and *Pinus*

²⁰ See the Output 4 of the original project in “3.2.1.1 Project Output”

²¹ See the Output 5 of the original project in “3.2.1.1 Project Output”

massoniana for the production of seedlings in Hubei province.

(3) Effective use of equipment

During project implementation, an electron microscope was frequently used for various research analyses. After project completion, the use of this equipment became less frequent. With the cooperation of a private company, CFTB-HP has provided rental services to researchers in the region (university professors, students, doctors, etc.) since 2011. The rental service for the electron microscope is expected to contribute not only to the revenue of CFTB-HP and but also to the advancement of research activities in the region.

This project has largely achieved its project objectives (acquisition of technical and planning skills). On the overall goals, advancements in the technical capacity for forest tree breeding in Hubei province and Anhui province has been in accordance with the expected targets and this suggests that the incidence of project effects is as planned. Therefore its effectiveness and impact is high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Inputs	Plan	Actual Performance
(1) Experts	(Original Project) 6 persons for Long-Term TBD for Short-Term	(Original Project) 11 persons for Long-Term 25 persons for Short-Term
		(Extended Project) 3 persons for Long-Term 5 persons for Short-Term
(2) Trainees received	(Original Project) Field(s) of training: TBD	(Original Project) Field(s) of training: Management of forest tree breeding research, Related techniques for forest tree breeding, Breeding of <i>Pinus massoniana</i> against <i>Bursaphelenchus xylophilus</i>
		(Extended Project) Field(s) of training: Planning for forest tree breeding, Breeding of <i>Pinus massoniana</i> against <i>Bursaphelenchus xylophilus</i>
(3) Equipment	(Original Project) Equipment relevant to breeding, nursery and genetic analysis, Vehicles, other necessary equipment	(Original Project) Equipment relevant to breeding, nursery and DNA analysis, office equipment, vehicles, etc.
		(Extended Project) Equipment relevant to DNA analysis, surveying instruments, etc.
Total Project Cost	Approx. 740 million yen	990.64 million yen
Total Local Cost	N/A	287.91 million yen

3.3.1.1 Elements of Inputs

The increase in the number of long-term experts was due to the replacement of experts and, so the areas of their expertise remained the same. Based on the questionnaires answered by the counterpart agencies and the interviews with project officials, there seemed to be no problem in the areas of expertise and the timing of expert dispatch. Considering the capacity of the staff of the counterpart agencies and local conditions, the equipment provided by this project was appropriate. As the arrival of equipment and materials was partially delayed, mainly due to

custom clearance and the shipment of chemical substances, substitution products were purchased in China.

Regarding inputs from the Chinese side, no serious problem was pointed out in the allocation of the counterparts. As the counterparts could speak Japanese fluently and communicated smoothly with the experts, the interpreter included in the initial plan was not assigned to the project. The facilities required for project implementation (such as laboratories, nurseries, experimental forests, conservation forests and seed orchards) were appropriate. In Anhui province, the nurseries were small. In Hubei province, the long trip from CFTB-HP to the nurseries and sites for breeding materials was inconvenient for frequent monitoring. However, these issues did not prevent the smooth implementation of the project and thus they were considered to be relatively marginal.

3.3.1.2 Project Cost

Project cost was higher than planned (134% of the original plan). The increase in the project cost was mainly due to the implementation of the extended project. It is difficult to compare the planned and actual allocation for the provision of equipment and local costs because there was no information on the amount of allocation in the project planning.

In order to enhance the sustainability of the project effects, the terminal evaluation recommended the continuation of this project, but limited to two subjects. One was the planning of forest tree breeding and human resource development and another was the breeding of species resistant to *Bursaphelenchus xylophilus*. As aforementioned in “3.1.1 Relevance to the Development Plan of China”, the policy for the forestry sector changed its main focus from quantity to quality. In Hubei province, it was desirable that the institution to promote breeding through the preparation of the forest breeding plans by breeding districts in the extended project be enhanced. The terminal evaluation decided that technical development was still half-way in the breeding of species resistant to *Bursaphelenchus xylophilus*. Based on this assessment, the extended project continued to identify clones of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus*. As the breeding of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus* usually takes almost ten years, the project period of the original project was too short to confirm the incidence of the project effects and then transfer this breeding subproject to the counterpart agency.

3.3.1.3 Period of Cooperation

The period of cooperation was longer than planned (139% of the original plan). The implementation of the extended project was the main cause for the longer period of cooperation as it was for the increase in project costs.

The inputs were appropriate for producing outputs. Both project cost and period of cooperation exceeded the plan, therefore efficiency of the project is fair.

3.4 Sustainability (Rating: ③)

3.4.1 Related Policy towards the Project

At the time of the ex-post evaluation, both the long- and medium-term plans in the forestry sector pursued quality improvement in both afforestation and forest. To achieve this policy agenda, importance was attached to the breeding and supply of superior species and seedlings. Given these priorities in the national policy, techniques and planning capacity for forest tree breeding, both of which were enhanced by this project, will be required in the future. Similarly, the superior species bred by this project are expected to be applied to various afforestation projects. For these reasons, the sustainability of the project is high in terms of the policy aspects.

The major sector plans at the time of the ex-post evaluation were the National Afforestation Planning Outline 2011-2020 and the 12th Five-year Plan of Forestry Development (2011-2015),

which also included a plan for the development of the forestry industry. The National Afforestation Planning Outline set targets for forestry areas and the forest coverage rate and, furthermore, aimed at the use of superior artificial seeds at 75% for the improvement of forest quality. During the plan period, it is planned that 300 sites supplying superior seeds (16,870 ha) and 100 sites collecting superior seeds (4,710 ha) will be established. The 12th five-year plan in the forestry sector also pursues quality improvement both in afforestation and forests and has the policy of accelerating the breeding of superior tree species.

According to the counterpart agencies, the Hubei Province 12th Five-year Plan for Forestry Development (2011-2015) maintains the policy of establishing a comprehensive station covering research to dissemination, and the Anhui Province 12th Five-year Plan for Forestry Development (2011-2015) also emphasized countermeasures for *Bursaphelenchus xylophilus*.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

At the time of the ex-post evaluation, CFTB-HP and CBPMBX-AP, both of which played a vital role of this project, continued forest tree breeding. The research system pays good attention to the continuation of study in the case of staff rotation. For these reasons, sustainability of the project is high in terms of the institutional aspects.

CFTB-HP is a part of the Hubei Province Seed Administration Station and its staff also belongs to the above station. After project completion, the number of staff decreased (see Table 5). According to counterparts, because the State Forestry Administration paid attention to the development of *Camellia oleifera* Industry, Forestry Department of Hubei Province established Management Office for *Camellia oleifera* to take charge of relevant development matters and transferred some counterparts to arrange relevant tasks such as the breeding of *Camellia oleifera* and the afforestation for this management office. A research study is always conducted with two researchers (one with primary responsibility and another with secondary responsibility). In the case of staff rotation, one of the researchers remains in CFTB-HP and continues the study. The Hubei Province Seed Administration Station (mainly CFTB-HP) is in charge of the maintenance of the equipment provided. The management of experimental forests, conservation forests, and seed orchards is put in the hands of state forest farms and the research centers of city/district governments as the facilities are located on land owned by these organizations.

Staff of CBPMBX-AP holds additional posts at the Anhui Province Seed Administration Station or the Forest Research Institute of Anhui Province. The researchers who conduct breeding of species resistant to *Bursaphelenchus xylophilus* are engaged in research activities on a full-time basis. The number of staff in CBPMBX-AP remained the same after project completion (see Table 5). A research study is always conducted with two researchers (one with primary responsibility and another with secondary responsibility) as is the case in Hubei province. This arrangement is intended to ensure continuity of the study. Maintenance of the equipment provided is conducted by the Anhui Province Forestry Department or by CBPMBX-AP. Under similar arrangements in Hubei province, the management of experimental forests, conservation forests, and seed orchards is put in the hands of the government organizations which own the forest land.

Table 5: Number of employees at counterpart agencies

Counterpart agency	2008	2009	2010	2011
Center for Forest Tree Breeding in Hubei Province	10	10	9	8
Center for breeding of <i>Pinus massoniana</i> against <i>Bursaphelenchus xylophilus</i> in Anhui Province	9	8	8	8

Source: Questionnaire answers from counterpart agencies, interviews with counterpart agencies

3.4.3 Technical Aspects of the Implementing Agency

Researchers at both CFTB-HP and CBPMBX-AP have had opportunities to acquire

techniques for forest tree breeding after project completion. As the current situation enables them to maintain the capacity they obtained from the project, sustainability is high in terms of the technical aspects.

The staff of the counterpart agencies is mainly researchers, and they acquire new skills by participating in the presentation of research results and obtaining academic degrees besides joining in training programs. In CFTB-HP, opportunities to obtain new skills include participation in academic conferences in the Chinese Society of Forestry, joint research with other institutions, such as the Chinese Academy of Forestry and Nanjing Forestry University, and the acquisition of master's degrees and Ph.Ds. In CBPMBX-AP, staff obtains new skills through participation in presentations on breeding techniques, training on data analysis, and the acquisition of master's degrees and Ph.Ds.

After project completion, the JICA follow-up study was carried out, mainly focusing on the establishment (i.e. test on clones) and dissemination of species resistant to *Bursaphelenchus xylophilus* in Anhui province. The follow-up study conducted monitoring and provided technical guidance by visiting project sites for a short period several times a year. The equipment and materials used for the follow-up study (knives, plastic bags, etc.) are mostly inexpensive. Inputs from the follow-up study are small and, thus, the completion of the study is unlikely to negatively affect sustainability.

The Forestry and Forestry Products Research Institutes in Japan conducted an MOU on research cooperation with the Hubei Province Forestry Department and the Anhui Province Forestry Department and conducted several joint studies (i.e. on the breeding of tree species with high carbon fixation, gene resources of *Zelkova serrate* and *Quercus*, the establishment and the dissemination of seed orchards for species resistant to *Bursaphelenchus xylophilus*) between October 2008 and March 2011. Joint studies also continuously help the counterparts acquire breeding techniques.

3.4.4 Financial Aspects of the Implementing Agency

Since project completion, the budget allocation for forest tree breeding has been sufficient enough for the continuation of research. Sustainability is also high in terms of the financial aspects.

The Hubei Province Seed Administration Station is on a self-paying basis and its revenue comes from testing of seeds, the sales of trees for afforestation and gardening as well as from the government budget. CFTB-HP also obtains revenue from the provision of services (material testing on woods, etc.). As CFTB-HP is a part of the Hubei Province Seed Administration Station, the sustainability of forest tree breeding was a matter of concern at the time of the project completion. However, budget allocation has stayed at a certain level and, in fact, has increased by forest tree breeding commissioned by the State Forestry Administration since 2011 (see Table 6). According to CFTB-HP, funding is not a constraint on the implementation of forest tree breeding.

CBPMBX-AP has no budget allocation for personnel expenses as its staff belongs to other organizations. It is difficult to finance costly expenses such as the establishment of seed orchards but the budget for research is allocated with no problems. Budget allocation has been stable since project completion and the State Forestry Administration has allocated a research budget to CBPMBX-AP since 2010 (see Table 6).

Table 6: Budget allocation for forest tree breeding at the counterpart agencies

Counterpart agency	Unit: RMB			
	2008	2009	2010	2011
Center for Forest Tree Breeding in Hubei Province	1 mil.	0.8 mil.	0.8 mil.	2 mil.
Center for breeding of <i>Pinus massoniana</i> against <i>Bursaphelenchus xylophilus</i> in Anhui Province	0.2 mil.	0.2 mil.	0.38 mil.	0.49 mil.

Source: Questionnaire answers from counterpart agencies, interviews with counterpart agencies

No major problems have been observed in the policy background, the structural, technical, financial aspects of the executing agency, therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project aimed at human resource development for the breeding of forest trees through measures such as the breeding of superior tree species and the plan of forest tree breeding. As the project purpose is in line with development policy and development needs, its relevancy is high. After project implementation, the counterparts acquired the capacity for forest tree breeding and the planning of breeding. As this project had several achievements, such as the advancement of techniques, systematic and sustainable forest tree breeding and contributions to forest tree breeding in southern provinces by developing technical training for forest tree breeding, its effectiveness and impact is high. There was no problem with the inputs, including equipment and experts. Nevertheless, an extension in the project period resulted in both a longer implementation term of cooperation and a larger project cost and, hence, the efficiency of the project is fair. No major problems have been observed in the structural, technical, financial aspects of the executing agencies, and therefore the sustainability of the project effects is high. The skills for forest tree breeding and the superior tree species are expected to be utilized in the future.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Promote experiences based on an operational model for forest tree breeding

As a result of capacity building for forest tree breeding, Forestry Department of Hubei Province Forest and Seed Administration Station plays a more important role as a comprehensive station for the supply of seeds and seedlings, also covering research, production, and dissemination. In China, breeding research has been conducted mainly by research institutes and universities and there are few cases where a seed supply station has a research division for forest tree breeding. For this reason, knowledge from the establishment of a model for forest tree breeding (issues mentioned during intuitional building, advantages/disadvantages of a comprehensive supply station) is worth sharing widely with government organizations which conduct forest tree breeding. It is desirable that the State Forestry Administration promotes an operational model and relevant experiences for forest tree breeding in CFTB-HP among the southern provinces.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) Implementation period depending on specific contents of forest tree breeding

This project was for cooperation in forest tree breeding which means a long period before the incidence of project results. In particular, the breeding of *Pinus massoniana* resistant to *Bursaphelenchus xylophilus* needed an extension of the project period for the suitability of project results. This was one of the major factors behind a longer period for project implementation. It is appropriate that project formation for forest tree breeding assesses an approach which allows a longer project period even if this means a narrower scope of cooperation.

(2) Application of project effects needs to be strongly supported

The extended project assumed that the results of forest tree breeding in Hubei province and Anhui province would promote the planning and institutional building for forest tree breeding in the southern provinces. However, it had marginal effects on planning and institutional building in other provinces beyond the jurisdiction of the counterpart agencies. The regional and decentralized administration of the forestry sector in China allows provinces to be autonomous. The extended project did not have activities which directly dealt with the dissemination of project results in other provinces. The lack of the activities to disseminate project results presumably made this task difficult. In a similar project, which intended to disseminate project effects outside the project areas, it would be desirable to identify bottlenecks in the dissemination of project effects in the planning phase and to include activities to support the dissemination of project results. It is also desirable that information is obtained on the status of dissemination via monitoring in the implementation phase and that feedback is provided on project activities.