Ex-Post Project Evaluation 2012: Package III-3

(Cambodia, Myanmar)

September 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the results of the ex-post evaluation of ODA Loan projects that were mainly completed in fiscal year 2010, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2009. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

September 2013
Masato Watanabe
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

This volume of evaluations, the English translation of the original Japanese version, shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA. JICA is not responsible for the accuracy of English translation, and the Japanese version shall prevail in the event of any inconsistency with the English version.

Minor amendments may be made when the contents of this volume is posted on JICA's website.

JICA's comments may be added at the end of each report when the views held by the operations departments do not match those of the external evaluator.

The Kingdom of Cambodia

Ex-Post Evaluation of Japanese ODA Grant Aid Project

The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (Phase II)

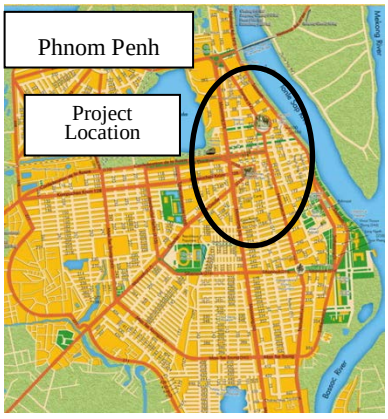
External Evaluator: Jun Totsukawa, Sano Planning Co., Ltd.

0. Summary

This project is to improve the flood control safety of Phnom Penh city, with the aim of reducing the damage caused by flood disasters through revetment work on flood protection facilities and the development of drainage facilities. This project was relevant with Cambodia's development plan and needs at the time of planning and is still relevant at the time of ex-post evaluation, therefore the relevance of the project is high. Further, from the information collected in this survey, it can be said that the project achieved the target values of numerical indicators set during the planning in regards to both "duration of flooding" and "inundation depth". Also, due to the fact that traffic congestion has been reduced and there has been a positive economic impact to the region brought about by the mitigation of inundation, the effectiveness and impact of this project is high. The target revetment work and construction of drainage facilities has completed as planned within originally planned budget and project period, thus, efficiency is evaluated high as well. On the other hand, in regards to sustainability, the Drainage and Sewerage Division (DSD) of the Department of Public Works and Transportation which is responsible for the maintenance of drainage facilities, has faced with a limited number of cleaning staff of drainage pipes and other facilities. Also, the budget has been one of challenging issues for ensuring the fully implementation of drainage cleaning until now. However, despite of challenging concerns as such, positive pictures are also observed at present such as improvement of cleaning infrastructure e.g. vacuum trucks have been brought up with other countries' assistance including Japan. Therefore, sustainability can be evaluated to be fair.

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

1. Project Description



Project Location

Revetment work

1.1 Background

The drainage and flood control facilities in Phnom Penh City had been developed and maintained during the period of French colonial rule up until the 1960s. However, during the civil war that spanned almost 20 years, starting from the 1970s, they were neglected and maintenance almost completely ceased, and the majority of facilities had deteriorated so that their functionality had significantly decreased. Therefore, during the rainy season, dikes in places such as the Tonle Sap River were annually exposed to a risk of overflow due to rising water levels and inundation brought about by inadequate drainage facilities would occur frequently across the city. As a result, while there was the obvious impact on economic activity and the living environment of citizens, there was also a growing concern over the increase in water-related disasters coinciding with the rapid population growth in Phnom Penh City. Therefore there was an urgent need for improvement measures.

With this background, following an assistance request from the Cambodian government, the Japanese government produced a comprehensive Master Plan for the flood protection and urban drainage in Phnom Penh City and suburbs through JICA between 1998 and 1999. A basic design study for the emergency projects proposed in this Master Plan was implemented in 2001 by JICA and, following a detailed design created in 2002, the "The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh" corresponding to Phase I of the project was implemented during the period of December 2002 to September 2004. It has been requested that Phase II of the project be carried out in the same manner as Phase I of the above Master Plan. Whereas in Phase I the target area of drainage improvement was the western and southern regions of Phnom Penh City, in Phase II of the project the target areas for drainage improvement were the North, Eastern and Southern parts of the City. After a survey was carried out in the requested target areas of the project and after the target areas were narrowed down, a plan and detailed design was produced and construction was started in 2007.

1.2 Project Outline

The project aims to reduce the damage caused by flooding disasters by putting in place drainage and flood control facilities in Phnom Penh City and improving the degree of flood control safety.

Grant Limit / Actual Grant Amount	2,644 million yen (Detailed Design: 49 million yen, Main: 2,595 million yen) / 2,354 million yen (Detailed Design: 49 million yen, Main: 2,305 million yen)
Exchange of Notes Date	Detailed Design: January 2007, Main: June 2007
Implementing Organizations	Phnom Penh City Department of Public Works and Transport (DPWT)
Project Completion Date	February 2010
Main Contractor	Kubota Construction Co.,Ltd
Main Consultants	CTI Engineering International Co., Ltd, Nippon Koei Co., Ltd.
Basic Design	The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (Phase II), December 2005 – November 2006
Related Projects (if any)	• The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (2002 exchange of notes signed) • The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (Phase III) (grant agreement in 2011)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa, Sano Planning Co., Ltd.

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: November 2012 - August 2013

Duration of the Field Study: December 16 - 25, 2012 and May 5 - 10, 2013

3. Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Cambodia

(At the time of planning)

In Cambodia between 2001 and 2005 in the Social-Economic Development Plan II (SEDP II), the three national goals shown below in (1) to (3) were raised.

(1) Sustainable economic development in a wide range of fields that provides a break from poverty.
(2) Socio-cultural Development through the equal distribution of health care, education, etc.
(3) Sound environmental management and sustainable use of natural resources

Of these, "prevention and control of disaster" was specified as part of the strategy to achieve number (3) "sound environmental management and sustainable use of natural resources", and the aim to establish a safe town structure with no inundation and flooding was raised.

In addition, the third mandate of the Royal Government of Cambodia formed in 2004 set a "rectangular strategy" at the heart of the nation's development strategy and with a focus on "good governance" it positioned "further construction and reconstruction of infrastructure" as one aspect of this important development strategy.

Also, in Phnom Penh City the City Development Strategy (CDS), was developed in 2005 setting 2015 as a target and as part of this one of the items in the strategy section on "social infrastructure", "rehabilitation and improvement of dilapidated drainage pipes", was raised as a target issue.

It can be said from the above that the project's aim to contribute to disaster prevention, drainage improvement and flood protection in Phnom Penh City, is an approach that is consistent with the development plan of Cambodia.

(At the time of ex-post evaluation)

At the time of this ex-post evaluation the above "rectangular strategy" is moving into Phase II and while the four aspects that make up the strategy are all basically being implemented, construction of infrastructure is still regarded as one essential aspect. Currently, the National Strategic Development Plan Update 2009-2013 based on the rectangular strategy has been presented as a development plan, in which it raised the item of "irrigation management and water resources", and touted the necessity of "meeting the needs of locals in flood-prone areas and striving for infrastructure development for reducing inundation damage and flooding."

Therefore, this project was relevant with Cambodia's development plan at the time of planning

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] 3: High, 2: Fair, 1: Low

and is still regarded as key issues even at the time of ex-post evaluation.

3.1.2 Relevance with the Development Needs of Cambodia

(Development needs at the time of planning)

Having originally been developed in the back marshes and natural levees on the right bank of the Mekong River, Phnom Penh City has expanded to the floodplain while establishing a ring levee in conjunction with development of the city. Therefore, although it is basically flat terrain, it also has lowlands with qualities that make it difficult to drain water that accumulates there. Therefore inundation during the rainy season occurs at various locations throughout the city due to poor drainage which leads to a deterioration of the living environment and sanitary conditions of residents. In addition, urban areas facing the Tonle Sap River and Mekong River are in a constant state of discord because of the risk of flooding due to the rising water of these two rivers, and there is the serious problem of preserving the functionality of the capital during times of flood.

The drainage and flood control facilities in Phnom Penh City had been developed and maintained during the period of French colonial rule up until the 1960s. However, during the civil war that spanned almost 20 years, from the 1970s up until 1991, they were neglected and maintenance almost completely ceased, and the majority of facilities had deteriorated so that their functionality had significantly decreased.

From the above, improvement of drainage and flood control facilities in the city is, from the view of preserving the functionality of the capital and conserving the living and hygiene environment of citizens, recognized as an important issue to be addressed as soon as possible.

From the above, the project can be evaluated as being relevant with the development needs of the target areas.

(Development needs at the time of ex-post evaluation)

Phnom Penh has until now been working to improve its drainage and flood protection including this project. However, there are still many facilities in the city that require rehabilitation and improvement.

The Phnom Penh City Department of Public Works and Transport (hereinafter referred to as the DPWT), as well as other relevant local authorities have laid an annual average of about 20 km of new drainage pipe in Phnom Penh City since 2007. However, although such efforts have been made, there still remain markedly decrepit drainage pipes in the city. The efforts to reduce or mitigate damages of inundation are still in the developing stage.

Table 1: Length of Newly Laid Drainage Pipe in Phnom Penh City

(m)

Pipe/Year	2008	2009	2010	2011	2012
Newly laid	29,586	33,956	8,479	3,343	3,429
Total extension	420,638	454,594	463,073	466,416	469,845

Source: Material from Phnom Penh City Department of Public Works and Transport (DPWT)

Note: These figures include 4,400 meters laid by this project

In addition, the drainage plan of Phnom Penh City has been promoted on the basis of the Master Plan by JICA created in 1999.

Table 2: Relationship of this project to the Master Plan

Master Plan contents	Phase	Scope of the Project
Sap River section revetment	Phase 2	Only repair of damaged places
Reinforcement of Tumpun and Kop Srov ring levee	Phase 1	Only Tumpun embankment
Tumpun basin drainage improvement	Phase 1	Only downstream of major drainage facilities
Trabek basin drainage improvement	Phase 2	Only the Northeast
Drainage improvement to northern part of city	Phase 2	Only Wat Phnom Area
Eastern Pochentong basin drainage improvement	Out of the scope of the project	-
Northeast, northwest basin drainage improvement	Phase 1	Only Svay Pak Drainage Sluiceway

Source: Preparatory Survey Report on the Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (Phase III) in Cambodia

Note: Drainage improvement projects carried out through the grant aid of Japan have not been referred to as phases 1, 2, and 3 formally, however the term “phase” was used amongst the related parties to distinguish each work. Therefore they are referred to as “phases” in the above table as well as below.

As shown in the table above, the contents of Phase 2, which is this project, corresponds to the three items represented in the shaded regions and components of the Master Plan. However, project target areas shown in the inner right column of the Table merely cover a part of the Master Plan and are not intended to be covering the entire Master Plan region (It should be noted, Phase 3, currently being conducted, is also intended for some areas in the table).

Since the Master Plan was created in 1999, there are significant aspects that can be seen that do not meet the reality of the rapid development of Phnom Penh City. In particular, due to the expansion in urban areas great changes have occurred in land use and residential areas have been developed in areas not studied in the Master Plan. These include places that served as a buffer against flooding such as reclaimed lakes, ponds or wetlands. Therefore, a new drainage Master Plan is currently being planned to make for Phnom Penh City.

In this way Phnom Penh City is faced with the need to improve drainage not only for the previous city center but also in accordance with the expansion of the new city, therefore, it can be said that development needs are higher than ever before.

In addition, flood protection in the form of revetment measures are also still an important issue, and its necessity is still high. The Cambodia side itself has implemented revetment work on the opposite side of the project area since 2011,, apparently showing that the need is recognized as high.

Thus, it can be confirmed that the project is aligned with the development needs of the government and the target areas at that time of planning and this ex-post evaluation.

3.1.3 Relevance with Japan's ODA Policy

Japan's Country Assistance Plan for Cambodia (2002), fixing poverty reduction and sustainable economic growth as the biggest theme, sought to develop human resources for addressing the serious shortage of skilled workers, restructure battered institutions and develop the essential infrastructure left destroyed by the country's protracted civil war. In other words it focused on realizing support balanced on both hardware and software perspectives.

The plan has set four challenges for emphasis, one of which is; "strengthening of social and economic infrastructure and environmental improvement for economic growth". In this regard, the plan clearly shows "because massive flooding occurs in the Mekong River Basin, there is a necessity for attention to be focused on disaster-resistant infrastructure development".

From these, the project's goal to maintain the drainage and flood control facilities of Phnom Penh City can be evaluated as being relevant with Japan's ODA policy.

In light of the above, 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[3] (Rating: ③)

3.2.1 Quantitative Effects

Quantitative effects of the project were composed of three major fields, and each was

[3] Sub-rating for Effectiveness is to be put with consideration of Impact.

implemented as follows.

(Flood protection)

The quantitative effect of the project has been determined as “highest water level of the Mekong and Tonle Sap rivers, which corresponds to about 30-year probability of planning scale, does not overtop the dike without any damages”. At the time of this ex-post evaluation, there is no conspicuous damage to revetment facilities. In addition, since the completion of revetment work, overtopping and dike breaks have not occurred which means floods have been prevented suggesting that the target effects have been secured.

(Inundation reduction)

Regular monitoring of the duration and depth of inundation has not been implemented. Therefore, in this ex-post evaluation the extent of damage mitigation was determined through responses of residents to a beneficiary survey[4]. The results are shown in the table below and it can be evaluated that there have been reductions in both the duration and depth of inundation and that the target values have been achieved[5].

Table 3: Achievement State of Quantitative Effects (Inundation Reduction)

At time of planning (2005)		Target value after completion		At the time of ex-post evaluation *Average value of the beneficiary survey answers to flooding during the rainy season during 2012	
Inundation depth: Maximum 60cm	Duration: longest 12 hours	Inundation depth: 20cm or below	Duration: 1-2 hours or less	Inundation depth: 18cm	Duration: 0.91 hours

Source: Results of surveys of beneficiaries

Note: Made up from three areas of Wat Phnom Area, Central Market Area, and Royal Palace & National Museum Area (a total of 100 people). The three target areas of these are important areas that are located in the commercial center.

[4] The beneficiary survey was implemented in January 2013 targeting 80 store owners in Wat Phnom Area, Central Market Area, and Royal Palace & National Museum Area, as well as 20 company employees in the areas, totaling 100 people. The store owners are local residents since basically they live in the premises of the target stores.

[5] The beneficiary survey result in the table is based on the responses subject to the rainy season during 2012. According to the responses to the same question for 2011, the year when a heavy rain of 10-year probability occurs, the average value was 29.2cm.

(River environmental improvement)

In this project, setting up a new intercepting sewer so that sewage is no longer discharged to the Tonle Sap River during fine weather thereby improving the river's environment was listed as a goal. Published reference values from the time and numerical targets are shown in the table below.

Table 4: Achievement State of Quantitative Effects (River Environmental Improvement)

Item	Standard Value	Target Value (After implementation: 2010)	At the time of ex-post evaluation (2013)
Sewage discharge amount (m3/day)	9,000	0	0 (Judged to be basically 0)
Discharge BOD5 amount (kg/day)	900	0	0 (same as above)

Source: Material provided by JICA (Reference and target values)

Note: The reference value is the BOD5 amount and the amount of sewage discharge based on population estimates of 2010.

In the time of the ex-post evaluation, it can be evaluated by the construction of a new interceptor, sewage discharged into the Tonle Sap is basically no longer occurring in southern Wat Phnom during fine weather and the environment of the river was improved compared to the previous recorded levels. However, in the interpretation of this indicator, it is necessary to pay attention to the following points.

The mechanisms of the intended river environment improvement of this indicator are outlined below.

Before implementation of this project, all drainage in the target area had been discharged into the Tonle Sap River regardless of whether it was rainy or fine weather. After implementation of this project, through the laying of an interceptor, in fine weather, it will not be discharged into the place it has been released so far, but transported through the Trabek main canal to Trabek Pumping Station in the city south and be pumped out into wetlands (by the way, it has been released into the Tonle Sap river during rainy season as usual, but this is as the project intended).

Currently, there is no sewage treatment plant in Phnom Penh City. This way of leaving treatment to the purification effect of water plants in wetlands has become the best way to reduce the load on the river environment at present.

The Trabek pump drainage location is not in the Tonle Sap River but falls on the Bassac River, therefore the goal of "ending discharge to the Tonle Sap River, and improving the river environment" can be said to have essentially been achieved.

The reason we have used the term "essentially" here is that there are scattered cases of waste water overflowing the height of the interceptor in the No. 4 underground reservoir and then being discharged into the Tonle Sap River even in fine weather (eyewitness reports of December 2012 by the evaluator). The amount of wastewater is not a particularly large amount (just during peak flow time), but strictly speaking it means that there is an amount flowing into the Tonle Sap River, and therefore the expression "essentially" has been used. Incidentally, the cause of the overflow is believed to be related to the silt accumulated in existing pipes and out of a view to maintaining the future effects of the project this fact has been described in the sustainability section.

3.2.2 Qualitative Effects

In this ex-post evaluation, the effect qualitative characteristics can be confirmed and these impacts are outlined below (no assumed qualitative effects at the time of planning).

3.3 Impact

3.3.1 Intended Impacts

Implementation of this project has caused the following impacts.

(Economic effects)

The beneficiary survey shows recognition of effects related to economy as follow:

The major answers indicated that economic opportunities have been increased by longer business hours. It seems that effects such as "reduced damage to goods by inundation" and "elimination of interruption of economic activities such as purchase work" are confirmed.

Table 5: Economic Effects Confirmed

Item	% of respondents
Extended possible business hours (Days) for shops.	68.7 %
Amount of products wasted due to inundation has decreased (reduction in products unable to be sold due to submersion or spoilage)	41.8 %
Decrease in damages to furniture, shelves etc. in stores due to inundation which can render them unusable, cause lingering odors and so on.	9.0 %
Cease of interruptions to activities such as stocking operations (cease obstructions to those going to purchase goods or intermediate wholesalers bringing in goods)	32.8 %
Decreases in foul odors seeping from leakages in underground drainage	55.2 %
Increased visitors (Because there are no visitors at times of flood)	28.4 %

Source: Results of surveys of beneficiaries

Note: From multiple responses of 67 (out of 80) shop people who answered "flood damage has been reduced".

(Sanitation improvement)

In regards to sanitation improvements due to reductions in flood damage, the recognized effects are shown in the table below.

Table 6: Comparison to number of infections in homes that occurred after flooding

	Extremely reduced	Reduced	No real change	Slight increase	Increased	Don't know	Total
No of response	19	50	8	0	3	0	80
%	24%	62%	10%	0%	4%	0%	100%

Source: Results of surveys of beneficiaries

Note: 80 shop people residing in the target areas were questioned.

Of the people questioned, among the 69 who answered, "extremely reduced" or "reduced", most pointed out decreases in common colds (45 people), skin diseases (37 people) and diarrhea (29 people).

(Effects of reduced travel time)

The majority of people answered that reduction in the lengths of inundation had improved traffic congestion compared to in the past. However, because the number of bikes and vehicles is rapidly increasing in Phnom Penh City, it is also a fact that recognition of the mitigating effect is difficult to determine due to an increase in absolute traffic volume. That said, if we take into account the fact that until now flooding would reach up to the knees, last up to a few hours, and stop road traffic completely, it can be said that improvements in traffic congestion and shortening of transit times have been clearly realized.

Table 7: Recognition of improved traffic congestion at times of flooding

	Extremely improved	Improved	No real change	Slightly worsened	Worsened	Don't know	Total
Stores	11	49	7	4	9	0	80
Companies	4	6	8	1	0	1	20
Total	15	55	15	5	9	1	100
%	15%	55%	15%	5%	9%	1%	100%

Source: Results of surveys of beneficiaries

3.3.2 Other Impacts

(Impact on the natural environment)

The environmental monitoring plan and environmental impact mitigation plan were implemented as scheduled.

At the time of revetment work and construction of the underground reservoir for the Tonle Sap river, in order to prevent third party injury on the river side of the road parallel to the river bank and to reduce the noise and dust generated by construction, installation of construction fences was implemented. In addition, in the implementation of the monitoring plan, a system was arranged of weekly meetings where the three parties of Cambodian side, contractors and consultants met and the results of work observations reported. In addition, meeting minutes were shared among the participants as a record. Furthermore, in addition to these meetings, safety patrols were performed weekly and confirmations of construction location safety and environmental impacts were made. Information sharing on patrol checkpoints as well as improvements was carried out through the meetings and minutes. Overall, it was confirmed that there were no negative impacts to the natural environment caused by the construction of this project.

(Land acquisition and resettlement)

No occurrence of land acquisition nor resettlement.

(Other indirect effects)

1) Tourist attraction effect

In the perceptions of more than half of regional shops and residents, it was recognized that flood damage mitigation contributed to a certain extent to the increase in domestic and foreign tourists.

Table 8: Recognition of the role flood damage mitigation played in the increase in tourists

	Very large	Somewhat Large	Not really related	Had a negative effect	Don't know	Total
Stores	33	28	1	0	18	80
Companies	9	9	2	0	0	20
Total	42	37	3	0	18	100
%	42%	37%	3%	0%	18%	100%

Source: Results of surveys of beneficiaries

2) Aesthetic effect

Survey respondents expressed the opinion that the landscape around Tonle Sap River has been

improved considerably by green belt development of the river carried out alongside the laying of drainage facilities and revetment work.

Table 9: Recognition of the landscape change to Tonle Sap River

	Extremely improved	Improved	Not really change	Slightly Worsened	Worsened	Don't know	Total
Stores	38	32	5	0	1	4	80
Companies	10	4	4	1	1	0	20
Total	48	36	9	1	2	4	100
%	48%	36%	9%	1%	2%	4%	100%

Source: Results of surveys of beneficiaries

In light of the above, this project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

In this project, because there was a route change during the laying of the interceptor pipe and part of the drainage pipe, a small difference occurred in the total length, but construction of the facility itself was carried out as planned. Also, revetment work for flood protection was done as planned. Planned and actual values are compared as the table below.

Table 10: Comparison of planned and actual flood defenses

Area name	Facility	Plan	Actual
ChaktoMukh Theater Revetment	Revetment work	70 m	Same
Old Market East Revetment	Revetment work	260 m	Same

Source: Provided materials by JICA

Table 11: Interceptor pipe laying and drainage improvement

Area name	Facility	Plan	Actual
Wat Phnom Area	Drainage pipe	1,115 m	1,104 m
	Side Ditch	320 m	Same
Central Market Area	Drainage pipe	2,216 m	2,218 m
	Pumping Station	2 stations	Same
	Reservoir	2 stations	Same
Royal Palace & National Museum Area	Drainage Pipe	726 m	767 m
	Pumping Station	2 stations	Same
	Reservoir	2 stations	Same
Along the Tonle Sap River	Interceptor Pipe	1,818 m	1,518 m

Source: Provided materials by JICA

Changes in the drainage pipe were a result of making changes to the pipe line shape due to a need to avoid buried structures. In addition, the total length of the interceptor pipe was 1,518 m. This was also due to changes in the pipe line shape but proved to have a positive effect as it enabled a reduction in the bent portion of the pipeline and, as a result, the flow of the interceptor pipe became even smoother.

In addition, drainage pipe laid in this project are large scale tubes with tube diameters ranging from between 1,000 mm to 1,800 mm and thus the flow rate is very large compared to pipes with average tube diameters. Thus, the large effect of drainage improvement has been noted (including the new drain pipe shown in Table 1, the scale of most are 600mm or less).

3.4.2 Project Inputs

3.4.2.1 Project Cost

Given below are the planned and actual project costs of this project. The project cost was lower than planned.

Table 12: Planned and Actual Project Costs

	Japan side:			Cambodia side:	Total project cost To Japan and Cambodia
Plan	Detailed design	Main	Subtotal		
	49 million yen	2,595 million yen	2,644 million yen	3.8 million yen	2,647 million yen
Actual	49 million yen	2,305 million yen	2,354 million yen (89.0% compared to the planned value)	3.9 million yen (102.6% compared to the planned value)	2,357 million yen (89.0% compared to the planned value)

Source: Provided materials by JICA and the Phnom Penh Department of Public Works and Transport (DPWT)

Primarily as a result of the fact that the main construction bid amount was lower than initially estimated, the project cost of the Japan side was within the estimated amount. On the other hand, while the burden on the Cambodian side was almost as expected, the distance of electricity cable extension was slightly longer than planned, and therefore the estimated amount was exceeded slightly.

3.4.2.2 Project Period

The Project period including detail design and construction was mostly as planned.

Table 12: Planned and Actual Project Period

Materials	Planned Period	Actual Period
Entire project	37.5 months in total	37.2 months in total :99% compared to the planned value

Source: Provided materials by JICA

Both project cost and project period were within the plan, therefore efficiency of the project is high.

3.5 Sustainability (Rating: ②)

In order to take advantage of the facilities established in this project and sustain their desired effects in the future there is a need for the following points to be improved. To put it another way, because they are important requirements to ensure the sustainability of the project's facilities, by first clarifying these points, it is assumed that the sustainability of the project will be addressed.

1. The need for cleaning and periodic inspection of existing pipes

Currently, refuse has accumulated in the existing pipes that are connected to the new drainage

pipes of this project which results in silt and garbage flowing from the existing pipes into the new pipes of this project. So far, even if refuse flows into the new pipe it doesn't cause a serious hindrance to the flow rate due to its large capacity. However, if this situation continues, the flow rate of the new pipe will be limited and it will have a negative impact on drainage function.

In fact, in regards to the mentioned impact on effectiveness, silt accumulation has continued in the No. 4 underground reservoir, and incidents of overflow from the interceptor pipe have already occurred[6].

In future, it will be necessary for the DPWT, particularly those responsible for actual cleaning within the Drainage and Sewage Division (referred to below as DSD), to carry out cleaning of existing pipes which adheres to a cleaning plan created through careful consideration of the results of regular inspections of drainage pipes.

2. Further reduction of refuse inflow flowing into the underground reservoir screen pit ~ Need for enlightenment of residents

In order to prevent refuse from entering the underground reservoir a screen pit (grating) has been installed. However, during heavy rain, incidents of considerable amounts of waste accumulating on the trash screen are expected to occur. If the trash screen is blocked by refuse the pump in the underground reservoir may not run in full capacity and drainage may become less effective.

To prevent this situation, in addition to performing regular inspections and cleaning of drainage pipe networks, to stop the dumping of waste into roadside gutters and so on it is necessary to promote resident awareness. At the same time it is also necessary to carry out services improvements on private companies doing garbage collection in the city. In order to prevent trash from flowing into gutters etc., it is important to implement shorter holiday periods in the festival week and ensure regular garbage collection work as well as strengthen the garbage collection services.

Along with the simultaneous improvement of the above situation, it can be considered that effective utilization of the project facilities is persisting.

In addition to the points described above, below are the outlines of the sustainability of the project's facilities in operational and maintenance aspects.

3.5.1 Institutional Aspects of Operation and Maintenance

(Drainage facilities)

Staffing for the project facility is as shown in the table below. It can be said that, as the number of assigned staff has quite generously exceeded the number proposed during planning, that the situation is adequate for carrying out operation and maintenance of the project facilities.

[6] From eye-witness accounts in December 2012. Following this, in March and February 2013, cleaning of the underground reservoir and drainage pipes laid out in this project was carried out by the DPWT. Thus it can be assumed that the subsequent circumstances have improved.

Table 13: Placement number of personnel in the project drainage facilities

(people)

	Proposed Number	Actual Number
Pumping Station No 1	3	4
Pumping Station No 2 (concurrently acting as No 3)	3	6
Pumping Station No 4	3	4
Pumping Station No 5	3	4
Underground Reservoir	10	10

Source: Material from Phnom Penh Department of Public Works and Transport (DPWT)

On the one hand, for cleaning the existing drainage pipe there are 24 personnel belonging to the DSD "drainage pipes cleaning section". However, in order to clean the existing pipes throughout the city, including the target area, the present 24 people will be insufficient and the DSD estimates that about 90 or so people will be required.

In addition, 2 high-pressure washing cars and 2 vacuum trucks have been provided in the third phase of this project and these vehicles are expected to improve the efficiency of cleaning work (which will also have the positive effect to the shortage of workers)[7].

Cleaning of the screen pit can be corresponded with many of the personnel of DSD together, in view of its importance and in its emergency until now. It can be said that the current number of staffs can somehow deal with screen pit cleaning with hand in hand.

(Revetment work)

Currently, the River Bank Division is staffed by four people. Since revetments do not require frequent inspection, the repair work and maintenance management staffing for this project is currently not a concern. As for the revetment cleansing work, it has been delegated to the District to carry out this work.

In general, if the facilities of this project themselves are verified, in general there is no problem in the current system, but it is necessary to enhance the personnel structure related to cleaning in order to continue the project's effects[8].

[7] In addition, in recent years, four vacuum trucks have been granted by France and two by Vietnam and therefore the number of vacuum trucks is becoming quite substantial.

[8] Enlightenment of residents in relation to garbage disposal has been carried out on occasion by the Ministry of Tourism and the Department of Environment of the Phnom Penh government. In addition, with support from the JICA office, the DPWT is also initiating seminars to provide information to the media (an effort stemming from the idea that it is essential to be understood by the media such TV, newspapers, etc. which disseminate information).

3.5.2 Technical Aspects of Operation and Maintenance

(Drainage facilities)

The installation of the facilities and equipment regularly used by the DPWT in this project as well as their primary maintenance work such as inspection and regular cleaning does not demand a particularly high level technical knowledge. For that matter, because it is for tasks such as cleaning, it is not particularly necessary to hold in-house training courses or the like.

However, once again, in view of the above stated need for cleaning work on existing pipes, the formulation of cleaning plans is required for steady implementation and maintenance as well as other related improvements as "techniques". Currently, the DSD has created a yearly cleaning work plan, but this merely indicates the planned figures of cleaning work distance and stops short of outlining plans for inspection work etc. There is also the fact that the monthly plan is insufficient and, despite all the DSD's efforts, delays have been occurring in cleaning work. Therefore, it is expected that the DSD will acquire feasible and effective planning capacities[9].

(Revetment work)

Since repairs and inspection do not occur frequently in revetment, fundamentally, cleaning services are the principle operations and do not require advanced technology. Further, maintenance rules for revetments have been developed and carrying out inspections in emergency situations (such as heavy rainfall) has become possible.

3.5.3 Financial Aspects of Operation and Maintenance

Expenditure items by DSD that are required to maintain the sewage and drainage facilities, included those established in this project, are shown in the table below. Expenditure for these items has continued to decline over the past three years from 2011-2009. Though there was visible improvement in 2012, the situation has still not reached the levels of 2009.

On the one hand Phnom Penh City can finance the maintenance costs of sewage and drainage facilities through assigning 10% of the city's water supply rates revenue, however, this decision is left to the internal departments of the city government and this allocated amount of 10% merely indicates the upper limit. It is estimated that water supply revenue has been increasing every year, though, this survey could not ascertain if its allocation amount has exceeded its 10% assignment or not.

[9] In regards to this point, through incorporating the soft component in the third phase of this project, technical assistance for cleaning planning is currently being undertaken at the time of this ex-post evaluation. It is expected that through the activities of this component DSD officials will improve practical skills for cleaning planning. Over the medium to long term the development of one-year plan and five-year plans will be implemented.

Table 14: Expenditure breakdown of DSD sewage and drainage facility maintenance (million Riel)

	2009	2010	2011	2012
Drainage pipe cleaning	321.48	438.05	732.98	682.02
Drainage pipe repair	265.91	297.73	162.02	179.02
Pump station repair	253.67	0	0	171.00
Regulating reservoir cleaning and maintenance	672.17	0	0	265.74
Total	1,513.23	735.78	895.00	1,297.78

Source: Material from Phnom Penh Department of Public Works and Transport (DPWT)
Note: USD1 = KHR 4,100

However, according to the DSD, which is responsible for the operation of the pumping station, it can be said that there has been no cases in which the pump was unable to be run due to budgetary shortfalls in electricity or diesel costs, and in terms of operation there are no large financial concerns.

In addition, there is no regular expenditure required for revetment work, so from a financial perspective, in the short to medium term revetments are not seen as concerns threatening the sustainability of the project.

[Reference]

The following shows estimates of the degree to which the DSDs actual expenditures can cover the required cleaning tasks (basic design study calculations applied as the basis[10]).

- Necessary amount for drainage pipe cleaning work under DSD jurisdiction:
  About USD 777,400 / year
- Actual amounts assigned to drainage pipe cleaning work under DSD jurisdiction:
  About USD 178,800 (2011 results) > Equivalent to about 22 percent of the amount required
  * In addition, districts administration also conduct cleaning works of drainage pipes.

Currently, it can be expected that the effect of materials and equipment such as sludge vacuum trucks will reduce the required amount for cleaning tasks calculated above based on labor costs. However, it has to be judged that there is still a gap between the required amount and the actual result at a certain level.

[10] USD5 / m set as pipe cleaning costs.

3.5.4 Current Status of Operation and Maintenance

Currently, a little over two and a half years have passed since completion of the project facilities and there have not been any occurrences of damage or failure. As mentioned in the above system section, the Cambodia side is staffing the project facilities in accordance with the recommendations.

In terms of actual results, the cleaning of underground reservoirs in four locations, in accordance with the recommendations of this project, is being carried out prior to the rainy season every year. In addition, the submersible motor pump is only lowered into the water at times when the water level of the Tonle Sap River has risen, in line with the manual.

In addition, there is no current record of spare parts being purchased so far, but should the need occur, the purchase is possible through an agent in Cambodia.

However, as mentioned repeatedly, in order to continue the effective use of drainage it is necessary to implement even more regular and systematic cleaning work and inspections.

Overall, concerning the sustainability of this project, 1) the number of cleaning staff, 2) capacity for cleaning plan development as well as plan compliance (including inspection work), 3) the budget, including the cleaning work, are essential points. Within this, technical guidance is being performed using phase 3 soft components for 1) and 2), and, in conjunction with introduction of vehicle equipment such as sludge vacuum vehicles, etc., it is expected that increased efficiency of cleaning work. On the other hand, although there are uncertain areas in regards to 3), the outlook for the budget has a larger advantage in terms of the possibility of securing budget allocation from Phnom Penh city water supply rates, comparing with other types of public works where there are no expectations of funds at all.

From the above, some problems have been observed in terms of structural, technical and financial aspects, therefore sustainability is fair. It, however, should be noted that activities to enhance its sustainability are being carried out actively as of ex-post evaluation period and as a result the prospects for improvements in the future are hopeful.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is to improve the flood control safety of Phnom Penh city, with the aim of reducing the damage caused by flood disasters through revetment work on flood protection facilities and the development of drainage facilities. This project was relevant with Cambodia’s development plan and needs at the time of planning and is still relevant at the time of ex-post evaluation, therefore the relevance of the project is high. Further, from the information collected in this survey, it can be said that the project achieved the target values of numerical indicators set during the planning in regards to both "duration of flooding" and "inundation depth". Also, due to the fact that traffic congestion

has been reduced and there has been a positive economic impact to the region brought about by the mitigation of inundation, the effectiveness and impact of this project is high. The target revetment work and construction of drainage facilities has completed as planned within originally planned budget and project period, thus, efficiency is evaluated high as well. On the other hand, in regards to sustainability, the Drainage and Sewerage Division of the Department of Public Works and Transportation which is responsible for the maintenance of drainage facilities, has faced with a limited number of cleaning staff of drainage pipes and other facilities. Also, the budget has been one of challenging issues for ensuring the fully implementation of drainage cleaning until now. However, despite of challenging concerns as such, positive pictures are also observed at present such as improvement of cleaning infrastructure e.g. vacuum trucks have been brought up with other countries' assistance including Japan. Therefore, sustainability can be evaluated to be fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

In order for effective long-term utilization of drainage facilities built in this project, cleaning work on a regular basis with a focus on existing pipes is required. To that end 4 points are required; (1) development of feasible and effective cleaning plans, (2) increasing of the number of cleaning workers based on this plan, (3) effective use of equipment such as high-pressure washing cars and sludge vacuum vehicles, etc., (4) resident awareness about proper waste disposal.

Currently, while receiving cleaning plan capacity building support from the soft component in phase 3, enhancement of cleaning equipment and the effort to carry out complete cleaning of laid target pipes in March and February of 2013 are points that warrant special mention, further efforts from the DPWT are expected for in the future in terms of points (1) to (4) mentioned above.

As for Phnom Penh Capital Hall, allocation of money to cover the maintenance of drainage facilities from water supply charges is an inhibition factor to the implementation of necessary on-site cleaning work and it is recommended that, in view of the current situation, that the current allocation amount be increased.

4.2.2 Recommendations to JICA

For awareness-raising campaigns about residents' garbage disposal, the continuation of indirect support to drive the campaign making effective use of ongoing Phase 3 timing is recommended.

4.3 Lessons Learned

It was recognized from the time of planning, that both the Japanese side and Cambodian side were insufficient for cleaning the existing pipes in this project. However, while the cleaning results still do

not meet the required level, influence has been seen in the effects of this project in terms of achievement level. In light of the above, at the planning stage, it is necessary to confirm if the recipient government actually developed more detailed cleaning plans, structures and cleaning performances. Then, it is crucial to encourage the recipient government for making necessary counteractions and improvement of organizational structure/system.

Kingdom of Cambodia

Freshwater Aquaculture Improvement and Extension Project

External Evaluator: Machi KANEKO, Earth and Human Corporation

0. Summary

This Project was planned when the Cambodian government was working for aquaculture promotion that would contribute to nutritional improvement and poverty reduction for rural residents. The four Southern provinces of the project target are located distant from major freshwater fisheries such as the Tonle Sap and the Mekong River. Also, in these rural areas, freshwater fisheries had not been common practice among small-scale farmers. Given these circumstances, the Project, which aimed at extending aquaculture and increasing freshwater-cultured fish production, is considered to have been consistent with policy objectives of the Cambodian government and development needs of the country.

While the number of small-scale aquaculture farmers has increased from 2,000 prior to the project implementation to 9,000, more than doubling of the project objective targeted 4,400. Furthermore, the aquaculture production in the target provinces has increased by 165% during the project implementation, achieving more than the overall goal indicator. Given that these outcomes have positively turned out as planned, effectiveness and impact of the Project are evaluated to be high.

In terms of the cost and period, the Project has been implemented as planned, and therefore, the efficiency is evaluated to be high.

The sustainability of the Project is considered to be high as the existing system and policies in the country are supportive. The ongoing national development policies emphasize that the aquaculture development shall play a crucial role to improve management, preservation and development of marine resources. Also, the target areas are suitable in extending aquaculture, given its natural environment, a food culture, the localities and a lifestyle of people. In fact, seed-producing farmers, trained by extension officers, have been transferring their technologies to small-scale farmers through sales of their seeds. This step-by-step technical transfer among farmers has been retained after the project completion, and therefore, the sustainability of the Project is considered to be high in terms of technical feasibility. As for financial sustainability, the ex-post evaluation study has observed seed-producing farmers have continued their activities, using their network. Thus, aquaculture has gained a solid ground for its technological extension, which allows Fisheries Administration (FiA) to manage at lower cost. Given these circumstances, the sustainability of the Project is considered to be high.

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

1. Project Description

Project Location
(Target areas: Provinces of Kampong Speu, Kampot, Takeo and Prey Veng)

Lower left: An aquaculture pond of a small-scale farmer
Upper right: Silver barb raised by the Project (good-tasting fish favored by local residents)

1.1 Background

In Kingdom of Cambodia (hereinafter referred to as "Cambodia"), approximately 80% of its labor force engage in the fishery, agriculture and forestry industry, and of these, people largely subsist on agriculture, mainly rice cultivation. Since 1995, although the country has attained self-sufficiency of rice, which is its staple food, the productivity is lower compared to that of neighboring countries. This is one of the factors that have trapped people in chronic poverty. To address poverty reduction and food security, the Cambodian government has been working for an increase and diversification of agricultural production.

Cambodia has the world's fourth largest fisheries production in inland fisheries, and annual fish consumption per capita is as much as 52.4 kg (2007), which provides the Cambodian people with 75% of their animal protein intake. However, poor infrastructure has limited supply of marine products in rural areas distant from the Tonle Sap and the Mekong River. Accordingly, for these areas, low-input aquaculture development using rice field and seasonal temporary reservoirs has been increasingly considered to better fit the local needs. In the rural areas, having no experience of aquaculture, lack of the know-how and seeds has hindered farmers from starting the practice.

Given these backgrounds, the Cambodian government had requested Japan for technical cooperation to technologically improve small-scale aquaculture and promote its extension, targeting Southern four provinces (Prey Veng, Takeo, Kampong Speu, and Kampot). Upon this request, Japan International Cooperation Agency (JICA) had started "Freshwater Aquaculture Improvement and Extension Project[1]" to disseminate small-scale aquaculture. Started in February 2005, this five-year Project had been implemented by a counterpart agency, Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries of Cambodia.

[1] This technical cooperation project was implemented as a Request-responding project (Type A).

1.2 Project Outline

Overall Goal		Aquaculture production in target provinces is increased.
Project Purpose		Small-scale aquaculture technologies are extended largely in target provinces.
Outputs	Output 1	Seed producing farmers are trained among existing small-scale fish farmers by improving their aquaculture technologies.
	Output 2	Small-scale aquaculture technologies and its extension methods are improved.
	Output 3	Promotion of aquaculture activities that benefit poor farmers in the project area
	Output 4	An aquaculture extension network in rural area is developed.
Inputs		Japan side: 1. Dispatch of Experts 11 Japanese experts, 164.9MM in total 8 Third-country experts, 10.3MM in total (Indonesia, Vietnam, India and Nepal) 2. 7 trainees for training in Japan 3. 77 trainees for Third-country training 4. 26 million yen for provision of equipment 5. 20 million yen for facility development Cambodia side: 1. Counterpart staffing (39 members at the time of a mid-term evaluation, and 37 at the time of a terminal evaluation) 2. Land, facilities, project office, Bati seed production facility, local FiA office in the target provinces, and utilities 3. Local cost and salaries for counterpart staff
Project Cost		513 million yen
Cooperation period		February 2005 - February 2010
Implementing Agency		Fisheries Administration (FiA)
Cooperation Agencies in Japan		Saitama Prefecture Fisheries Laboratory at Research Center for Agriculture and Forestry Tokyo University of Marine Science and Technology
Related Project		Technical Cooperation Project: Technical Cooperation Project: Freshwater Aquaculture Improvement and Extension Project (Phase 2) (March 2011-February 2015)

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement of Overall Goal

The attainment of the overall goal was assessed by an indicator that “aquaculture production of target provinces is increased by 1.5 times.” According to agricultural statistics provided by the Ministry of Agriculture, Forestry and Fisheries of Cambodia and FiA’s statistics, a terminal evaluation study revealed the indicator of the overall goal was achieved

during the Project implementation. Specifically, as indicated in Table 1 below, the aquaculture production by small-scale farmers in the four target provinces increased from 1,390 tons in 2004 prior to the project implementation to 2,294 tons in 2008. This is an increase of 165%, exceeding the 150% indicator set for the overall goal. In accordance with such positive project outcome, the number of aquaculture farmers has also been increasing. It is thus anticipated that the aquaculture production would be more likely to increase after 2009 onwards.

Table 1: Aquaculture production by small-scale farmers in 4 target provinces

(unit: ton)

Province / Annual	Kampot	Kampong Speu	Prey Veng	Takeo	Total
2004	25	40	510	815	1,390
2005	50	110	600	800	1,560
2006	90	163	845	950	2,048
2007	114	208	850	1,000	2,172
2008	158	287	830	1,019	2,294

Source: Terminal Evaluation Report of this Project (December 2009)

1.3.2 Achievement of Project Objective

Attainment of the project purpose was assessed by an indicator that the number of small-scale fish farmers is increased from existing 2,000 households to 4,400 in the target four provinces. At the end of FY2008 when the Project was half implemented, about 6,000 households have already started aquaculture as a result of its effort to transfer the technique. This was largely made possible by a farmer-to-farmer training in which seed-producing farmers provide instructions to small-scale farmers. The number of aquaculture farmers at the time of project completion was estimated by aggregating the number of households participating in aquaculture training and that of households purchasing seeds from seed-producing farmers. It indicates that about 9,000 households practice aquaculture led by the project activities. This far exceeds the indicator targeting 4,400 households, and thereby the project purpose is considered to have already been achieved.

1.3.3 Recommendations

The following is proposed in terminal evaluation.

(1) Strengthening a network to extend aquaculture that would contribute to sustainable development

1) Technical development of seed-producing farmers participating in the network

Using their network, seed-producing farmers can develop their production techniques by

interchanging their parent fish or know-how. It is thus recommended experts and regional extension officers provide them with continuous support to enhance such alliance.

2) Supporting the farmers' network in expanding the marketing base for seed sales

The farmers' network needs to increase potential buyers by marketing seeds more strategically and by exchanging market information systematically including supply and demand trends by region and type of fish.

(2) Ensuring monitoring of propagation-related activities in community fish refuges (CFRs)

With respect to propagation in CFRs, it requires monitoring activities of the Resource Management Committee such as stocking fish in CFRs. Monitoring should assess how such propagation in CFRs possibly affects people in the surrounding communities. By extracting the best practice out of 22 CFR sites provided by the Project, better CFR management shall be shared and practiced accordingly.

(3) Documentation on farmer-to-farmer aquaculture extension system

One of the key factors that enabled rapid aquaculture extension is a farmer-to-farmer extension mechanism incorporated into the project design, which applied a three-step technology transfer. The process involved transferring techniques (1) from Japanese experts to extension officers, (2) from extension officers to seed-producing farmers, and (3) from seed-producing farmers to small-scale farmers. Thus techniques were handed down stepwise, with a geometrically increasing number of trained farmers. It is suggested the joint evaluation team keep a record of this successful experience of the Project so as to be utilized in other similar projects.

2. Outline of the Evaluation Study

2.1 External Evaluator

Machi KANEKO, Earth and Human Corporation

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: September 2012 - October 2013

Duration of the Field Study: November 30 - December 23, 2012 and May 7 - 25, 2013

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Cambodia

The Project was started when the Second Five-year Social and Economic Development Policy (2001-2005) was being implemented in Cambodia. In this policy framework, inland fisheries aquaculture using rice field and reservoirs was thought to be the key to increase fish production, and for that end it emphasized promotion of small-scale aquaculture in rural areas. In addition, freshwater fish is a ready available source of protein for the Cambodian people, which is in steady demand in the country. By using this resource, the Second Five-year Plan in Fisheries Sector (2001-2005) addressed an increase in income and improvement of health. Specifically, it targeted a 300% increase of the fish aquaculture production to meet the needs of animal protein and reduce poverty.

During the implementation of the Project through its completion, the National Strategic Development Plan (NSDP 2006-2010) had given priorities, among other things, in agricultural development, as well as an increase in agricultural production and productivity. Also, in the Rectangular Strategy which underpins the Cambodian basic development policies (agricultural development, infrastructure development, private sector growth and employment and human resource development), agricultural development constitutes one of the four sides of the strategic growth rectangles. It also emphasized fisheries, as a part of agricultural sector, needs sustainable development so that fish production can provide basic food, nutrition, income and livelihoods to people. In particular, aquaculture was considered to play a pivotal role, and therefore these policies outlined specific needs in aquaculture development, including culture ponds, rice field aquaculture, training, seed plant construction and seed-producing networking.

In the Fisheries Development Plan of Cambodia, given as the fisheries sector policy, its objectives are directed at poverty reduction, food security and sustainable and equitable use of natural resources. Within this policy framework, a strategic action plan specifies the following six key areas (1) development of policies and related laws, (2) reform of fishery rights, (3) propagation and stoking, (4) rural development tailored to localities, (5) improvement of livelihoods for poor families through sustainable use of natural resources and aquaculture promotion in rural areas, and (6) improvement of livelihoods for poor families through personnel training in postharvest treatment. Given that the Project supports rural small-scale, poor farmers in promoting their appropriate practice of aquaculture and

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low

propagation in CFRs, its objectives are consistent with (3), (4) and (5) mentioned above.

Extending low-input aquaculture technologies, the Project aimed to contribute to nutritional improvement and better livelihoods of poor residents in rural areas, and therefore it has been considered that it was consistent with the national development policies and sectorial development plans of the Cambodian government from its planning phase to completion. The ex-post evaluation study confirmed the country has still retained these objectives, and therefore the Project is considered to consistently support the ongoing Cambodian national policies.

3.1.2 Relevance with the Development Needs of Myanmar

Distant from major freshwater fisheries such as the Tonle Sap and the Mekong River, the target four Southern provinces had a limited catch and supply of natural fish. Also, the freshwater fisheries had been limited among small-scale farmers in rural areas, unable to supply an adequate amount of freshwater fish. Given low agricultural productivity due to droughts and floods, moreover, the Cambodian government had recognized inland fisheries and its extension as alternative sources of cash income and animal protein for people. It strongly desired to obtain assistance in coping with these situations, and the development needs were increasing at the time of the project planning.

Furthermore, the ex-post evaluation study confirmed fisheries and aquaculture production is increasing every year, reaching 610,000 tons in 2011 after the project completion. A catch from inland fisheries accounts for as much as 450,000 tons of the total fisheries production, leading to the world's fourth largest fish production of its kind. In Cambodia, people take 82% of animal protein from fish and processed marine products, with an annual per capita fish consumption of 52.4 kg. Most of such consumption depends on freshwater fish, which is said to represent the world's highest consumption of its kind.

Aquaculture production has been largely increased in recent years, almost doubling in 2011 compared to 2007. This reflects a rapidly growing demand of the aquaculture fish to make up for a shortage of natural fish, mainly caused by a population growth in rural areas.

The following Table 2 illustrates a change in fisheries and aquaculture production.

Table 2: A change in fisheries and aquaculture production

(unit: ton)

	Fisheries and aquaculture production	Inland fisheries catch Sea fishery catch	Aquaculture production	Aquaculture production
2007	493,760	395,000	63,000	35,260
2008	470,100	365,000	66,000	39,100
2009	515,080	390,000	75,000	50,080
2010	550,000	405,000	85,000	60,001
2011	608,000	445,000	91,000	72,000
2011/2007	123%	127%	144%	204%

Source: Fisheries Administration

Targeting rural small-scale farmers who have little experience in inland fisheries, the Project was designed to widely extend freshwater fish aquaculture. From the beginning of the Project through its completion, these areas had such development needs to be responded. In the Project target areas, small-scale farmers were compelled to live on rice cropping where irrigation system was poorly developed. Their rain-fed cultivation hinders increasing productivity, resulting in chronic poverty of these farmers. Given this situation, aquaculture promotion through the Project expected to contribute to nutritional improvement and income generation, and thereby it has been consistent with needs of small-scale farmers, who were to be final beneficiaries.

One of the emerging issues in rural areas in Cambodia is a population increase, and this has led to the necessity of diversifying income sources other than rice farming as well as securing stable food production and supply. Since aquaculture in rural areas is expected to have positive effects –nutritional improvement and generation of income--the need for aquaculture is growing even more after the completion of the Project. Moreover, the Project has successfully developed a method of extending low-input aquaculture among a large number of farmers, using their rice fields and seasonal temporary reservoirs. Given these circumstances, the Project is evaluated to be relevant with the development needs of Cambodia at the time of the ex-post evaluation.

3.1.3 Relevance with Japan's ODA Policy

The Project was planned in accordance with the framework of Japan's "Country Assistance Policies for Cambodia (February 2002). To achieve sustainable economic growth and a stable society in Cambodia, it highlights an importance of "agricultural and rural development, and agricultural production increase." As a part of its efforts to realize such objectives, the Policies aim to develop technologies of freshwater aquaculture.

Also, in JICA Country Assistance Strategy for Cambodia, a "promotion of the livestock and fisheries industries" is considered to be one of the development priorities aimed at "Agriculture and Rural Development."

In light of the above, 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 Impact[4] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Project Output

The terminal evaluation study suggests that the outputs, purposes and overall goal of the Project had been mostly achieved. Therefore, the ex-post evaluation study has assessed the degree of attainment of respective output as much as possible.

1) Output 1

Seed producing farmers are trained among existing small-scale fish farmers by improving their aquaculture technologies. (Indicator) 20 seed-producing farmers are developed and produce seeds by themselves. (Degree of attainment) Upon the project completion, 48 farmers engage in seed production, more than doubling of the target of 20 farmers, and therefore the Output 1 is achieved.

This Project had set four pilot communes in the respective four target provinces. Then, one candidate seed-producing farmer was carefully selected from each commune every year (a total of 48 farmers, given 4 provinces x 4 communes = 16 farmers and 16 farmers/year x 3 years= 48 farmers). The Project provided technical training in addition to necessary equipment of fish hatcheries (about 500US$). As a result, by 2009, 48 farmers have been able to operate seed production, using their own financial resources and learned know-how, as indicated in Table 5. However, it should be noted, at the time of the project planning, that 11 farmers had already engaged in seed production, and that existing 2,000 farmers had been practicing aquaculture. Hence, the Project supported these farmers to assume a leading role in farmer-to-farmer training.

Table 3: Change in the number of seed-producing farmers in the target 4 provinces

(Unit: household)

Province	During the project implementation				After the project completion	
	2006	2007	2008	2009	2010	2011
Takeo	4	7	10	12	13	17
Kampong Speu	4	7	10	12	14	17
Kampot	4	8	12	12	12	14
Prey Veng	4	8	12	12	13	16
Total	16	30	44	48	52	64
Number of existing seed-producing farmers	11	11	11	11	11	11
Total	27	41	55	59	63	75

Source: The Terminal Evaluation Report of this Project (2006-2009), Reference provided by FiA (2010-2011)

[4] Effectiveness should be judged in consideration of impact to determine a rating.

Selection and training of seed-producing farmers were completed in 2009, and afterwards the Project worked particularly on developing and strengthening an aquaculture extension network among seed-producing farmers. As a result, in the target four provinces where farmers used to have little aquaculture experience, seed production increased from 1.55 million fish in 2006 right after the project launch to 7.2 million (a total of 37 million country-wide) in 2008.

A seed-producing farmer in Kampot
A fish hatchery provided by the Project for artificial hatching by flowing water

The ex-post evaluation study assessed the current situations in the four target provinces about three years after the project completion, and found FiA has continued a training for seed-producing farmers, despite on a smaller scale compared to during the project implementation period. Also, the number of seed-producing farmers has increased since the project completion. More specifically, as mentioned in Table 3 above, the number of seed-producing farmers increased from 59 in 2009 (inclusive of existing 11farmers and 48 new farmers trained by the Project) to 63 in 2010, and to 75 in 2011 subsequently. This is underpinned by a continuous support provided by FiA for seed-producing farmers after the project completion. Also in the target areas the demand for seed has outreached the production, and thus FiA anticipates there would be a growing number of core farmers who wish to start seed production. An on-site interview revealed most of all the seed-producing farmers have been expanding their fish hatcheries and aquaculture facilities at their own expenses. Given these situations, seed productivity would be further increased.

Mrigal's eggs which are about to hatch (about 200,000 fish are incubated: photographed in May, 2013)

Aquaculture pond of a seed-producing farmer in Takeo
(The farmer's own investment has expanded 6 ponds in 2005 to 16 in 2012.)

Juvenile fish of Silver barb
Generally beginning in May, the production of juvenile fish starts in the rainy season, depending on the rainfall.

In the light of the above, it can be said that the Output 1 has been achieved at the time of the project completion. Also, the ex-post evaluation study has observed the amount of seed product marketed in the target areas has been increased. This is because aquaculture technologies have become widely available in the target rural areas in a post-project period. Moreover, an increasing number of farmers have started seed production, while existing seed-producing farmers have further improved their productivity (through

self-financed improvement of facilities, etc.).

According to FiA, it plans to expand the project outputs in and out of the target provinces, covering the rural areas. Under the "Framework for Strategic Plan in Fisheries in Cambodia from 2010 to 2019," revealed by FiA most recently, a target is set to achieve seed production of 150 million fish in 2015, increasing up to 250 million fish in 2019. In addition, in order to duplicate the project outputs countrywide, a JICA project, "Freshwater Aquaculture Improvement and Extension Project Phase II" is underway in other three Northern provinces. Other international agencies such as EU have provided assistance in developing seed-producing farmers.

2) Output 2

Small-scale aquaculture technologies and its extension methods are improved. (Indicator) Small-scale aquaculture technologies suitable for local conditions are developed and its extension materials are prepared. (Degree of attainment) The technologies have been improved, developed into instruction materials to be used in training. These technologies are widely applied, and therefore the Output 2 is achieved.

The Project had mainly worked for technological improvement in the first half term of the project period. It includes development of aquaculture (grow out) techniques of small-scale farmers, techniques of seed-producing farmers and propagation techniques in CFRs in each community. They have been organized in a booklet, a manual, posters and videotapes so as to be utilized in technical instruction. Distributed by extension officers and seed-producing farmers to small-scale aquaculture farmers, these materials have been a useful tool in extending aquaculture technologies.

Seed-producing farmers use these instruction materials in training small-scale aquaculture farmers.

The terminal evaluation study revealed improved technologies have been widely accepted and practiced among farmers, and that they have positive effects on a nutritional intake and income generation.

A signboard indicating a seed producer trained by the Project

The on-site interview during the ex-post evaluation study observed instruction materials provided by the Project have been still posted and used in a training of farmers in small-scale aquaculture. Also, a farmer-to-farmer technology transfer has come into effect where some seed-producing farmers trained in the Project have become an instructor; they teach incubation for core farmers of new starters as well as seed-producing farmers trying

propagation of new fish species. Such training for technology transfer is supported by the government and international development agencies.

In order to extend small-scale aquaculture, the Project has incorporated a farmer-to-farmer training through a three-step technology transfer. The process involves transferring aquaculture technologies (1) from Japanese experts to extension officers, (2) from extension officers to seed-producing farmers, and (3) from seed-producing farmers to small-scale farmers. Thus the technologies were effectively handed down stepwise, with a geometrically increasing number of trained farmers. As mentioned above, the outcome of this ex-post on-site study indicates a farmer-to-farmer technology transfer is gradually developing, given that experienced seed-producing farmers are playing a leading role to train farmers starting seed production and those farmers incubating new fish species. The successful experience is underpinned by the fact that extension of small-scale aquaculture technologies has increased farmers' profit from seed production. The beneficiary survey revealed the number of households which gained more income than three years ago was 9 out of 15, with 4 households experienced no change. However, in terms of their livelihoods, 14 out of 15 households have felt a positive change. Moreover, 14 out of 15 households have invested in their seed production after the project completion, with an average of 5 million riels (about 1300US$). All of the farmers surveyed said they wished to continue their seed production. Thus, these survey results suggest an increase in profit from seed production is an incentive for those farmers to continue aquaculture.

In light of the above, the Output 2 has been achieved. After the project completion, the instruction materials created during the project have been used in extending aquaculture technologies, and thus the project output is considered to be sustainable or even be developing.

3) Output 3

Aquaculture-related activities to benefit the poor farmers are promoted. (Indicator) Stock enhancement activities are undertaken in 20 community fish refuges (Degree of attainment) Cultivation activities carried out in 22 shared ponds in FY2009, the final fiscal year of the Project, and at project end Output 3 has been achieved.

As shown in Table 5, in the Project, as a general rule one village is selected from each of the four target provinces every year, and by FY2009 shared ponds were installed at 22 sites, shared pond management committees were established, construction carried out of link canals to rice paddies, stocking of seeds, fishing resource management awareness achieved through shared resources, and guidance performed on patrol activities by residents groups. Furthermore, up until project completion these activities were being continued on a voluntary basis by residents groups, with the management committee at its center, and fisheries resource management activities for shared ponds was taking root.

Takeo province shared pond

Table 5: The number of established shared ponds in target provinces

Fiscal Years	The number of established shared ponds
2005	4
2006	4
2007	6 (3 locations collaborating with WFP)
2008	4
2009	4
Total	22

Source: Terminal Evaluation Report of this Project

In addition, the goal of the shared pond activities of this Project outlined below are for fish in the existing ponds to be released and cultivated, then enter into rice paddies through the fish ladder and be harvested by individual farmers who cannot own their own ponds in order that they can benefit from the effects of aquaculture.Use the existing man-made ponds and natural ponds of the floodplain

- ✓ Stocking native fish
- ✓ Connecting the shared pond with the fish ladder and rice paddy
- ✓ Farmers harvest with light fishing gear at the waterway and rice paddy

In addition, a management committee was set up for shared pond management, (1) fish ladder service and maintenance, (2) stocking of native fish, and (3), along with management of fishing prohibition, resident educational activities are being carried out to ensure adherence to the rules of fishing prohibition times, fishing prohibited areas, prohibition on particular fishing gear, prohibition on discarded garbage etc. The committee activities are voluntary, but because the majority of rule violations are committed not by locals but by outsiders from other regions and villages, the awareness that monitoring activities are carried out to protect the property of the village acts as an incentive.

Confirmation was established for the FiA and visits to six shared pond locations as well as public hearings with the community-based management committees were carried out during

the ex-post evaluation. As a result, as self-management at each shared pond is continuing to be carried out and information such as the management rules for local shared ponds are becoming known. Consequently, the use of prohibited fishing gear and fishing at prohibited times has almost completely ceased. In addition, one effect of the installed shared ponds that residents point out is that the amount of fish caught in paddy fields has increased significantly and the fish flowing into the paddy from the shared pond has helped their household finances. Furthermore, being able to rely on the shared fish pond at times of food scarcity brought about by poverty and so on has become reassuring for the whole village, not only the poor. On the other hand, they have not reached the point of purchasing new seeds and supplementing stock.

As for the spread of shared ponds, the FiA sought to expand educational activities based on the "One commune, one community fish refuge" concept nationwide and, with a degree of support from NGOs and donors, by the end of 2008 share ponds were established in 207 locations. At the time of this ex-post evaluation, a policy of effective and sustainable shared pond expansion is being continued and the "The Strategic Planning Framework for Fisheries 2010-2019," using the reference value of 2009 (235 places), set a numerical target of 1,200 locations by 2019.

To conclude, this Project established shared pond management committees in 22 target villages, resource management activities of these shared ponds have been carried out in each village as community-based shared pond business, therefore it is determined that Output 3 has been achieved upon project completion. In addition, at the terminal evaluation carried out three years following the end of the project, community-based management activities for the shared ponds developed in the Project are ongoing. Furthermore, at the national level, in accord with the policies of the government, effective and sustainable expansion of shared ponds will continue into the future.

4) Output 4

An aquaculture extension network in rural area is developed.

(Indicators)

4-1: Seed producing farmers conduct farmer to farmer training at least once a year by their initiative.
4-2: Meetings of the network in each target province are held 3 times a year.
4-3: Joint meeting of the network for all target provinces is held at least once a year.

(Degree of attainment) The three indicators above were all achieved by FY2008 and it has been confirmed at the time of project completion that activities have continued to be carried out in FY2009.

Number of participants in farmers training (Seed producing farmers -> small-scale aquaculture farmers)

For Indicator 4-1, an aquaculture dispersal network consisting of 48 seed producing farmers who were selected and trained by the Project plus 11 existing farmers that had engaged in seed production since before project launch has been established in each province. In addition, as shown in Table 6 below, in FY2008 these network farmers carried out aquaculture training 147 times for a total of 3,608 small-scale farmers. This equals to an average of 2.5 times for each seed producing farmer, one time higher than the target, and these activities continued in FY2009.

Seed growers network in Takeo province

At this "training", the breeding methods were explained to farmers with a high potential of purchasing seeds and ultimately the purchase of seeds is encouraged. It has been confirmed by concerned parties through interviews carried out at terminal evaluation that since expansion of the customer base can be achieved effectively, seedling production farmers have been actively conducting business promotion activities in this group training format, and have implemented "original" training not related to the Project.

Table 6: Estimates of the number of farmers who attended aquaculture training or have been practicing aquaculture in the four project target provinces.

(Unit: household)

		Number of trainees		Number of farmers practicing aquaculture
		Aquaculture basic training (led by FiA diffusion workers)	Farmer to farmer aquaculture training led by seed farmers	
During the Project	2005	640		576
	2006	640	479	1,007
	2007	640	960	1,440
	2008		3,608	3,052
	2009		3,600	2,916
	Total	1,920	8,647	8,991
After project completion	2010	-	1,480	-
	2011	-	680	-
	Total	-	10.807	-

Source: The Terminal Evaluation Report of this Project (20052009), Reference provided by FiA (20102011)
Note: The number of farmers practicing aquaculture is calculated as "the number of trainees × practice rate (90 ~ 100%) × retention rate (90%)". The retention rate is set as 90% since the percentage of farmers that continue aquaculture one year after taking a training course was between 94% and 100% according to results of a sample survey carried out by provincial FiA extension officers..

In the ex-post evaluation study, the number of small-scale farmers who participated in farmer to farmer aquaculture training has increased and, as shown in Table 6 above, the total number of students was more than 10,000 by 2011. In addition, during project implementation in 2008 and 2009, there was easy access for each seed farmer at group

training and the number of participants rapidly increased with farmers who desire an immediate start to / are capable of starting aquaculture gathering together. However, it is postulated that because farmers usually make a decision only after confirming the success of other preceding farmers and prepared farmers have been entering in stages, actual aquaculture participation has been increasing gradually. As it is difficult to grasp the exact number of seed farmers who attended the training carried out for new aquaculture farmers, the data of the 2010 and 2011 group training quoted in table 6 is the number available at FiA.

In addition, seed farmers possessing high technology, with the help of NGOs or the government, also visit other provinces as lecturers for TOT (Training of Trainer) and provided guidance in incubation methods. By the end of the Project, four farmers from Kampot province, two farmers from Prey Veng province and 15 farmers from Takeo province had served in lecturer roles for TOT.

Number of seed producing farmer network meetings

With regards to Indicator 4-2, the aquaculture extension network meetings were set up in each province and have been held regularly on an almost quarterly basis in all provinces. In FY2008 they were held three times in each province with a total of 193 participants. Network meetings in each province regularized and carried out in the following year FY2009.

Each member exchanges views on the three main points of seed production technology, seed sale supply and demand, and financing. It has been identified at the end of the Project that these meetings act as an opportunity for members to search for clues in solving common problems that farmers face such as technical improvement, stable management and facility expansion.

In the ex-post evaluation survey it has been confirmed that the seed producers network in each province is working, and extension workers of the FiA are also actively involved. For example, the Takeo province network has held a meeting once a month and is also focusing on lending to members. The Kampot province network took advantage of mobile phones to exchange information and implemented joint purchase of chemicals and equipment, and an opportunity for everyone to gather directly occurs about once a year.

As for Indicator 4-3, all four province network meetings were held once each in FY2008 and FY2009 and more than 70 farmers participated each time, but after the completion of the Project there has not been an opportunity for the all four provinces network to meet.

Aquaculture activities in a school

One part of the activities planned in Output 4 is, in addition to the three indicators described above, "the introduction of aquaculture as educational activities in schools." In the Project, 1 school was selected every year starting from 2006 and, as a joint venture,

support for the introduction of aquaculture activities into four elementary schools, 10 junior high schools and five high schools was carried out. As a result, other than just being able to eat the fish that they harvested, it has been confirmed that school management has benefited from the aquaculture business, it has acted as a public relations activity for promoting understanding of aquaculture with those related to the schools (children / students, parents, relatives, neighbors, etc.) and it has been incorporated into the curriculum.

In the ex-post evaluation we visited the four schools mentioned above, however, at some, activities had ceased completely. The reasons given for this by teachers is that managing the ponds by school staff alone is a large burden and as there are no clear rules between the school and local residents, there are large numbers of people who take fish without permission. They also pointed out the difficulty of balancing school education with water management for a rain dependent pond.

From the above is can be said that Output 4 has been somewhat achieved by the time of project completion. Further, it has been confirmed that the seed producers' network was still generally being maintained even after project completion. However, differences could be seen in the activities of each province. As for farmer to farmer training, the transfer of technology from seed producers to small-scale farmers is continuing in each province and it is determined that training will continue in order to secure customers for seeds in the future.

3.2.1.2 Achievement of Project Objectives

Project objective: Small-scale aquaculture technologies are extended largely in target provinces. (Indicator) In the Project's four target provinces, small-scale farmers increased to 4,400 from the existing 2,000. (Degree of attainment) It is estimated that at the end of the Project about 9,000 small-scale farmers were conducting aquaculture in the target provinces (more than double the target) therefore the project objective is considered to have been achieved.

As mentioned earlier in Output 4 the total number of farmers who participated in aquaculture training carried out by seed production farmers had reached 8,647 by the end of the Project. From the monitoring results of Province extension workers, the percentage of participating farmers that actually implemented aquaculture (practicing rate) was 90-100% and the percentage of farmers who were continuing aquaculture one year after beginning (retention rate) was about 90%. If we multiply this by the number of farmers who participate, we can estimate the number of small scale farmers implementing aquaculture and

the figures are shown in the table below. It is estimated that there were 8,991 by the project end.

Table 7: The number of small-scale farmers carrying out aquaculture in the Project's four target provinces (estimated from aquaculture trainee numbers)

(Unit: household)

	2005	2006	2007	2008	2009
Aquaculture basic training					
Number of trainees	640	640	640		
Number of farmers practicing aquaculture	100%	100%	100%		
Retention rate after one year	90%	90%	90%		
Number of farmers practicing aquaculture	576	576	576		
Farmer to farmer aquaculture training					
Number of trainees		479	960	3,608	3,240
Number of farmers practicing aquaculture		100%	100%	94%	90%
Retention rate after one year		90%	90%	90%	90%
Number of farmers practicing aquaculture		431	864	3,052	2,916
Total	576	1,007	1,440	3,052	2,916
Total	576	1,583	3,023	6,075	8,991

Source: Terminal Evaluation Report of this Project

Table 8 below shows the changes in the number of customers sold seeds grown by seed producing farmers of the Project. In 2008, 9,525 households were buying seeds from seed producing farmers. Sales equal to or greater than this had been expected for 2009. In addition, at the start of the Project 70% of farmers in the target commune had purchased cultivated seeds from government seed production facilities, but in 2007, 70% of farmers were now buying from regional seed producers. In 2009 the ratio achieved was 100%.

Table 8: The number of customers sold seeds from seed producing farmers.

(Unit: household)

	2006	2007	2008
Takeo	768	1,036	3,176
Kampong Speu	165	651	1,210
Kampot	88	1,575	1,788
Prey Veng	316	1,488	3,348
Total	1,337	4,750	9,525

Source: Evaluation report at the end of this Project

In light of the above, the estimated number of small-scale aquaculture farmers in the region and number of seed sales customers are both about 9,000 households and it can be suggested that

these 9,000 households implemented and continued aquaculture due to the motivation of the project activities. In addition, we suggest that this number of 9,000 small scale farmers conducting aquaculture in the target provinces is equal to about double the project objective of 4,400 and thus we judge that the project objective has been achieved.

The number of small-scale aquaculture farmers and number of seed producing farmer seed sales customers after the completion of the Project are as shown in Output 4 and, as mentioned earlier, because the number of trainees undertaking farmer to farmer training has increased to 2,000 by the time of project completion it can be expected that small aquaculture farms have also increased further. In addition, according to the results of a beneficiary survey carried out on seed producers (15 households), 9 out of 15 households answered that, compared with three years ago, farmers engaged in aquaculture throughout residential areas have been growing in number. In regards to life improvements for their family, 14 out of 15 households answered that it had improved compared to three years ago and this has become one of the factors that increases the ambition of seed producing farmers. In addition, according to the results of a beneficiary survey of small-scale aquaculture farmers (80 households), in response to the question, “compared to before you started aquaculture, has the amount of fish you eat increased?", more than 90% answered that it had increased and it can be determined that the spread of farming technology has led to the improvements in animal protein intake. The factors that led to this smooth diffusion of aquaculture are listed in Table 9.

It is determined from the above that each indicator related to the project objective has been largely achieved. In addition, from the fact that even at the end of the Project the number of participants in farmer to farmer aquaculture training are increasing, it can be further determined that small-scale aquaculture farmers are also growing in number.

Table 9: Factors that promoted the manifested results and characteristics of small-scale freshwater aquaculture that has been established in this Project

	Features of this Project	Promotional factor
(1)	Use of farmers own reservoir ponds etc.: The target areas have always been dependent on rainwater for agricultural water and domestic water use and so many farmers maintained their own reservoir ponds. In this Project, in order to reduce the initial investment burden to farmers, aquaculture was carried out using rice paddies or reservoir ponds.	⇒ Inexpensive initial investment, the use of regional characteristics
(2)	Abundant fish species and ingenuity of feed: In addition to using livestock manure as fertilizer for generating plankton and so on in breeding water, materials such as rice bran leftovers that are readily available to rice farmers are also used as feed. Therefore for the fish species, plankton, plants and omnivorous fish that do not require a special diet were used and there is the potential for four species to be raised simultaneously. In addition, Cambodia is rich in fish species that live in freshwater and this has nurtured a food culture that prefers freshwater fish. Furthermore, many species that require certain technology for breeding, the possibility of creating differences in the technological capabilities of aquaculture farms and seed growers and competition from neighboring farmers over the same species are factors to avoid.	⇒ Utilization of unused resources, spread of application of simple techniques, abundant fish species (Reference Information: the parent fish of tilapia, that are cultured in abundance in Africa and so on, do not prey on fry and are a fish species that is easy for natural breeding, meaning there is the possibility that the need for seed producing farmers will decrease over time)
(3)	Seasonal Freshwater aquaculture : Instead of all year round, the freshwater aquaculture that is planned to be spread in this Project will have a season of about nine months and will rely on rainwater accumulated in the rainy season. More specifically, fish will be stocked in the rainy season (June-July), fish grown from October to November gradually harvested, then, when the water level drops during the dry season of March-April, a pump or the like will be used to drain water from the pond and harvest all the fish that may have remained. For this reason, in order to carry out aquaculture in the following year, it is necessary to purchase seeds. Further, for completely draining water, quality management is also facilitated.	⇒ Establishment of seed production and an aquaculture cycle utilizing the characteristics of the region / natural environment
(4)	Aquaculture for self-consumption: Rural households in Cambodia endeavor to be self-sufficient in fish, their day-to-day staple, as much as possible and make up for any lack therein by purchasing fish at the local market. In this Project, the primary intention was for self-consumption and, if there happened to be a surplus, these fish could be sold and become an additional income source. (In the beneficiary survey carried out for ex-post evaluation, 80 small-scale aquaculture farmers' households were asked why they started aquaculture. 71% stated it was so their family could eat and 23% stated that it was for additional income.)	⇒ The height of ongoing satisfaction and motivation of farmers for being self-sufficient in fish
(5)	Food culture that prefers freshwater fish: The average per capita annual fish consumption of Cambodian people is 52.8kg, one of the top levels in the world. In addition, most of the countries with high fish consumption are a production center of seafood, such as Japan, but when it comes to the heart of freshwater fish consumption, Cambodia is the largest. Furthermore, in country comparison (FAO2009) in terms of the proportion of fish as ingested animal protein, Cambodia stands at 68.7%, which is higher than even Thailand (34.9%), Vietnam (38.3%), and Japan (39.9%). The context that livestock production is scarce should also be mentioned.	⇒ Consistent with food culture, there is a lack of animal protein other than fish (beef, pork, chicken, etc.) and there is no competition from marine fish.

(6)	The presence of existing aquaculture farmers: There were 2,000 farmers carrying out aquaculture in the four provinces before the Project began.	⇒ Certain understandings of aquaculture fish production (such as spreading farming culture in areas that rely only on natural fish is difficult)
(7)	Specifics of economic benefits to seed producing farmers: During the implementation period of this Project, seed producing farmers could confirm that aquaculture farmers had increased in the target areas and that sales revenue was attainable, so it was possible to make material for future predictions. In addition, since the population density, and household density of the target areas are higher than the national average, customer access is easy. In response to this information and experience, as well as the proactive guidance and support from seed producing farmers to small-scale farmers who are their customers, investments will be carried out for facility expansion aiming to increase seed production which will additionally lead to an increase in small scale farmers.	⇒ Aquaculture diffusion based around seed producing farmers

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

In the target provinces, aquaculture production volume increases.
(Indicator) Aquaculture production in target provinces will increase 1.5 times.
(Achievement) In comparison with 2004, before the Project started, aquaculture production by small farmers was 1.65 times higher in the 4 target provinces in 2008, so it can be said that the overall goal has been achieved.

At the time of terminal evaluation, it was confirmed that during the project implementation period, aquaculture production in the target provinces achieved the overall goal indicator of a 1.5 times increase according to the statistics of the Fisheries Administration and the statistics of the Cambodia Ministry of Agriculture, Forestry and Fisheries.

In addition, in Table 10 below, at the time of terminal evaluation, figures confirmed for 2004 to 2008 were added to figures confirmed for 2011 to 2009 and consolidated to show the transition of aquaculture production in the four provinces over about eight years. From this table it can be seen that the amount of production was 1,390 tons in 2004, increased to 2,294 tons in 2008 (at the time of terminal evaluation), and can be assumed to have been increasing steadily since then.

Table 10: Trends in aquaculture production by small-scale farmers in the four target provinces

(unit: ton)

	Kampot	Kampong Speu	Prey Veng	Takeo	All four provinces
2004	25	40	510	815	1,390
2005	50	110	600	800	1,560
2006	90	163	845	950	2,048
2007	114	208	850	1,000	2,172
2008	158	287	830	1,019	2,294
2009	500	2,500	1,800	3,000	7,800
2010	520	3,000	2,500	3,900	9,920
2011	1,185	3,860	3,500	3,690	12,235

Source: Fisheries Administration

It can also be determined that the indicators for the overall goal were achieved during the project period and that, even after completion of the Project, the effects are continuing to be maintained.

3.2.2.2 Other Impacts

(1) Impact on the natural environment

Since the aquaculture method subject to being spread in this Project is performed using ponds that accumulate rainwater in the rainy season in order to ensure valuable domestic water for the dry season, the possibility of water contamination due to aquaculture or contaminated water being drained into surrounding rivers is extremely small. Further, due to the use of rice bran and manure (a by-product of agriculture) for fertilization material and bait, unlike high-value aquaculture there is no burden on other productive activities due to issues such as competition over bait materials. Moreover, the target species[5] included exotic species that do not originate in the Mekong river system but at the time of introduction it can be considered that all had previously been disseminated and naturalized and, as fish that feed on detritus and plankton, their feeding habits are mild so even if they were to escape to natural waters the impact on biodiversity and fish fauna in the region's river system would not be large. In addition, appropriate attention has been given to ecosystems, ensuring the release of only native species for harvesting in the open waters of rice paddies through shared pond activities.

(2) Land acquisition and resettlement

As aquaculture promotion was carried out using existing rice paddies and naturally occurring seasonal reservoir ponds, no resettlement or land acquisition has been implemented.

[5] The five fish species that are subject to aquaculture diffusion in this Project are the native Silver Barb, along with Nile Tilapia, Common Carp, Silver Carp and Mrigal Carp which had already been introduced in the past and were established as general target aquaculture fish.

(3) Other indirect effects

(1) Gender

Although the majority of students for farmer to farmer aquaculture training were the male heads of the household, along with the general increase in the number of participants, at project completion it has been confirmed that the number of participating women has also increased.

In addition, as men are often away from home for prolonged periods of time due to working away from home and managing side businesses, producing feed and water management is often actually carried out by women. When making field visits to small scale farms at the time of ex-post evaluation, women were often seen engaging in farming activities on a day to day basis.

Furthermore, even with seed producing farmers, many women are actively taking lead roles and there is a high hope for the entry of women into the aquaculture field. Women have in particular served as leaders in the Kampot province aquaculture network, which has made seed loans (interest-free) to poor farmers who can't purchase seeds with cash. This initiative, which has not been implemented in other provincial networks, is the brainchild of women leaders.

(2) Implementation of Phase 2 by utilizing the results of the Phase 1

The approach applied in this Project of farmer to farmer extension with seed producing farmers at its core, saw a rapid spread of aquaculture technology among farmers in the target villages. As the Government of Cambodia highly rated this Project's results, they have further requested the "Freshwater Aquaculture Improvement and Extension Project Phase 2" targeting high poverty northwestern areas.

In response to this, JICA sent a detailed planning study team twice, in May and September of 2012, and after a series of discussions with the Cambodian government, including the FiA, the framework was decided that in the three target provinces of Pursat, Battambang and Siem Reap (1) Seed production and aquaculture would be improved, (2) capacity building carried out for local administrations to extend aquaculture, (3) training implemented for seed producing farmers, (4) small aquaculture activity developed, and (5) activities performed that will contribute to the strengthening and broadening of a seed producing farmers network. Based on this framework, a project with a planned period of four years aiming to achieve increased production of small-scale aquaculture was determined. At the time of this ex-post evaluation, it had been put into practice since mid-March 2011.

From the above, it is determined that the number of small-scale aquaculture farmers, raised

as a project objective, increased to about 9,000 from the 2,000 before project planning, and thus more than twice the target number of farmers are conducting aquaculture in the target provinces. In addition, in relation to the overall goal, as it has been confirmed that during the Project the amount of aquaculture production in the target provinces increased by 1.65 times, the manifestation of the plan's effects can be seen and therefore the effectiveness and impact is considered high.

3.3 Efficiency (Rating: ③)

3.3.1 Inputs

The input plan and actual performance of this Project are as follows.

Inputs	Plan	Actual Performance (as of the end)
(1) Experts	Chief advisor / extension administration, farming technology improvement and dissemination, rural development / operational coordination Parent fish cultivation / seed production, participatory planning, bait development, shared pond management, gender mainstreaming, fish distribution, facility design, bidding assistance / supervision of works other	Japanese experts 11 For 11 fields, a total of 164.9MM Third Country Expert 8 , total 10.3MM (Indonesia, Vietnam, India, Nepal)
(2) Trainees received	Training in third countries or Japan, 2-3 trainees each year.	Trainees in Japan 7
(3) Third-Country Training Programs		Third Country Trainees 77 (Host countries: Philippines, Vietnam, Thailand, Indonesia, Singapore)
(4) Equipment	Vehicles, various farming equipment etc.	Equipment provision 27 million yen Facility improvement 20 million yen
Total project cost	Total 550 million yen	Total 513 million yen
Recipient government's input amount	In terms of local cost, since the principle amount was a counterpart provision and isolating only the budget for this Project is difficult, the budget has not been established.	For the reason on the left, the amount of input from the Cambodia side has not been added.

3.3.1.1 Elements of Inputs

Inputs on the Japan side including items such as the dispatch of experts, training in Japan, third country training, provision of equipment, were conducted largely as planned. The period of dispatch for Japanese experts, their expertise and leadership abilities were evaluated

highly on the Cambodian side, and the equipment (ex. fish hatcheries for seed farmers) provided is still being utilized at the time of ex-post evaluation.

Third Country Training and dispatch of third Country Experts have been conducted in this Project. In regards to this, concerned parties acknowledged that they were very helpful and effective since Cambodian counterparts could learn slightly more advanced technology (attainable technology) from the countries with similar environments with Cambodia(fish species, etc.). In particular, Third Country Training Programs in Singapore and Indonesia were appreciated with trainees because it was possible to learn all technologies in a straightforward manner.

On the Cambodia side, a counterpart was established for project activity promotion and cases of long-term training or absence due to transfers were kept to a minimum and there were no disruptions to project activity.

3.3.1.2 Project Cost

Project cost was within the 93% of the initial budget.

3.3.1.3 Period of Cooperation

Project period was as planned (100% consistent with planned period).

From the above, in relation to project cost/period, the efficiency of this Project is high.

3.4 Sustainability (Rating: ③)

3.4.1 Related Policy towards the Project

The latest development plan is the National Strategic Development Plan (2009-2013). As with the previous development plan it sets "agricultural development" as a priority area, aiming at poverty reduction and food security for the local population, it seeks to promote the management, conservation and development of effective and sustainable marine resources. In particular, it has been mentioned that in aquaculture development, since aquaculture farms play an important role in the preservation of marine resources, the provision of seeds and technical support is required.

Developed with the assistance of the EU, the "Strategic Planning Framework for Fisheries: 2010-2019" strove for numerical targets in aquaculture production volume from 40,000 tons in 2008 (reference value) to 10.2 million tons in 2015 and 18.5 million tons in 2019, increased numbers of cultivated aquaculture farmers (2008: 44,000 -> 2015: 65,000 -> 2018: 85,000) and increased seed production (2008: 37 million -> 2015: 150 million -> 2018 : 250 million). In addition, with respect to community shared ponds, using the reference value of 2009 (235 locations) numeric goals were set of 1,200 locations by 2019. In this context numerical targets

for production from rice paddy fisheries were set from 110,000 tons in 2008 (reference value) to 225,000 tons in 2015, then up to 50 million tons 2019. Furthermore, a master plan which sets a more concrete framework (five-year plan: August 2013 to July 2018) is currently under development with support from the EU and it is expected to continue support of aquaculture farmers in the future, therefore it is determined that the sustainability of policies and institutions is high.

On the other hand, in hearings with seed producing farmers, the need to provide regulation on imports of seed from Vietnam etc. was requested by network officials in each province. The survey data of 2007 indicates that 18% of seeds in circulation in Cambodia were of domestic production, 26% were natural fry and the remaining 55% were dependent on imports from Vietnam, etc. For this reason, the Cambodian government is attempting to increase domestic seed production and is seeking to reduce the volume of imports but in response to the recent spread of aquaculture technology in Cambodia, seeds produced in Vietnam that are cheaper than those domestically produced have begun to circulate in rural areas. Sometimes the quality of some of these seedlings is low and voices of concern have been heard from seed producing and aquaculture extension workers from provincial FiA. However, one factor of imported seeds' distribution is the fact that domestic seed production cannot always ensure adequate amounts corresponding to the demands of the season. Therefore, in order to expand future small-scale aquaculture techniques, it is important to tackle quality control and management of seasonal seed production (including imported seeds) for seeds distributed within the country.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

During the period of this Project, as part of the flow of administrative reform, the provincial fisheries offices was transferred from provincial governments to the FiA in order to form a uniform chain of command. As a result, central and local diffusion efforts have been integrated and the mobility required to expand in line with the basic policy of the FiA has been increased. This system was being maintained at the time of ex-post evaluation and training and so on of small aquaculture farmers and support for seed producing farmers in the target four provinces was being carried out by the FiA staff. At the same time Japanese experts of Phase 2 have recognized that smooth communication between central and provincial staff has contributed to select[6] the most appropriate seed farmers from the target

[6] Selection of seed farmers: According to the FiA, in current farmer selection, tests are conducted after giving consideration to (1) the Environment (natural conditions, social conditions, and land ownership), (2) the economy (not the most wealthy but also not the most poor), (3) experience, (experience conveying aquaculture technology and maintaining harmonious relationships with neighboring farmers etc.), and (4) interest (interest in involving their wife in farming). In these tests, as observed successful husband and wife farmer candidates were those who are genuinely interested in aquaculture and begin aquaculture

areas.

Further, in this Project, the support and involvement of government officials was minimized and the main component established was the technique of technology transfer among farmers and this approach was a major factor contributing to the success of achieving the project objective. Specifically, three stages of technology transfer from (1) Japanese experts to government extension workers (provincial Departments of Fisheries) (2) from government extension workers to seed producing farmers and (3) from seed producing farmers to small scale farmers is being pushed forward with the recipient establishing extension methods each time and, at the time of project completion, stages (2) and (3) were being continued. In particular,(3) technology transfer from seed producing farmers to small scale farmers was continuing and expanding ex-post evaluation and, even though three years has elapsed since project completion, it has been confirmed that through this method of extension, the receiving of aquaculture technology is still expanding throughout the regions of the four target provinces.

One factor that seed producing farmers focus on in the training of small-scale farmers is establishing that there are clear economic incentives (revenue increases) and as seed producing farmers see small-scale farmers as important customers, they have become an active driving force in activities promoting seed purchase.

In addition, the Implementing agency of this Project, the Ministry of Agriculture, Forestry and Fisheries, Fisheries Administration (FiA), with not only support from Japan, but also from the EU, Netherlands, Spain, etc., is endeavoring to reinforce matters at the policy level.

From the above, the systems of the Implementing agency and the sustainability of the terminal extension system is judged to be high.

3.4.3 Technical Aspects of the Implementing Agency

At the time of terminal evaluation, through the implementation of this Project, the counterpart's technical capabilities and extension capacity were improved, seed producers were nurtured through their guidance, and farmer to farmer technology transfer occurred through the sales of cultivated seeds. The step-by-step technology transfer strategy of this Project proceeded as planned and the number of recipients of technology increased dramatically at each stage. Further, by using the technology that had already been accumulated to its utmost capacity, technology suitability was high and was evaluated to be a factor in technology transfer and development.

At the end of the Project, technology transfer among farmers was being continued. In this

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through their own power without any support, selection is carried out after a final (4) interest check has been confirmed.

context, the regional appropriateness of technology introduced has been raised. First, it may be mentioned that for seedling production technology, with a focus on fish species that are popular in Cambodia, advantage was taken of the technology of pioneering farmers who were already engaged in seed production in the target areas prior to project implementation, and so they were not entirely new technologies. Also, in regards to small-scale aquaculture technology, the fertilization technique of using grain residue or livestock manure from farmers was used as a basis, therefore the use of plankton that does not rely on feeding and fish that feed on plant matter etc. was intended and low input technology that does not burden small scale farmers was introduced. Though this was during implementation of the Project, it was a factor that increased the trainee retention rate after one year (90%). In addition, in the target areas there is a custom of digging one's own reservoir pond in the garden for domestic water in order to cope with water shortages in the dry season. Therefore there is the possibility for most farmers to use this existing reservoir pond to start aquaculture which is also becoming a factor in promoting and expanding aquaculture in the target areas.

From the above it can be suggested that the technology transfer of this Project is progressing smoothly and the possibility of aquaculture technology spreading in the target areas is high. In addition, in response to the success of this Project, the FiA is showing clear policies directed at expanding the spread of small-scale aquaculture through the development of seed producing farmers in other provinces and regions, and donors including Japan and NGOs are actively supporting this. Due to this, the sustainability of the technical aspects of the Project are considered high.

3.4.4 Financial Aspects of the Implementing Agency

The Project aims to establish a seed producing farmers' network and promote the spread of aquaculture through a farmer to farmer extension system. Therefore, it has been assumed that at the terminal evaluation, if a self-reliant network can be established, continuance and maintenance of the small-scale aquaculture activities of the Project that do not require large scale use of the FiA budget can be spread throughout the target area. As a consequence, the network is functioning, even at the time of ex-post evaluation, the number of small-scale aquaculture farmers is increasing.

However, since only seed farmers were trained in the Project due to it not being feasible to supply seeds to all of the target provinces, the training of seed producing farmers by the FiA will be required further in the future. After a review of the annual budget of the FiA regarding small-scale farming (national) in the ex-post evaluation, in 2012 it was about USD 26,250 (105,000,000 Riel). Even though there is a support policy for aquaculture promotion, it cannot be said that there is sufficient financial resources to systematically increase the number of seed producing farmers in the target provinces in future, thus the cooperation of

donors is indispensable.

On the other hand, for credit businesses run through the networks, there was a concern from seed producing farmers seeking to expand business at the point of terminal evaluation. After a review of the current situation in the study, differences in the financial resources possessed by each provincial network were discovered. For example, while the Prey Veng network does not currently have adequate financial resources to run a credit network, since leaders of the Takeo province network have large financial resources and strong practical abilities a credit business is beginning to function. For this reason, support to boost the functions of the networks such as refresh trainings for accountants and leaders is also important.

From the above, the present Project's institutional policy as well as counterpart system, technology, and financial situation are without impediment and therefore the sustainability of outputs realized by this Project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This Project was planned when the Cambodian government was working for aquaculture promotion that would contribute to nutritional improvement and poverty reduction for rural residents. The four Southern provinces of the project target are located distant from major freshwater fisheries such as the Tonle Sap and the Mekong River. Also, in these rural areas, freshwater fisheries have not been common practice among small-scale farmers. Given these circumstances, the Project, which aimed at extending aquaculture and increasing freshwater-cultured fish production, is considered to have been consistent with policy objectives of the Cambodian government and development needs of the country.

While the number of small-scale aquaculture farmers remained 2,000 prior to the project implementation, it has achieved 9,000, more than doubling of the project objective targeted 4,400. In addition, in relation to the overall goal, as it has been confirmed that during the Project the amount of aquaculture production in the target provinces increased by 1.65 times, the manifestation of the plan's effects can be seen and therefore the effectiveness and impact is considered high.

In terms of the cost and period, the Project has been implemented as planned, and therefore, the efficiency is evaluated to be high.

The sustainability of the Project is considered to be high as the existing system and policies in the country are supportive. The ongoing national development policies emphasize the aquaculture development shall play a crucial role to improve management, preservation and development of marine resources. Also, the target areas are suitable in extending aquaculture,

given its natural environment, a food culture, the localities and a lifestyle of people. In fact, seed-producing farmers, trained by extension officers, have been transferring their technologies to small-scale farmers through sales of their seeds. This step-by-step technical transfer among farmers has been retained after the project completion, and therefore, the sustainability of the Project is considered to be high in terms of technical feasibility. As for financial sustainability, the ex-post evaluation study has observed seed-producing farmers have continued their activities, using their network. Thus, aquaculture has gained a solid ground for its technological extension, which allows FiA to manage at lower cost. Given these circumstances, the sustainability of the Project is considered to be high.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Due to the spread of aquaculture technology in rural areas, inexpensive import seed from countries like Vietnam has begun to circulate into rural areas. However government extension workers and seed producers have raised the issue that often the quality of these imported seeds is poor and they have a low survival rate. The fact that the techniques established in this project are not only low-input aquaculture technologies that use rice paddies and reservoir ponds, but that they also reduce as much as possible the risk of lost fish (an important food staple) in the growth phase, is an important factor in helping to expand the spread of this technology. For this reason, quality control of imported seed is important. In addition, it is important for the FiA to start assistance initiatives for areas such as quality control and seasonal management to be able to ensure that production activities can be carried out for domestic seed of a fixed quality at times when farmers need.

4.2.2 Recommendations to JICA

Similar projects utilizing the success factors of this project expanded to other provinces in Phase 2 and there are also others being carried out in Africa. From the results of these activities in other countries and other regions, deeper verification of the success factors of this project will be useful.

4.3 Lessons Learned

A success factor of this project mentioned was that it established simple, low-input aquaculture technology that was highly suitable for the natural environment, food culture, locality, and lifestyles of the target areas.

In particular, the following items were pointed out.

[Effective use of local resources and high development needs]

- The demand for freshwater fish is large, with high needs for both home consumption and sales, and a market for sales already exists.
- The government recognized freshwater fish as an important source of protein and had been promoting a strong policy of inland water culture.
- The use of already existing reservoir ponds and rice paddies for aquaculture ponds and taking full advantage of regional resources, such as rice bran, for feed.

[Introduction of technology that enables dissemination among farmers]

- Seedling production technology with a low degree of difficulty has been adopted but, for hatching and breeding, uniform technological strength is required and so an ongoing sales and purchase relationship between the aquaculture farmers and seed producers was established.
- It was low-input and simple aquaculture technology that could be carried out by farmers also engaged in rice cultivation.

[Extension development left to the structure making of market expansion]

- On the recognition that widespread adoption through the government alone would be difficult, a project design where, after a certain amount of support was granted from the government, regional extension would be left to the expansion of the market was implemented.
- Seed producing farmers transfer technology to other farmers having the clear economic benefit incentive of "seeds sales revenue."
- By training a large number of farmers, the opportunities for farmers to start their own businesses increased and these many successful experiences contributed to the building of an aquaculture market in the region.

From the above, in order for the Project to be acceptable to the target area, at the planning stage of the Project, sufficient study of the mechanism of extension development with consideration given to the confirmation of government policies and measures, assessment of the needs of residents, use of local resources, the setting of the technical level to be introduced, and the expansion of the market is essential. The present Project's approach of maximizing the utilization of local resources combined with incentives for the manufacturing and economic activities of local residents and the approach of expanding and ripening the existing market in the target area is not just relevant to the aquaculture field but can also be considered lessons for other community development projects.

Kingdom of Cambodia

National Tuberculosis Control Project Phase 2

External Evaluator: Machi KANEKO, Earth and Human Corporation

0. Summary

This Project was implemented for the purpose of reducing deaths from tuberculosis (TB) and a reduction in the number of TB patients in Cambodia, one of the specified "22 high TB-burden countries". The Project has undertaken qualitative improvement of DOTS (Directly Observed Treatment with Short-course chemotherapy) that is expanding across the country, strengthened diagnosis capabilities for TB control beyond that of DOTS, strengthened administrative capacities and worked to develop human resources. This effort has been carried out in an approach consistent with the policies of Cambodia and therefore its relevance is very high.

Upon completion of the Project, it has been confirmed that the foundation for disseminating and expanding the DOTS that involves citizens, Public-Private Mix (PPM) DOTS and community DOTS, has been built and the results are being continued by other donors at the time of this ex-post evaluation. In addition, as a result of efforts to focus on strengthening the diagnosis capacities of labs, it contributed domestic tuberculosis culture labs that meet the criteria of the WHO in three locations. Furthermore, from the fact that the prevalence of all types of TB and the TB mortality rate, which were the indicators for assessing the overall goal, have been achieved four years earlier than the target year, 2015, effectiveness and impact of the Project is high. Although the project period was within the plan, the project cost was significantly exceeded, therefore efficiency of the Project is fair.

In regards to sustainability, while TB with slight symptoms, smear negative (-) TB, TB in aged patients etc. and other new challenges are becoming apparent, there are slight problems in regards to the technology and a systems that can respond to them. In addition, while there is an apparent trend of decreases in external funds from donors pertaining to TB control, Cambodia continues to be specified as one of the "22 high TB-burden countries," and as there are problems in terms of long-term financial sustainability, sustainability is considered fair.

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

1. Project Description

Project Location
(Target Area: all regions of Cambodia)

A pilot activity example:
Right: Culture laboratory of Battambang Referral Hospital (supported the diagnosis capacity building)
Left: Monument commemorating the introduction of DOTS to Cambodia
(The built in 1999 in the same hospital, a nurse hands water and TB drugs to a TB patient and watches as he takes it)

1.1 Background

In the Kingdom of Cambodia (hereafter referred to as "Cambodia"), access to health care and sanitary conditions deteriorated due to the effects of the civil war which raged for 30 years and from a global perspective tuberculosis infection has increased to an alarming level with the yearly occurrence of new sputum smear positive (+) patients reaching 130 per 100,000 people. For this reason, the Cambodian government has been working to strengthen TB control measures and, under the guidance of WHO, has been introducing DOTS (Directly Observed Treatment with Short-course chemotherapy) into hospitals from 1994. However the need for the quality of TB control to be maintained and further expanded is high and therefore a request for assistance was sent to the Japanese government.

In response to this, JICA, as a counterpart of the National Tuberculosis Control Program (NTP), initiated the "Tuberculosis Control Project" from 1999 with a goal of providing DOTS to 900 health centers across the country. After conducting this cooperation, it completed the goal of a nationwide spread of DOTS by 2004, earlier than the original target year (2005). On the other hand, due to the fact that new problems such as maintaining DOTS quality, increases in the rate HIV infection, and the need for TB control in urban areas, cooperation for Phase 2 had been requested and the cooperation of this Project was initiated from 2004 to extend for the next five years.

Based on strengthening the fundamental capabilities of national TB control and expanding the DOTS services achieved in Phase 1, this Project will enable the improvement and quality assurance of national TB control.

Aimed to strengthen management capacity building, introduce "Beyond DOTS" (tuberculosis services beyond the existing DOTS), strengthen the sustainability of the NTP service delivery system as a whole (National Center for Tuberculosis and Leprosy Control (CENAT), provincial health departments, operational districts, health centers, etc.).

1.2 Project Outline

Overall Goal		TB morbidity and mortality are reduced
Project Objective		Sustainable quality TB Programme is implemented nationwide.
Outputs	Output 1	Management capacity of the NTP is improved.
	Output 2	Sustainable quality DOTS is expanded nationwide.
	Output 3	Suitable services and guidelines beyond routine DOTS are developed.
	Output 4	Quality of laboratory services to support DOTS, TB/HIV activities and surveys is improved.
	Output 5	Effective IEC/advocacy activities to support TB control program are implemented.
Inputs		Japan side: 1. Dispatch of Experts: 30 3 for long-term, 27 for short-term 2. Trainees Received 20 3. Total Trainees for Third Country training programs: 50 4. Provision of Equipment: 65 million yen 5. General operational expenses: 182 million yen Cambodia side: 1. Counterpart position 2. Establishment of a Joint Coordinating Committee: CENAT project Director, CENAT staff, provincial health departments, operational districts, health centers tuberculosis staff 3. Land and Facilities: Project Office, training facilities 4. Local Costs: CENAT staff, local NTP staff activity costs, administrative expenses
Total Cost		786 million yen
Period of Cooperation		August 2004 - July 2009
Implementing Agencies		Cambodia Ministry of Health (MoH), National Center for Tuberculosis and Leprosy Control (CENAT)
Cooperation Agency in Japan		The Japan Association of Charitable Organizations, Japan Anti-Tuberculosis Association
Related Projects		[Short-term dispatch of experts] dispatch of TB control experts (1995-2000) [Technical Cooperation Project] Tuberculosis Control Project (1999.8-2004.7) The Project for Improving the Capacity of the National TB Control Program through Implementation of the 2nd National Prevalence Survey (2009.11 – 2012.11) [Grant aid] National Tuberculosis Center Improvement Plan (2000) [Other aid agencies] ✧ World Health Organization (WHO)

	✧ World bank (WB) (about 10 years support up until 2008) ✧ Canadian International Development Agency (until 2005) ✧ The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) ✧ United States Agency for International Development (USAID) (TBCTA (2000-2005), TBCAP (2005-2010), TB CARE I & II (2011-2015) ✧ US Centers for Disease Control (USCDC) ✧ Médecins Sans Frontières (MSF), Various other NGOs

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement of Overall Goal

The WHO Global target[1] is to achieve a 70% detection rate of new smear (+) TB patients, maintain an 85% cure rate, and in so doing work toward a reduction in the prevalence of smear (+) tuberculosis and the number of TB patients. This Project aims to achieve an overall goal based on this global target and therefore set project objective indicators of achieving a 70% detection rate of new smear (+) tuberculosis patients, maintaining an 85% cure rate that if maintained will achieve the overall goal of a reduction in the prevalence of smear (+) tuberculosis and the number of TB patients.

At the time of terminal evaluation, it has been confirmed that the project objectives have been achieved or improved, and the foundation for the achievement of the overall goal has been determined to be in order. As for new projects related to TB control introduced through the cooperation of organizations related to this Project, in order for the National Center for Tuberculosis and Leprosy Control (CENAT) and the National TB Control Program (NTP) to achieve nationwide coverage, efforts are in full swing towards achievement of the overall goal and the expectation that it will be realized is high.

1.3.2 Achievement of Project Objective

For the project goals, four indicators have been set. The discovery rate of indicator 1 of 70% of new smear (+) TB patients was achieved in 2005. In addition, the cure rate of new smear (+) TB patients of indicator 2 remained at a high level of around 90% or so throughout the project period, maintaining the goal of 85%. In regards to indicator 3, in 2009 there were 8,378 reports of smear (+) pulmonary tuberculosis which approximates to about twice that of 2003, and in 2007 1,422 people reported tuberculosis in children, which achieved the indicator 4 target of 1,268.

[1] WHO global target: Goals and plans published by the WHO in 2006, in the "Stop TB strategy". Associated Millennium Development Goals (MDGs) set numerical targets such as to "detect at least 70% of new sputum smear (+) TB cases and cure at least 85% of these cases" and “by 2015: reduce prevalence of and death due to TB by 50% relative to 1990”

1.3.3 Recommendations

The followings are proposed in terminal evaluation.

- ✓ In order to take advantage of the talent that has been cultivated by the Project, the development of human resource development systems that can support new technology introduction is necessary. It is also necessary to strive for improved program monitoring and evaluation capacities at each level from, central to district, and improve the capabilities of surveys, research designs, and data analysis carried out by CENAT itself.
- ✓ In regards to community DOTS[2], it is necessary for CENAT, while promoting the activity management of related organizations, to aim for quality improvement. As for childhood TB control, it is necessary to take the two provinces that have been supported in this Project as a model, and raise the quality to a level that can be expanded nationwide.
- ✓ X-ray diagnosis was intended, through the support of relevant organizations and this Project, to strengthening the diagnostic capacity of sputum-negative cases, however the need to enhance diagnostic capabilities further has been pointed out by experts. The EQA (external quality assessment) of sputum smear diagnosis is expanding nationwide through the system developed in this project, however it is necessary to establish a system that practically promotes capacity building.
- ✓ As for culture tests, while implementation has been made possible for laboratories in three locations nationwide, implementation support for culture testing is limited, improvement is required for the diagnosis of drug-resistant tuberculosis and sputum-negative cases to function effectively. In addition, it is necessary to promote ongoing capacity building of culture test laboratories which meet the biosafety standards of the WHO.

[2] The method of DOTS implementation, there is "hospital DOTS" where health workers directly monitor the drug intake of patients admitted to the hospital as well as "health center DOTS " where the patient visits a health center every morning and their drug intake is carried out under direct monitoring by a health worker, etc. In "community DOTS" monitoring people is not done by a health worker, but by responsible members of the community who received a certain level of guidance. Within the flow of DOTS diffusion, there are residents who do not have access to enough DOTS services through public medical institutions, and therefore community DOTS which involves the community through a kind of “DOTS at home”, where community members act as “DOTS Watchers” to directly monitor the drug intake of patients, has begun to be actively introduced. Village health support groups (VHSG) play this role in Cambodia.

2. Outline of the Evaluation Study

2.1 External Evaluator

Machi KANEKO, Earth and Human Corporation

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: September 2012 - October 2013

Duration of the Field Study: November 30 - December 23, 2012 and May 7 - 25, 2013

3. Results of the Evaluation (Overall Rating: B[3])

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance with the Development Plan of Cambodia

In 2004, corresponding to the start of this Project, the Cambodian government announced its "Rectangular Strategy" as a comprehensive framework of national development. In this strategy, positioning health and medical care, education, gender, population as the main pillars for "capacity building and human resource development" placing particular focus on the health and medical fields, effective use of the private sector, facility expansion of health centers and referral hospitals, disease prevention, infectious disease control, and maternal and child health as important issues. In addition, the first sector strategy policy of the "Health Strategic Plan (HSP 2003-2007)", created jointly by the Ministry of Health and aid agencies, raised the reduction of infectious diseases such as tuberculosis, malaria, dengue fever, etc. as first priorities. Furthermore, the Cambodia Millennium Development Goals (CMDG 2005 Update,) indicated the long-term development goals of Cambodia, raised the important issue of infectious disease control for tuberculosis, AIDS, and malaria, and on the basis of the global targets of the WHO, numerical targets have been set respectively for the prevalence of smear tuberculosis, mortality from tuberculosis, case detection rate and the cure rate.

The National Strategic Development Plan (NSDP 2006 - 2010), which is the national development policy related to this Project from its implementation to its completion, regarded the health sector as an important area of nation-building. In addition, the "Health Strategic Plan (HSP 2008-2015)", set addressing perinatal medicine, infectious diseases and non-infectious diseases as three overall goals (HSP Goals). With tuberculosis included in infectious diseases, target values in line with those of the CMDG were set. In addition, the health strategy, particularly the "National Health Strategic Plan for Tuberculosis Control in

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[4] 3: High, 2: Fair, 1: Low

the Kingdom of Cambodia (2006-2010)" which indicates TB control, set numerical targets in line with the CMDG and HSP Goals and, as an approach to achieve these target values, called for nationwide dispersal of "Directly Observed Treatment with Short-course chemotherapy (DOTS)", a strengthening of laboratories and TB control that goes beyond the basic premise of DOTS (such as C-DOTS, TB / HIV, PPM-DOTS), an improvement in the quality of services, human resource development and a strengthening of administrative capacities. Each of these measures is consistent with the approach outlined for this Project.

In light of the above, both at the point of ex-ante evaluation and at the time of project completion, it can be said that the purpose of this Project was consistent with the goals listed in the various policies above and that its relevance to the health and national policies of Cambodia is high.

3.1.2 Relevance with the Development Needs of Cambodia

In Cambodia tuberculosis infection has expanded due to the collapse of the medical system and the deterioration in the nutritional status of its people brought about by the civil war which lasted until the 1980s. The WHO has specified it as one of the "22 high TB-burden countries[5]" that urgently requires TB control measures. In order to cope with this TB epidemic, the WHO introduced its DOTS strategy into Cambodia in 1994 and the TB cure rate improved significantly. However, along with the impasse that has occurred in capacity building and the shortage of health care workers, many patients fall within the twenty to fifty working age range and therefore the spread of tuberculosis infection is a problem that directly affects the economy. Further, as the status of the tuberculosis epidemic in the whole country is not accurately understood, the fact that it is difficult to attain a long-term perspective in relation to TB control has also been a problem. For this reason, the Cambodia government requested the implementation of a project centered on the requests of health care workers and focused on strengthening the operational functions of the national TB program (NTP). Accordingly JICA began this Project in 1999 as a technical cooperation project that falls on Phase 1 of the "National Tuberculosis Control Project" (hereinafter referred to as “phase 1”).

In phase 1, with CENAT / NTP as a counterpart, and taking into account the flow of general health sector reform being carried out by the WHO in the same period, this Project aimed to spread diagnosis by sputum smear examination and TB treatment with DOTS to health centers throughout the country. As a result, upon project completion in 2004, DOTS coverage to health centers had expanded to 79% (over 750 locations) from the 0% recorded at the start of the Project. Also, although the tuberculosis detection rate stood at 64% (2004), lower than the project goal of 70%, the tuberculosis cure rate continued to be maintained at more than 85%.

[5] 22 high TB-burden countries: Shows the 22 countries specified by the WHO as having particularly large numbers of estimated outbreaks of patients with tuberculosis. It is said that these 22 countries account for 80% of the new occurrences of tuberculosis.

On the other hand, in addition to the fact that there remains challenges in terms of ensuring the quality of DOTS which has expanded rapidly nationwide, new challenges such as the increased TB/HIV co-infection in urban areas (about 30% of TB cases in the capital), the importance of public and private mix (PPM) cooperation, the need to respond to pediatric tuberculosis etc. are becoming clear and the Cambodian government has requested this Project, the "National Tuberculosis Control Project Phase 2" in order to deal with these problems. For these reasons it can be said that the sequence of this Project from Phase 1 through to Phase 2 has been clear and relevant with the development needs at the time. In addition it has been determined that the approach of this Project has been consistent with the global strategy of the WHO to lead world TB control as part of the "Stop TB Strategy".

In addition, after completion of this Project, with the aim of comparing the changes in the prevalence of current results compared to those of the 1st National Tuberculosis Prevalence Survey conducted in 2002 (before the full-scale nationwide expansion of DOTS), and in cooperation with international organizations such as the WHO, "The Project for Improving the Capacity of the National TB Control Program through Implementation of the 2nd National Prevalence Survey (2009.11-2013.01) (hereinafter referred to as the 2nd prevalence survey)" technical cooperation project was implemented. From this, an approximately 38% reduction in the number of sputum smear (+) patients (from 437 down to 272 per 100,000 people over the age of 15) was observed in the first survey results. However, Cambodia continues to be designated as one of the "22 high TB-burden countries" even today, despite 20 years having passed since DOTS implementation, and the continued need for TB control in the future has been recognized.

This Project has been working on addressing the new challenges of quality improvement following the expansion of DOTS implemented in phase 1, and TB/HIV co-infection, etc. The development needs can be considered high both at the start and completion of the Project.

3.1.3 Relevance with Japan’s ODA Policy

The Japanese "Country Assistance Policy for Cambodia" is actively involved in cooperation for infectious disease control measures, in particular those for HIV/AIDS and TB, as well as the complications that go with them, and malaria and parasites. In addition, in JICA’s Country Assistance Policy for Cambodia, an important area of the health sector, TB control is a priority problem to be addressed in the same way as family planning and AIDS prevention.

In addition, Japan has a track record with respect to TB control because it has been promoting TB control in Asia in cooperation with international organizations such as the WHO. For this reason it can be said, from the perspective of cross-sectional operation, that it

was appropriate to make use of the advantages of Japanese aid through the means of this Project.

In light of the above, 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 Impact[6] (Rating: ③)

3.2.1 Effectiveness

3.2.1.1 Project Output

For TB control in Cambodia, the WHO, MSF and Japan initiated support at the beginning of the early 1990s, after the turmoil following the civil war, after which the World Bank, USAID, USCDC, GFATM and a number of other donors and NGOs began full-fledged support. Therefore, while bearing in mind the difficulties incurred in extracting and evaluating only the contributions of this Project in the achievement of each outcome, we have focused on the results of which this Project has played a particularly important role.

1) Output 1

Management capacity of the NTP is improved.

Indicators for Output 1:

Program management

1-1: By the end of the Project, all the NTP staff at central and provincial levels has ability to formulate plans based on objective assessment.

Information management, monitoring and evaluation

1-2: By 2007 "Annual Statistics of Tuberculosis in Cambodia" is published without delay.

1-3: Throughout the Project, the database is updated timely and appropriately.

1-4: By the end of the Project, NTP activities are analyzed and evaluated using computers in selected areas.

Logistic management

1-5: By the end of 2005, the CENAT staff correctly qualify the yearly TB drug needs and request them to the MOH(Cambodia Ministry of Health) with the specification for the products.

1-6: By the end of 2007, all the TB drugs procured through the national supply system are of high quality, preferably of GDF standard

1-7: By the end of 2006, the quantity of TB drugs requested quarterly from all the operational districts (OD) is consistent with actual TB incidence and existing stocks.

Research

1-8: By the end of the Project, NTP has technical capacity to conduct and analyze survey/research with less assistance of experts.

Coordination

1-9: Achievements of the Project or Survey results are presented at international conferences every year.

[6] Sub-rating for Effectiveness is to be put with consideration of Impact

Output 1 was intended to improve the operational and management abilities of the NTP by improving the abilities of TB control related planning, information management, monitoring and evaluation, drug management, survey research and aid coordination, etc. It was intended that this Project would effectuate capacity building of mainly CENAT, Provincial Health Department (PHD) and operational district (OD) staff and it has been confirmed that the 9 indicators, above, were mainly achieved by the time of project completion.

In particular, central level and provincial level CENAT staff have become capable of formulating annual activity plans, and their planning ability has been greatly improved compared to before the start of the Project. In addition, capacity training for staff was also conducted regarding tuberculosis annual statistics, which were being issued annually by the middle stage of the Project, and a database of statistical data was also developed. As a result, it has become possible to reflect statistical data, analysis and evaluation and analysis results in planning and supervision. In addition, with respect to indicator 1-7, in 2009 it became possible for 65% of all ODs to make requests based on the actual amount of stock and number of TB patients. Also cyclic guidance for the drug management of TB treatment facilities in health centers, etc. was conducted at about 400 locations and this information was shared through central level workshop and feedback on the plan was promoted.

As for the output 1, with regards to medical and lab staff training, information management, drug management, etc., a portion was implemented through cooperation with the WHO but the majority of activities were funded by JICA.

At the time of this ex-post evaluation, the "National Health Strategic Plan for Tuberculosis Control in the Kingdom of Cambodia (TB-NSP 2014-2021)" is in the development stage, and central level CENAT / NTP staff have taken the lead. On the basis of survey results conducted so far, they have set targets, considered implementation policies, etc., and after confirmation by CENAT, continued to regularly issue tuberculosis annual statistics, and utilize a tuberculosis patient information management system. While ODs are making requests based on drug inventory levels and tuberculosis patient numbers, etc., not only are the OD personnel conducting supervision of health centers, but health centers are making requests to ODs and efforts are being undertaken for continually improve the system. In addition, the implementation of the 2nd prevalence survey contributed to these improvements, with the addition of improvements in the surveys and research capacity of the NTP, as well as improvements in site monitoring management, analysis/evaluation, report generation capacities etc. being particularly recognized on the CENAT side. Furthermore, the 2nd prevalence survey has been published in international conferences by the director of the CENAT.

In addition, including the implementation of the 2nd prevalence survey, the Cambodian

side has been working as the main protagonist for research operations, particularly at the field level, which has provided a chance to show relevant organizations tangible proof of the enhanced capacities of central and local level NTP staff made through Phase 1 and Phase 2 of the Project.

Based on the above, Output 1 had largely been attained at the end of the Project. Further, it has been confirmed that the capacities of CENAT and NTP will be enhanced continuously after completion of the Project.

2) Output 2

Sustainable quality DOTS is expanded nationwide.

Indicators for Output 2:

Quality Improvement of routine DOTS

2-1: By the end of 2005, number of HCs providing DOTS services is increased from 706 in 2003 to all the MPA (Minimum Package Activity) Health Centers.
2-2: By the end of the Project, at least 95% of TB patients receive correct TB drugs in the correct dosage in all the selected target areas (currently 90%)
2-3: By the end of the Project, 90% of TB patients in the continuation phase are observed by someone while swallowing TB drugs in all the selected target areas (currently 40%).
2-4: By the end of the Project, stock records for TB drugs correspond exactly with physical counts in 50% of the government drug stores in all the selected target areas (currently 10%).

6 Months Short Course regimen(6MSCC)

2-5: By mid 2007, guidelines for 6MSCC are developed.
2-6: By the end of 2005, 6MSCC is implemented in all existing referral hospitals and health centers.

Public-private mix (PPM) DOTS

2-7: By the end of 2007, guideline for PPM-DOTS is formulated.
2-8: By the end of the Project, PPM services are implemented in selected areas.

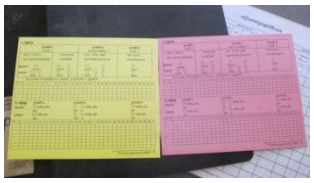
Community DOTS

2-9: By the end of the Project, community DOTS is implemented in more than 665 HCs among 950 HCs

Output 2 sought to spread a nationwide service for more efficiently delivering that DOTS that was introduced into health centers across the country through Phase 1, especially to remote areas with difficulty in accessing health care facilities, TB patients that cannot come to medical facilities and their families, and other rural residents. Along with this, by switching to the more efficient 6MSCC, it sought to achieve improvement and normalization of service quality. At the time of completion of this Project, along with the qualitative improvement of DOTS, a method of community DOTS and PPM-DOTS was implemented in a pilot region with the aim of providing wide-spread DOTS services to people that until now had found it difficult to receive DOTS. Therefore, by project completion it has been confirmed that the above indicator has been mostly achieved.

Specifically, indicator 2-3, the "percentage of TB patients receiving drug administration through DOTS in the continuation period" which is related to the qualitative improvement of DOTS, was 40% before the start of the Project, but improved to 95% following project completion. For 6MSCC it has been determined that changes to drug procurement by the GFATM from 2008 presented a chance to introduce 4FDC (four-drug fixed dose combination). Therefore, in addition to the development of guidelines towards this, monitoring/patrol guidance of 6MSCC was conducted with C/P, provincial/OD/hospital tuberculosis staff in need of re-training were identified, a retraining plan developed and support was given for staff re-training across the country. As a result, staff training and the switching of drugs is carried out smoothly with the support of the WHO and GFATM.

Health Center DOTS: Tuberculosis patient medical records that health centers manage



Community DOTS: Card to record daily dose of TB drugs
(Yellow: village health support groups (VHSG) keep tuberculosis medication and monitor and record daily dosage for TB patients)
(Pink: for TB patients record)
About once a week, health centers confirm both records.

In addition, PPM-DOTS was implemented with the aim of introducing public institutions to tuberculosis suspected patients who visit urban pharmacies and private clinics with a lot of resident access. In Phnom Penh City, where PPM-DOTS introduction was attempted, ODs positively confirmed increases in the number of patients with suspected tuberculosis who received DOTS services. Also, community DOTS, in cooperation with USAID, GFATM, and MSF, was introduced to 502 health centers by the time of project completion, after which, through continued support from donors, the number of locations has increased further to 799 by the end of 2012. In this survey interviews were carried out with medical personnel at central, state and district levels. In these interviews the many people said, “during the civil war there was no medicine and medical equipment and the only support from abroad came from the Red Cross, so there wasn’t anything we could do for patients. For this reason, when DOTS was introduced, medical personnel and resident volunteers, who had been waiting on-site for diagnostic technology and tuberculosis drugs, were actively involved in DOTS expansion”.

It should also be noted that to spread health center DOTS, cooperation was carried out with local NGOs (URC), and, to expand the activities of six month therapy, the WHO, GFATM and Public-Private Mix (PPM) DOTS cooperated with USAID.

In addition, the guidelines for Public-Private Mix (PPM) DOTS were formulated in this Project, then revisions were made with support from USAID and so on, and a site inspection confirmed that PPM-DOTS were functioning in the field while making use of the equipment that has been provided through USAID/TB-CARE1. In addition, in 2008, 919 people total were referred from small scale general practitioners and pharmacies due to suspicions of

tuberculosis, 424 people (46%) were examined in health centers, and 57 people were diagnosed with tuberculosis. As can be seen in Table 1 there has been a significant increase of 1908 referrals in 2012 and the examination rate has also improved to 63%. Also, revisions have been made in the guidelines for 6MSCC based on the latest guidance of the WHO.

Table 1: Activities as Public-Private Mix of (PPM) DOTS, referred from small scale general practitioners and pharmacies due to suspicion of tuberculosis, the number that are examined in public medical institutions (2012)

Phnom Penh OD	No. of referrals	Number examined	Number of patients with tuberculosis
North	544	249	33
South	598	375	111
Central	296	319	43
West	470	260	26
Total	1908	1203 (63%)	213

Source: Material from CENAT

Based on the above, Output 2 had largely been attained at the end of the Project. In addition, since the support from donors including USAID, GFATM and NGOs is continuing after project completion, the number of referrals from small scale general practitioners and pharmacies for suspicion of tuberculosis as well as the rate of examination will also increase following the end of the Project, and it is determined that the outcome are subsequently continuing to expand.

3) Output 3

Suitable services and guidelines beyond routine DOTS are developed.

Indicators for Output 3:

TB/HIV

3-1: By mid of 2005, a guideline for TB/HIV services is formulated.

3-2: By the end of the Project TB/HIV services are available at selected ODs.

Pediatric TB control

3-3: By the end of 2007, a guideline (national TB manual in 2003) for pediatric TB is revised

3-4: By the end of the Project, pediatric TB services are available at all Provincial Referral Hospitals (RHs).

Smear(-)

3-5: Guideline (draft) for smear (-) is developed.

Output 3 was to develop guidelines for dealing with the new challenges of TB control identified at the end of phase 1 such as TB/HIV co-infection, childhood TB control, and services for dealing with sputum smear (-) cases. The activities carried out through this Project have been recognized as fundamental tuberculosis services, so at the time of terminal evaluation it was confirmed the output has largely been achieved.

Specifically, indicator 3-2, services related to TB/HIV are provided in 67 out of the total 77

ODs, and an increase in the number of TB/HIV co-infection diagnoses have been confirmed. Also indicator 3-4, upon completion of the January 2008 pediatric tuberculosis guidelines, CENAT selected three pilot states (Battambang, Kampong Cham, Prey Veng) based on the advice of the Project and, under the leadership of project experts, carried out training in areas such as tuberculin sensitivity testing and patrol guidance. Further, while treatment for pediatric TB has been carried out in hospitals, since reporting had not been implemented properly, guidance was performed on periodic reports and information exchange and, as a result, in 2007 reports of pediatric TB cases exceeded the project target of 1,268, reaching 1,422.

For indicator 3-5, a smear(-) tuberculosis diagnosis measures proposal of the national TB control guidelines was created jointly by CENAT, USAID (TBCAP), and the project in July 2009.

At the time of this ex-post evaluation, these activities are continuing and the number of TB patients receiving HIV testing in Phnom Penh operational districts has increased as shown in Table 2 below. In addition, the referral system for TB/HIV co-infected patients has expanded to other operational districts even after the completion of this Project and having been introduced into 74 ODs in 2009 was finally introduced into all 77 OD locations by 2010.

In addition, these services are working to expand tuberculosis support from donors such as USAID and GFATM who plays a central role, but the budgets of these donors have seen yearly reductions and it can be said that these reductions will likely impact on monitoring frequency and activities on site.

In addition, with regard tuberculosis in children, the number of reported patients rose to 5,706 people in 2011, and therefore it has been determined that activities have been ongoing (see Table 8).

Table 2: Numbers of diagnoses of TB / HIV co-infected, number/rates of TB patients receiving testing for HIV in 4 Operational Districts of Phnom Penh City

Item	2009	2010	2011
Number TB receiving patients HIV testing	25,045	30,431	31,176
Diagnoses of TB / HIV co-infected	396	307	282

Source: Material from CENAT

Based on the above, Output 3 had largely been attained at the end of the Project. Further, it has been confirmed that some achievements have continued subsequently even after completion of the Project.

4) Output 4

Quality of laboratory services to support DOTS, TB/HIV activities and surveys is improved.

Indicators for Output 4:

Develop Guidelines

4-1: By the end of 2007, a guideline for total quality management (TQM) of bacteriological examination for TB is formulated.

CD4[7]

4-2: By the end of 2005, CD4 testing service is available in CENAT.

Stock Management

4-3: Throughout the project, it does not face shortage of reagents and materials at all TB laboratories.

Improvement in the quality of inspection

4-4: Training for smear examination are conducted strategically based on Quality Assessment results.

4-5: QC circle activities are sit up at selected province.

4-6: Throughout the project, evaluation indicators (ex. Agreement rates >95%, etc.) for bacteriological examination are maintained the expected ranges.

4-7: By the end of the Project, smear (+) rate among suspects is decreased to expected rate(10%-15%)

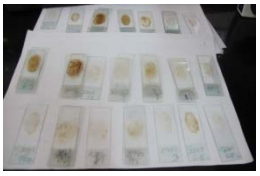
4-8: Trainings for assessors and cross-checkers are conducted once a year.

4-9: By the end of the Project, External Quality Assessment (EQA) system for Drug Susceptibility Test (DST) between supranational reference laboratory and CENAT laboratory is developed.

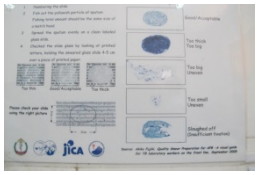
Output 4 sought to improve the quality of DOTS, TB/HIV measures, research activities, required inspections etc., through training and practice on TQM, CD4, sputum examination, bacteriological work, EQA for DST and so on. At the time of terminal evaluation the 9 indicators are confirmed to have been largely achieved.

More specifically, the English and Khmer versions of the TQM guidelines for the 2 pilot ODs related to indicator 4-1 (Battambang province, Mung Russey OD and Kandal province, S'ang OD) were created by the end of 2007 and published in May 2008 and July 2009 respectively. Also, in relation to indicator 4-7, the smear (+) rate of tuberculosis suspected cases was 13.0% in 2008, and remained within the Project's desirable range. The smear (+) rate has seen an improving trend since Phase I and, having achieved the numerical targets of 2006, has maintained the target number thereafter. The reason for this is that it has been determined that EQA (external quality assessment) expansion and regular support activities for the laboratories has been continuing.

Sputum smear slides of suspected tuberculosis patients are delivered to a district hospital lab from a health center



Sputum smear slides under examination in the lab



Inspection guide that was created in Phase 2 (introduced to lab facilities nationwide)

[7] CD4 testing is one indicator used to measure the progress of AIDS infection by measuring T lymphocytes which promote the production of immunoglobulins in plasma cells.

On the other hand, at ex-post evaluation it was confirmed that TQM activity has stagnated. The reason for this given by a representative from Battambang province is that the TQM method is difficult and to continuing it without the guidance of Japanese experts has proved difficult. In addition, development of a TQM system was aimed for at the planning stage of Phase 2, but problems in end lab inspection capabilities became apparent during project implementation and therefore, in order to shift from EQA every 3 months to every 6 months, activities focused on organizational building, training, and equipment provision were carried out in the Project. Quarterly EQA funded by GFATM came to be carried out in all 24 states in 2009 and, as shown in Table 3 on the right, with the support of the GFATM, Quarterly EQA is also being carried out after completion of the Project and the proportion of poor quality laboratories in decreasing.

Table 3: Quarterly ongoing EQA status following completion of the Project

Quarter	Percentage of poor quality laboratories for each EQA quarter
2010-I	21%
2010-II	22%
2010-III	21%
2010-IV	17%
2011-I	12%
2011-II	8%
2011-III	11%
2011-IV	14%
2012-I	17%
2012-II	13%

Source: Material from CENAT

In addition, during the project period, a culture test SOP (standard operating procedures) is in place, strengthening of the inspection capacity of culture labs at three locations, including the CENAT lab, has been performed, and this effort has contributed to the installation of tuberculosis (TB) culture labs that meet the criteria of the WHO, receiving high praise from the Cambodian side at the time of this ex-post evaluation.

Further, human resource development and the provision of equipment for lab testing in Kampong Cham and Battambang supported in this Project has been carried out with the support of USAID and MSF.

In addition, in regards to indicator 4-7, the smear (+) rate of patients with suspected tuberculosis, was decreased to 13.0% in 2008 from 28.6% in 2001, and was reduced further after 2009, after the end of the Project has remained in the range of 10.1% to 11.7% as shown in Table 4.

Table 4: Smear (+) rate in patients with suspected tuberculosis

Year	Number of samples	Number suspected of tuberculosis	Smear (+) rate
2005	463,246	138,144	15.3 %
2006	458,646	138,516	14.5 %
2007	487,987	147,929	13.3 %
2008	486,568	147,594	13.0 %
2009	506,636	154,465	11.7%
2010	521,353	161,541	11.0%
2011	539,825	165,554	10.1%

Source: Material from CENAT

Based on the above, Output 4 had largely been attained at the end of the Project. Further, it has been confirmed that some outputs are still continuing and numerical indicators are improving even after Project finished.

5) Output 5

Effective IEC/Advocacy (Information, Education Communication/Advocacy: IEC activities (e.g., production of teaching materials for awareness activities and educational activities)/advocacy) activities to support the TB control program are implemented. Indicators for Output 5: 5-1: By 2007, NTP has an IEC/advocacy strategy to support TB control program. 5-2: By the end of the Project, NTP implements the IEC/advocacy strategy with partner organizations 5-3: By the end of the Project, 70% of DOTS Health Centers is supported by Village Health Support Groups (VHSGs) through IEC/advocacy activities.

Output 5 was to formulate and implement the strategies concerning IEC/Advocacy to support the TB control program, and the nearly complete attainment of the three indicators was confirmed at the time of terminal evaluation. Note that there was a shift form IEC/Advocacy to ACSM (Advocacy, Communication and Social Mobilization) at the midpoint of the Project. ACSM is a concept adopted by the WHO's Stop TB Partnership, which has become the international main stream replacing IEC/Advocacy. Reflecting this change, the formulation of IEC/Advocacy strategies in Indicator 5-1 was redefined as the formulation of ACSM strategies, and the draft of these strategies has been completed. CENAT/NTP has conducted training concerning ACSM strategies for the OD-level staff at all 77 locations, and initiated the implementation of ACSM activities according to the guidelines. With respect to Indicator 5-3, C-DOTS has been introduced at 61 out of the 77 ODs in the country (about 80%), and activities are performed by VHSGs (village health support groups) who have received TB educational training through this Project.

At the time of ex-post evaluation, the importance of ACSM has increased further. It is positioned as a horizontal concept that must not only be discussed as a separate element but be considered in all aspects of TB control. ACSM activities are continued at all 77 ODs. C-DOTS has also been introduced at all 77 ODs (100%).

Based on the above, Output 5 had largely been attained at the end of the Project. It was also confirmed that the activities by CENAT have been continued after the end of the Project.

3.2.1.2 Achievement of Project Objectives

Project objective

Sustainable quality TB Programme is implemented nationwide.

Indictors of project objective:

Indicator 1: Throughout the Project, cure rate among newly registered smear (+) TB patients is maintained at least 85%.

Indicator 2: By the end of the Project, smear (+) detection rate is increased and maintained at least 70%.

Indicator 3: By the end of the Project, number of smear (-) registered cases is increased twice as many from the level in 2003.

Indicator 4: By the end of the Project, number of registered TB cases in children is increased twice as many from the level in 2003.

1) Indicator 1

Throughout the Project period, the cure rate among new smear (+) TB cases remained at high levels of about 90%. The target value for the cure rate of 85% was maintained.

Table 5 to the right shows the cure rate among new smear (+) TB cases as confirmed during this ex-post evaluation. It is considered that the rate is still maintained at the level at the end of the Project.

Table 5: Cure Rate among New Smear (+) TB Cases

Year	Cure rate
2004	89.7 %
2005	88.9 %
2006	90.4 %
2007	91.1 %
2008	92%
2009	92%
2010	92%
2011	91%

Source: Material from CENAT

2) Indicator 2

As shown in Table 6, Indicator 2 concerning the detection rate of new smear (+) TB cases achieved the target value in 2005 and then achieved 69% shortly before the end of the Project. Although the detection rate tended to decrease thereafter, such decrease was considered normal, as confirmed by the "Joint Study on NTP" conducted by the WHO in 2012 in collaboration with other organizations supporting TB control, and the rate is expected to decrease gradually in the future. Specifically speaking, the recent decrease in detection rate was not the reflection of general aggravation of situations, but of the actual decrease in the prevalence of smear (+) TB resulting from the efforts toward detection of smear (+) TB cases that have been continued for more than 10 years. We were told that the case detection rate (CDR) would cease to be an indicator and be replaced by the case notification rate (CNR[8]) of new smear (+) patients.

Table 6: Detection Rate of New Smear (+) TB cases (CDR)

Year	Detection Rate
2004	64 %
2005	70 %
2006	66 %
2007	65 %
2008	69 %
2009	63%
2010	63%
2011	60%

Source: Material from CENAT

[8] The smear (+) case notification rate (CNR) tended to decrease from 131 in 2009 to 109 in 2010 (vs. target 125) and 101 in 2011 (vs. target 122).

3) Indicator 3

The number of registered smear (-) TB cases in 2008 was 7,847. Although the number of registered cases increased satisfactorily during the Project period, it did not reach the target value of 8,314 (twice the number in 2003). However, because the number of reported cases of smear (-) pulmonary TB increased satisfactorily during phases 1 and 2, it was considered that the situations stabilized in 2005 and the stable state was maintained thereafter.

Table 7: Number of Registered Smear (-) TB Cases

Year	Registered Cases
2001	1658
2002	2668
2003	4307
2004	5800
2005	7057
2006	6875
2007	7120
2008	7847
2009	8378
2010	8301
2011	7686

Source: Material from CENAT

Therefore, although the target number was not attained at the time of terminal evaluation, the documented improvement in the detection of smear (-) cases supports the expectation that the number of reported cases of sputum negative pulmonary TB would increase further as a result of possible future improvement in the quality of chest X-ray equipment and that in the access to X-ray diagnosis. On the other hand, no concrete support programs for such quality improvement and access improvement have been identified at the present.

4) Indicator 4

NTP, in response to the recommendations in the Project, started registration of the total number of childhood TB cases in 2005, in addition to the number of smear (+) childhood TB cases. As shown in Table 8 to the right, the number of reported cases of childhood TB reached 1,422 in 2007, achieving the target number of 1,268. This number increased further to 2,540 in 2008. As a result, NTP became capable of grasping a more accurate picture of the entirety of TB patients in Cambodia, and hence became able to formulate more appropriate measures against TB for children.

Table 8: Number of Reported Cases of Childhood TB

Year	Registered Smear (+) TB Cases	Total number of Childhood TB Cases
2003	83	634
2004	64	NA
2005	94	696
2006	96	1081
2007	111	1422
2008	120	2540
2009	82	3853
2010	92	4613
2011	67	5706

Source: Material from CENAT

The number of childhood TB cases increased further in and after 2009. This is considered to demonstrate the enduring functioning of the system for the reporting of NTP data from hospitals.

As reviewed above, the indicators concerning the project objective of this Project are considered to have been achieved in general. And this project has largely achieved its objectives, therefore its effectiveness is high.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

The mortality rate and morbidity of TB decrease.

Indicators of overall goal at the time of terminal evaluation:

Indicator 1: By 2012 incidence of smear (+) TB is reduced from 241/100,000 in 1997 to 120/100,000 nationwide.

Indicator 2: By 2012 prevalence of smear (+) TB is reduced from 540/100,000 in 1997 to 270/100,000 nationwide.

Indicator 3: By 2012, mortality rate of TB is reduced from 90/100,000 in 1997 to 45/100,000 nationwide.

The WHO's global target concerning TB predicts that achieving a 70% detection rate of new smear (+) TB patients and maintaining a 85% cure rate would result in decreases in the incidence rate and prevalence of smear (+) TB and in the mortality rate of TB patients. The overall goal and the project objective of this Project were defined based on this global target. On the other hand, we confirmed the most up-to-date numerical targets at CENAT, and found that the current CMDG adopts numerical targets relative to the baseline levels set in 1990, and that the current National Health Strategic Plan (TB-NSP 2011-2015) for TB control also adopts the same baseline year and numerical targets as CMDG. In addition, the new numerical targets use the prevalence rate of all TB (including smear (-) TB) rather than the prevalence rate of smear (+) TB.

For this reason, we evaluate the achievement of the overall goal of this Project based on the attainment of the following two numerical targets, while also considering the indicators in the initial plan.

Indicators and achievement of overall goal at the time of ex-post evaluation:

Indicator 1: The prevalence rate of all forms of TB decreases by half from that in 1990 by 2015.

(Achievement)

About 60% decrease was achieved 4 years earlier than the target year.

1990: 1,670 / 100,000

2011: 817 / 100,000 (51% decrease)

Indicator 2: TB mortality rate decreases by half from that in 1990 by 2015.

(Achievement)

1990: 155/100,000

2011: 63 / 100,000 (60% decrease)

Source: WHO, "Global Tuberculosis Report 2012"

As shown above, the prevalence of all forms of TB decreased by half from 1670 per 100,000 in 1990 to 817 per 100,000. The TB mortality rate also decreased by half from 155 per 100,000 in 1990 to 63 per 100,000. The figures for the prevalence of all forms of TB were brought to light through the 1st prevalence survey conducted in phase 1 and the 2nd

prevalence survey conducted upon project completion. This result was featured prominently in the WHO "Global Tuberculosis Report 2012," which highly commended the fact that the approach to this problem, which requires long-term measures, achieved a substantial reduction in a period as short as 9 years and the outcome was clarified based on direct epidemiological information.

The overall goal target indicators were largely achieved and therefore its impact is high.

3.2.2.2 Other Impacts

No negative impacts, including those on natural environment, were identified during the implementation of this Project and at the time of ex-post evaluation. No relocation of inhabitants or acquisition of land is planned.

The implementation of this Project achieved the project objective of the 70% detection rate of new smear (+) TB cases in 2005. The cure rate of new smear (+) TB cases also hovered at high levels of about 90% throughout the Project period, consistently exceeding the 85% target. As for the overall goal, the prevalence rate of TB in all forms achieved a decrease of about 60% four years earlier than the target year. This project has largely achieved its objectives, therefore its effectiveness is high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

The input plan and actual performance of this Project are as follows.

Inputs	**Plan**	**Actual Performance** (as of the end)
(1) Experts	3 for Long-Term Chief advisor, task coordination, laboratory management Short-Term: As needed	F.Y. 2004 Long-term: 3 persons Short-term: 15 F.Y. 2005 Short-term: 16 F.Y. 2006 Short-term: 21 F.Y. 2007 Short-term: 17 F.Y. 2008 Short-term: 13
(2) Trainees received	Main training areas: TB control, testing techniques	Main training areas: TB control, testing techniques F.Y. 2004 C/P training: 5 F.Y. 2005 Country focus training: 3 F.Y. 2006 Country focus training: 2
(3) Third-Country Training Programs	Main training areas: TB control, testing techniques	Main training areas: X-ray diagnosis/examination techniques Number of trainees: 50 (Thailand, Philippines)
(4) Equipment	Main input equipment:	Main input equipment:

Inputs	Plan	Actual Performance (as of the end)
	Microscope, motorbike, X-ray equipment, OA equipment, smear test kit, etc.	Microscope, X-ray equipment, OA equipment, smear test kit, etc. Total 65 million yen
Total project cost	Total 510 million yen	Total 786 million yen
Local cost	Because CENAT conducts the activities in this Project and NTP activities as a whole and it is difficult to single out the budget for this Project, the budget amount has not been specified.	Because of the reason given in the left column, the input amount on the Cambodian side has not been estimated.

3.3.1.1 Elements of Inputs

The input from the Japanese side was executed largely as planned, including the dispatch of experts, acceptance of trainees, third-country training, and provision of equipment. The timing of dispatch, specialty, and teaching ability of Japanese experts, as well as the training in Japan and third-country training, were evaluated highly by the Cambodian side. The equipment provided is still in use at health centers and laboratories.

While the Cambodian side assigned counterpart personnel to facilitate Project activities, there were very few occasions in which they were unavailable because of long-term training or personnel transfer, and there were no problems in Project activities.

3.3.1.2 Project Cost

The amount of assistance significantly exceeded the planned amount (154% of the planned amount). This excess occurred because a scheme for technical cooperation project using outsourced operations was established and accordingly the configuration of the Project was changed from the dispatch of experts, assumed in the initial evaluation, to the commissioning of services.

3.3.1.3 Period of Cooperation

The period of cooperation was as planned (100% of planned period).

Although the period of cooperation was within the plan, elements of inputs were partially inappropriate and project cost exceeded the plan, therefore efficiency of the project is fair.

3.4 Sustainability (Rating: ②)

3.4.1 Related Policy towards the Project

All government initiatives from the National Strategic Development Plan (NSDP

2006-2010) to the Health Strategic Plan (HSP 2008-2015) clearly set forth consistently coherent TB policies, and the commitment of the Cambodian Government to TB control is solid. In addition, the Cambodian Government has formulated the "National Health Strategic Plan for TB Control," addressing the improvement of the quality of healthcare services, the involvement of communities and TB patients, TB/HIV control measures, PPM-DOTS , multiple drug resistant TB, information and research, human resource development, partnership with related organizations, etc. The current strategic plan is the National Health Strategic Plan (TB-NSP 2011-2015) with the target year of 2015. Although this target year has not arrived, the government is in the process of formulating a new National Health Strategic Plan for TB control (TB-NSP 2014-2021). According to CENAT, this new strategic plan is going to launch the 5.5 Strategy for TB Control in Cambodia, which promotes TB control aiming to reduce germ-positive prevalence rate and mortality rate by 5% every year for 5 years based on 5 principles. From this we can assume the Cambodian Government still gives a high priority to TB control, and that this direction is expected to be upheld in the future, therefore sustainability in political and organizational aspects is considered high.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

CENAT is the central organization driving the national TB program and has the comprehensive responsibility to promote the program on the national level. It is expected to stay in the position as the central organization. CENAT is striving to strengthen human resources and organizations under the support of Japan and other donors and is considered capable of driving the program into the future as a comprehensive and responsible organization for the national-level promotion of NTP. In addition, the strong leadership of the current director of CENAT is considered a factor ensuring the promotion of NTP.

Reinforcement of supervision from the central government to provinces, from provinces to OD/referral hospitals (RH), from OD/RH to health centers, and from health centers to VHSG is also planned through the expansion of DOTS. However, now that the expansion of DOTS has been achieved, it has become more important to further improve the quality of individual organizations in addition to the reinforcing supervision. For example, the prevalence survey in this study identified three problems; (1) TB with slight symptoms (cases lacking a cough persisting for over two weeks or bloody sputum), (2) smear (-) TB, and (3) TB in aged patients. Responses to these problems need decisions on whether to perform procedures such as chest X-rays even in slight or sputum negative cases. Although the field visits in this study confirmed the satisfactory functioning of supervision from OD to health centers and from health centers to VHSG, disparities were noted in frequency and capability, dependent on the status of donor and NGO assistance. It is necessary to improve the DOTS monitoring system, to increase the capabilities of localities showing weakened functions and to build a system to

support field-level problem solving.

As seen above, while the organizational sustainability of CENAT as the executing body of this Project is evaluated as high, problems have been noted because some initiatives, including the system for maintaining qualitative improvement of DOTS expansion, as well as human resource development and organizational reinforcement to respond to new issues are lagging. Therefore, sustainability in the systematic aspect is considered partially insufficient.

3.4.3 Technical Aspects of the Implementing Agency

Efforts were made in this Project to improve the technical abilities of individual workers engaged in TB control, such as the CENAT staff, provincial health department (PHD) staff and operational district (OD) staff. As a result, a basis for nation-wide deployment of C-DOTS, 6MSCC, PPM-DOTS, etc. was constructed, leading to the continuation of activities after the end of the Project. Guidelines for TB/HIV and childhood TB were also developed with the technical support from Japanese experts. In this sense, the Project helped the development of infrastructure for not only DOTS but also a wide range of activities necessary for TB control in Cambodia.

Furthermore, the prevalence survey in this study provided an opportunity for technology transfer in relation to survey design, data analysis, chest X-ray diagnosis, EQA, culture testing, etc., which were pointed out as problems during the terminal evaluation.

While TB control measures in Cambodia have been achieving success through steady efforts to develop infrastructure for a nation-wide spread of DOTS, our study identified the same three problems as those in the institutional aspect: (1) TB with slight symptoms (cases lacking a cough persisting for over two weeks or bloody sputum), (2) smear (-) TB (cases that are negative on sputum smear testing but are diagnosed as TB on chest X-ray and other examination), and (3) TB in aged patients (cases that are difficult to diagnose because of the vagueness of symptoms in aged patients). Measures to address these problems, including reinforcement of outpatient diagnostic functions, reinforcement of health center functions, and community-based health screening, are needed. During an interview, the director of CENAT pointed out that the decrease in prevalence rate has not been large enough to remove Cambodia from the list of the “22 TB high-burden countries,” although the prevalence survey in this study demonstrated the effectiveness of the TB control measures in the past, and strongly acknowledged the importance of further improvement of the operation management capabilities and technological strength of CENAT/NTP so that serious problems will not occur in the quality of TB control in the future.

Based on the above, while sustainability in the technical aspect is improving, the situation is considered partially unsatisfactory in terms of the further reduction of TB prevalence rate and the response to new issues.

3.4.4 Financial Aspects of the Implementing Agency

The TB control budget of NTP has depended chiefly on the WHO, GFATM, USAID, and Japan and it is expected to diminish in the future as financial assistance from multiple donors, including the 10-year financial assistance from the World Bank, is being discontinued. On the other hand, we appreciate the fact that the 2013 government budget for TB control had been increased by about 170% over 2009 when this Project ended. However, the government budget represents only 12% of the total budget (according to the WHO) and the situation in which the Government is dependent on external funds, such as from donors, for most of this budget is expected to continue for a long time. In the face of the need to address new TB control measures, CENAT/NTP plans to submit re-application to a new GFATM round for the purpose of securing funds for the years after the termination of Round 7 in 2014. However, as GFATM is revising its schemes for financial assistance, it is uncertain whether or not a sufficient budget can be secured.

Table 9: Government TB Control Budget of MOH (US$)

Annual	2009	2010	2011	2012	2013
Actual	650,000	653,000	868,000	998,000	1,115,000

Source: Material from CENAT

For these reasons, while there are no problems in the short term financial situation, there may be difficulties in long-term financial sustainability.

Some problems have been observed in the structural, technical and financial aspects of the executing agency, therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This Project was implemented for the purpose of reducing deaths from tuberculosis (TB) and a reduction in the number of TB patients in Cambodia, one of the specified "22 high TB-burden countries". The Project has undertaken qualitative improvement of DOTS (Directly Observed Treatment with Short-course chemotherapy) that is expanding across the country, strengthened diagnosis capabilities for TB control beyond that of DOTS, strengthened administrative capacities and worked to develop human resources. This effort has been carried out in an approach consistent with the policies of Cambodia and therefore its relevance is very high.

Upon completion of the Project, it has been confirmed that the foundation for

disseminating and expanding the DOTS that involves citizens, Public-Private Mix (PPM) DOTS and community DOTS, has been built and the results are being continued by other donors at the time of this ex-post evaluation. In addition, as a result of efforts to focus on strengthening the diagnosis capacities of labs, it contributed domestic tuberculosis culture labs that meet the criteria of the WHO in three locations. Furthermore, from the fact that the prevalence of all types of TB and the TB mortality rate, which were the indicators for assessing the overall goal, have been achieved four years earlier than the target year, 2015, effectiveness and impact of the Project is high. Although the project period was as the plan, the project cost was significantly exceeded, therefore efficiency of the Project is fair.

In regards to sustainability, while TB with slight symptoms, smear (-) TB, TB in aged patients etc. and other new challenges are becoming apparent, there are slight problems in regards to the technology of a system that can respond to them. In addition, while there is an apparent trend of decreases in external funds from donors pertaining to TB control, Cambodia continues to be specified as one of the "22 high TB-burden countries," and as there are problems in terms of long-term financial sustainability, sustainability is considered fair.

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

4.2 Recommendations

4.2.1 Financial Aspects of the Implementing Agency

The TB control budget of the Cambodian Government has been increasing year by year, and this point is highly appreciated. However, as the government budget represents only 12% of the total budget and there is uncertainty about the continuation of support from various international donors in TB control, it is important that the project implementing organization, in cooperation with the Ministry of Health, tries to increase the percentage of domestic funds and press the Government and private sector to make efforts towards this purpose.

4.2.2 Recommendations to JICA

Infrastructure for the nation-wide expansion of various activities needed for TB control in Cambodia has been developed through this Project, and the role of Japan in TB control in this country has been significant. On the other hand, new issues have been identified through the second national TB prevalence survey. In order for Cambodia to cease to be a TB high-burden country, it needs technical assistance in addressing these issues (support to the improvement of chest X-ray diagnosis, laboratory testing capabilities, etc.) and the training of young workers to support long-term TB control. Sufficient discussion must be held with CENAT in regards to the desirable forms of future assistance in TB control.

4.3 Lessons Learned

The TB prevalence in Cambodia is ranked high in the world, and the measures to control TB in this country are still in the process of development. However, the trajectory of the nation-wide expansion of DOTS from hospitals to health centers, from health centers to communities, and to Public-Private Mix has proved the effectiveness of DOTS-based TB control in reducing TB prevalence rate. In the background of this success were factors such as the persistent strong commitment of the Cambodian Government to TB control, as well as the positive participation of healthcare workers, eagerly looking forward to obtaining TB medicines and diagnostic technologies in the field, and inhabitant volunteers in the efforts to spread DOTS. Another important factor that led to the substantial reduction in the prevalence rate was the fact that international donors and NGOs strongly supported the TB control measures of the Cambodian Government and ceaselessly helped organizational improvement, human resources development, technical assistance, provision of medicines and equipment, etc.

On the other hand, while donors such as GFATM and USAID are still continuing assistance in TB control, the assistance from some other donors is shifting from the control of specific diseases such as TB to the reinforcement of healthcare systems. In this situation, difficulty is expected in securing financial resources for long-term TB control activities. The time has come to consider how to address the issues of new TB control measures that must be taken after the expansion of DOTS.

In similar projects in the future, it is considered important to begin discussion with the recipient government at early stages concerning the long-term vision of TB control, focusing not only on the success after the introduction of DOTS in Cambodia but also foreseeing measures for addressing the new problems ((1) TB with slight symptoms, (2) smear (-) TB, (3) TB in aged patients) confronting Cambodia at the present.

Republic of the Union of Myanmar

The Project for the Afforestation in the Dry Zone

External Evaluator: Jun Totsukawa, Sano Planning Co., Ltd.

0. Summary

The Project was to promote greening in the Central Dry Zone in the Republic of the Union of Myanmar (hereinafter referred as Myanmar) through planting of multipurpose forest. This objective was relevant with Myanmar's development plan and needs at the time of planning and is still relevant at the time of ex-post evaluation, therefore the relevance of the Project is high.

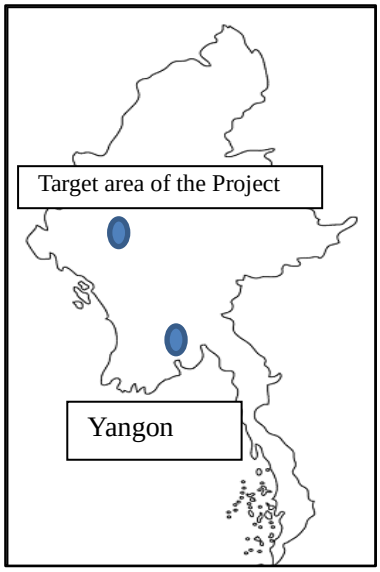
Afforestation has been carried out as planned in protected forest, fuel wood forest and community forest, and the trees planted in the afforestation sites have reached to the level that can be recognized as forest both in terms of survival rate and vegetation coverage. Moreover, the roads developed for the implementation of the Project are still maintained by local residents and have generated various positive impacts such as revitalization of traffic within the region and creation of tourism and retail businesses that followed. In light of the above, the Project's effectiveness and impact are evaluated to be high.

On the other hand, planting of the grazing forest was not carried out by the Myanmar side because the area of sites where trees could be planted was reduced. However, the roles expected of the grazing forest are mostly fulfilled by the large-scale fuel wood forest and community forest that were developed in the Project. Although the Project cost covered by the Japanese side was kept within the budget, the Project period slightly exceeded the original pan. Therefore the overall efficiency of the Project is evaluated to be moderate.

As for the sustainability, the Village Committee that consists of local residents still exists in the target area and the structure of the Nyaung Oo Office has been consolidated. Some village residents have also been hired as forest guards. Thus the administration system has been further improved since the time of project planning. Therefore the sustainability is evaluated to be high.

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

1. Project Description



Project Location

Afforestation area (Letpande Village)

1.1 Background

Myanmar, where forest occupies about 50% of the national land, depended on fuel wood for about 80% of domestic energy consumption (2002). However, due to excessive timber harvesting for export and household use (such as fuel wood), decreased the forest resources and caused such serious issues as soil erosion and land devastation. As demand for fuel wood increased with population growth, forest area had been significantly decreased, especially in the Central Dry Zone on the eastern side of the Arakan Range, where about 1/3 of the total population resides. On the other hand, as the zone is extremely dry that the average precipitation over the 10 years from 1987 to 1998 was only 568 mm/year, such harsh natural environment made it difficult for lost forest to recover through natural regeneration.

Therefore, having recognized the necessity to promote forest preservation and greening in the Central Dry Zone, the government of Myanmar carried out planting in an area of about 210,000 ha in the three years from 1994 and established the Dry Zone Greening Department (hereinafter afforestation techniques required in the zone. The government also established the Dry Zone Greening 5-year Plan, including a plan to conduct tree planting in about 40,000 ha by Fiscal Year 2005. Thus the government further promoted its greening program.

However, due to the severe natural environment and other conditions, it was technically difficult to expand afforestation in the Central Dry Zone. Therefore, the government of Myanmar requested the government of Japan to carry out an afforestation project in the Myethindwin Protected Public Forest Area in the Nyaung Oo District, the Mandalay Division, that could be a technical model for the expansion of afforestation in the Central Dry Zone.

1.2 Project Outline

The project is to promote greening in the Central Dry Zone of Myanmar through afforestation of multipurpose forest.

Grant Limit / Actual Grant Amount		[Limit] 1,508 million yen/[Provided amount] 1,453 million yen Term 1/5: 480 million yen/ Term 1/5: 469 million yen Term 2/5: 344 million yen/ Term 2/5: 335 million yen Term 3/5: 293 million yen/ Term 3/5: 288 million yen Term 4/5: 330 million yen/ Term 4/5: 300 million yen Term 5/5: 61 million yen/ Term 5/5: 61 million yen
Exchange of Notes Date		Term 1/5 Sep 30, 2002 Term 2/5 Jul 9, 2004 Term 3/5 Jun 27, 2005 Term 4/5 Aug 17, 2006 Term 5/5 Jun 28, 2007
Implementing Organizations		Dry Zone Greening Department (DZGD)
Project Completion Date		August 2008
Practitioners	Main	Hazama Corporation
	Consultant	Kokusai Kogyo Co., Ltd.
Basic Design		May 2001 – March 2002
Related Projects (if any)		Community Forestry Training and Extension Project in Dry Zone (2001-2006)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa, Sano Planning Co., Ltd.

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: November 2012 - August 2013

Field Survey: December 5-15, 2012, and May 12-23, 2013

3. Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Myanmar

(At the time of planning)

In response to the discussion at the United Nations Convention to Combat Desertification (UNCCD) in 1997, the government of Myanmar established an action plan for the forestry sector, which stated the promotion of systematic afforestation in the Central Dry Zone as one of the priority items as well as enhancement of natural forest preservation and promotion of forest management by local people's organizations.

In line with the action plan for afforestation of the Central Dry Zone, in 1997, the government announced the Dry Zone Greening Policy and established DZGD in the Ministry of Forestry as an organization to implement the policy. With six priority points[3], the policy declared sustainable utilization of forest resources in the Dry Zone.

As the contents of the Project directly contribute to the promotion of greening of the Central Dry Zone, it is evaluated to be relevant to the policies of the government of Myanmar.

(At the time of ex-post evaluation)

At the time of ex-post evaluation, the Dry Zone Greening Policy is still considered as a fundamental policy to promote greening in the Central Dry Zone. The Dry Zone Greening Program defines a master plan for six terms of a total of 30 years starting with the 1st term from 2001 to 2006 and specifies afforestation sites and target area for future afforestation.

In light of the above, the afforestation efforts in the Central Dry Zone made by the Project were relevant to the national policies of the country and such relevance still remains at the time of ex-post evaluation.

The National Sustainable Development Strategy for Myanmar, established in 2009, also states that vegetation degradation is the most serious in the Central Dry Zone among the nation and that it is important to make efforts for preservation and recovery of vegetation in the zone. It also states that greening of the Central Dry Zone is also important in terms of carbon dioxide absorption (a measure to mitigate climate change).

In light of the above, the Project was not only relevant to the development policies of Myanmar at the time of Project planning but also remains important at the time of ex-post evaluation, considered one of the propriety projects of the country.

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[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] 3: High, 2: Fair, 1: Low

[3] 6 priority points: 1) Biodiversity protection, 2) Sustainable utilization of forest resources, 3) Securing of commodities for living such as fuels and foods, 4) Establishment of effective methods to draw out the economic potential of forest recourses, 5) Establishment of resident participation, and 6) Promotion of understanding of the residents

3.1.2 Relevance with the Development Needs of Myanmar

(Development needs at the time of planning)

The government of Myanmar established the Dry Zone Greening 5-year Plan, including a plan to plant trees in about 40,000 ha from FY2001 to FY2005. The target of the overall plan was to plant trees in an area of about 210,000 ha in the Central Dry Zone in the 30 years from 2000 to 2030.

However, afforestation efforts in the Central Dry Zone had only been made in the areas where tree planting was relatively easy, and, in the areas with harsh environment where afforestation was more urgently required, only small-scale experimental afforestation had been conducted. Therefore, it was considered necessary to implement an afforestation project that would be a model for the future expansion of afforestation in the Central Dry Zone.

Moreover, although the personnel of the Ministry of Forestry had a good knowledge of forestry practice, participatory approach for forest management was limited, which were supposed to promote further. There was a high need to acquire skills for effective implementation of such forest management.

In light of the above, the Project is considered to have been relevant to the development needs of the target area and the counterparts.

(Development needs at the time of ex-post evaluation)

Based on the Dry Zone Greening 5-year Plan, DZGD planted trees in an area of about 85,000 ha in the 10 years from 2001 to 2010. Based on the plan, they plan to continue to plant trees in an area of about 120,000-140,000 ha in the remaining 20 years or so. At the time of ex-post evaluation, only a third of the period has passed and greening efforts in the Central Dry Zone are still on the way.

In light of the above, it is considered that the afforestation program in the area has not changed since when the Project was implemented and there is still a high need.

Table 1: Planned and Actual Area of Afforestation (unit: 10K ha)

Year	2001‐05	2006-10	2011-15	2015-20	2021-25	2026-30
Plan	4.27	3.50	3.50	3.50	3.50	3.50
Actual	4.53	3.98	-	-	-	-

Source: Materials from DZGD

Note: Only planned values for 2011 and later

The afforestation techniques of the Project, which were expected to be a model to be used in other areas, have already spread within DZGD and used for afforestation projects in other areas. Specifically, frequency of watering, size of planting holes, installation of fences to keep out animals, etc., are the areas where technical improvement is observed.

Thus it is confirmed that, both at the time of project planning and at the time of ex-post evaluation,

the Project was and is relevant to the needs of the government of Myanmar.

3.1.3 Relevance with Japan's ODA Policy

Since 1998, Japan has been expressing its intention to continue to support Myanmar mainly through projects in the field of basic human needs, in consideration of importance, benefits, etc., of the projects.

The Project was to improve the living environment of the residents in the Central Dry Zone and included some contents that would contribute to the improvement of the living standard of the residents, such as natural environment preservation and securing of fuel wood forest and other types of forest for livelihood through afforestation.

In light of the above, the implementation of the Project was decided based on the aid policy of Japan and the Project was relevant to the policies of Japan.

In light of the above, 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[4] (Rating: ③)

3.2.1 Quantitative Effects

The forest area, which was the indicator to measure quantitative effect of the Project, undoubtedly increased.

The following table shows the result of the vegetation survey of the afforestation sites conducted in the ex-post evaluation.

[4] Effectiveness should be judged in consideration of impact to determine a rating.

Table 2: Forest Area Increased through the Project

	2001 (At time of planning)	2013 (At the time of ex-post evaluation)			Remarks
	Afforestation area (Planned)	Afforestation area (Actual values)	Survival rate	Vegetation coverage	
Protection forest	Approx. 750ha	Approx. 734ha	74%	49.3%	The afforestation sites meet the forest definition and are recognized as forest.
Fuel wood forest	Approx. 720ha	Approx. 720ha	78%	47.5%	The afforestation sites meet the forest definition and are recognized as forest.
Grazing forest	Approx. 480ha	-	-	-	Afforestation has not been conducted.
Community forest	Approx. 65ha	Approx. 65ha	50%	21.3%	The afforestation sites meet the forest definition and are recognized as forest.

Source: Vegetation survey in the ex-post evaluation

The ex-post evaluation team conducted vegetation survey in a total of 30 plots (20 m x 20 m each) in the same method as DZGD conducts vegetation survey. DZGD's criteria for forest are 1) there is a block of 0.5 ha or more, 2) there is no land use for other purposes including agricultural use, and 3) canopy coverage is 10% or more. As all the plots of the target area of the Project have a total afforestation area of at least 10 ha and do not include any farmland, it meets the criteria 1) and 2). As the result of vegetation survey showed that the average survival rate was 72.7% (out of the 861 trees planted in the target plots, 626 survived) and the average vegetation coverage was 42.8%, it also meets Criteria 3. Therefore, it is confirmed that the trees in the afforestation sites of the Project have grown to the extent that they can be called forest.

Although the Myanmar side was supposed to plant trees in a grazing forest after the completion of tree planting by the Japanese side, it has not been taken place. The major reasons are as below.

The target area of the Project is called the Myethindwin Protected Public Forest Area, where many residents live and do farming. In the Project, the Myanmar side and the Japanese experts selected afforestation sites in the presence of the village chiefs and residents at the time of the basic design

study. However, after full-scale tree planting started, many people claimed land ownership[5]. Therefore, the Ministry of Forestry reselected afforestation sites, and, after removing all farmland including potential farmland, the protected area decreased to 1,857 ha. (The area was calculated to be about 6,390 ha at the time of basic design.)

The biggest factor that caused so many people to claim land ownership was probably lack of maintenance of the cadaster. It is presumed that, for some plots, the cadastral map was not consistent with the actual ownership status or no land ownership information was shown.

As the area of the afforestation sites covered by the Japanese side was about 1,500 ha, the remaining area for afforestation became about 350 ha and it was just a collection of tiny pieces of land that were not suitable for glazing land where a certain size of land is required. Therefore, planting of grazing forest was not carried out.

Although it was a negative factor in terms of forest area that the Myanmar side did not carry out planting of glazing forest, it was confirmed that large-scale fuel wood forest and community forest fulfilled the functions of grazing forest as residents are allowed to use undergrowth. Therefore, in terms of appearance of effect intended by the Project, it is considered that the desired level has been achieved. As will be described in the section about impact, local residents recognize that grazing has become easier.

3.2.2 Qualitative Effects

The Project aimed to “establish the operation and maintenance system for the afforestation sites” through the technical assistance, which is called as the “soft component” of the Project, as a qualitative effect[6].

For the establishment of the operation and maintenance system, concrete outputs were defined as follows.

a) An action plan for operation and maintenance of fuel wood forest and protection forest is established and carried out properly.
b) Community forest is developed and maintained properly.
c) DZGD personnel and residents learn skills for proper maintenance of fuel wood forest, protection forest and community forest.
d) Demand for forest resources (fuel wood forest) decreases.

The action plan mentioned in a) was established and implemented at the time of soft component implementation after many discussions and workshops with residents. The major action was the

[5] For the same reasons, the afforestation area of protection forests in Zio Village, where planting was carried out in Term 4/5, became slightly smaller than the original plan. However, the planned number of trees was planted with slightly smaller tree spacing. Therefore, it resulted in no difference in the effect of the Project.
[6] In the Project, Japanese consultants were dispatched from Term 1/5 to Term 4/5 to provide technical assistance as soft component of the Project (a total of about 32 man-months). Similar technical support was provided in all the 8 villages in the target area of the Project as soft component.

establishment of rules for maintenance and use of fuel wood forest and protection forest and thorough enforcement of the rules. So far, there has been no such violation as logging or use of trees as feed. (Use of undergrowth in fuel wood forest is allowed.)

The community forest described in b) is also maintained by the residents. The local user group formed at the time of the implementation of soft components and the committee that played the central role in the group still exist and organize pruning in the community forest as well as serve as contact when DZGD and other external parties visit the area.

As for the skill acquisition by the DZGD personnel described in c), DZGD personnel took the initiative in holding a workshop during the implementation of soft components and coordinated views with residents when preparing the action plan. It is considered that they have obtained skills through a lot of experience in the field. As for the current activities, as afforestation projects with participatory approach are carried out as DZGD's own activities, it is considered that the acquired skills have been handed down and utilized. The details will be discussed in the section of sustainability.

As for the decrease in demand for fuel wood, the demand for forest resources has decreased in the whole area along with the decrease in household consumption and number of sugar palm farmers. (See the Impact section for details.) Gradually increasing use of improved cooking stoves and crop residue also contributes to the decrease in demand.

In light of the above, the planned effects have mostly been produced through the implementation of the Project and the effectiveness of the Project is high.

3.3 Impact

3.3.1 Intended Impacts

The implementation of the Project generated various impacts. First, we discuss the status of indirect impacts envisioned at the time of basic design. In the ex-post evaluation, we conducted a beneficiary survey to assess the status of impact generation[7].

(1) Prevention of Soil Erosion

The majority of the residents in the target area considers the number of road closures due to soil erosion decreased after the implementation of the Project.

[7] Beneficiary survey was conducted with a questionnaire with local residents in all the villages with afforestation sites -- Myethindwin, Letpande, Weltu, Nyaunggyi, Zio, Indaing, Yanzan and Aungtha. The total number of samples was 100. (13 from the 4 villages with community forest and 12 from the 4 other villages with other types of forests – a total of 100 samples)

Table 3: Recognition of the Number of Road Closures due to Soil Erosion

	Significantly decreased	Somewhat decreased	Almost the same	Rather increased	Not sure	Total
No of responses	21	56	13	8	2	100

Source: Result of beneficiary survey

(2) Securing of Life Resources

(a) Fuel Wood

Over 80% of the respondents said it became easier to obtain fuel wood after the implementation of the Project. The reasons for this are increase in fuel wood supply in the target area and decrease in the total quantity of fuel wood used at households.

Table 4: Recognition of Difficulty to Obtain Fuel Wood

	Much easier	Somewhat easier	Almost the same	More difficult	Not sure	Total
No. of responses	41	40	17	2	0	100

Source: Result of beneficiary survey

Table 5: Household Use of Fuel Wood

	Significantly decreased	Somewhat decreased	Almost the same	Increased	Not sure	Total
No. of responses	16	25	57	2	0	100

Source: Result of beneficiary survey

The 41 respondents who selected “Significantly decreased” or “Somewhat decreased” cited as reasons increase in the use of crop residue (39), use of improved cooking stove (17), lessened need for fuel wood for winter heating with the increase of clothes (39), and tightened utilization rules (24) (multiple answers allowed). Increase in the use of crop residue and improved cooking stoves is especially the result of the soft components of the Project and the subsequent follow-up activities by DZGD.

Another important background factor concerning fuel wood is recent change in economic activities in the target area. Palm sugar production has been a major industry in the target area and one of the important income sources. However, mainly due to recent market slump, the number of

sugar palm farmers have dropped to about half of 10 years ago (estimate from interviews in the village). It is said that palm sugar production needs about five times more fuel wood than domestic use as it has to be cooked for a long time, and the decrease of palm sugar production had the direct effect of significantly decreasing the fuel wood demand in the whole area. Such background is probably one of the reasons many people said it became easier to obtain fuel wood.

(b) Building Materials

The trees planted in the target area have not been used as building materials because they have not grown to the size of timbers that can be used for that purpose.

(c) Grazing Forest

The grazing forest and community forest are also open to the local residents for such purposes as using undergrowth if they do not cut branches. Therefore, although planting of grazing forest was not carried out, there are an increasing number of choices in terms of places for grazing and many residents say glazing became easier than before.

Table 6: Recognition of Easiness of Grazing

	Much easier	Somewhat easier	Almost the same	More difficult	Not sure	Total
No. of responses	40	35	14	4	7	100

Source: Result of beneficiary survey

It is probably related to the increase of options for grazing places; most people said that they saw a drop in the number of food crop damages (feeding damages) by livestock in the target area. (84% said feeding damage decreased.)

(3) Promotion of the Dry Zone Greening Plan in the Surrounding Area

The heavy machinery procured in the Project is used in Mandalay region and contributes to the expansion of afforestation area in the region. The back foe and the bulldozer were kept at the Nyaung Oo Office and other trucks and tractors are kept and maintained at the DZGD headquarters in Mandalay.

3.3.2 Other Impacts

(1) Impacts on the natural environment

The result of the beneficiary survey shows that the majority of the residents think the number of

small animals (rabbits, wildcats, squirrel, etc.) and birds has increased. (76% said the number of types and population “significantly increased” and 14% said “somewhat increased”.)

There has been no large-scale forest fire.

(2) Land acquisition and resettlement

The implementation of the Project did not require any resident relocation or land acquisition.

(3) Other Indirect Impacts

(a) Economic Impact of Road Improvement

In the Project, road improvement including increase of width was conducted. This made it much easier to travel among villages and to Nyaung Oo, a nearby major city, and the roads are still maintained by local residents.

This road improvement has created business opportunities in several target villages as well as activated the economic exchanges in the region. A typical example is a case of ecotourism in Zio Village, which has grown so much that an average of over 50 tourist groups from home and abroad visit the village every month. (Zio has a giant tamarind tree that is a big tourist attraction.) Donation from tourists is used to repair temples and schools in the village. In Wetlu and other villages bordering on other villages, residents have started selling fuel for motorcycles on the street side.

(b) Use of Water Supply Equipment

The water supply equipment installed for afforestation is still operated and maintained by the residents even after the completion of the Project and is used when water shortage becomes serious in a dry season (in Letpande and Myethindwin). However, as the water rate is a little high to cover operation and maintenance cost, the water equipment is not used much in other seasons.

(c) Other Benefits

The following table shows the responses of the beneficiaries about the effects of the Project implementation. (Multiple answers were allowed.) Local residents recognize positive impacts of the Project implementation, e.g., “The relationship with the Ministry of Forestry improved” (it was pointed out that there was emotional distance between the residents and the ministry because quota used to be imposed to each village in some afforestation projects before) and “It led to support from other donors.” The residents also consider it a large impact that during the Project implementation local residents were hired for planting and a precious opportunity for employment was provided.

Table 7: Other Benefits of the Project

	Increased vegetation (shading and affiliation effects)	Increased rainfall	Improved roads	Creation of job opportunities (ongoing)	Better relationship with the Ministry of Forestry	Led to support from other donors
No. of responses	98	88	97	100	97	90

Note: Multiple answers from 100 respondents

: The question about the relation between increased forest area and rainfall was to ask the perception of local residents.

Source: Result of beneficiary survey

On the other hand, although no significant negative impacts were pointed out, some respondents to the beneficiary survey think the opportunities to sell fuel wood had decreased (10 respondents of Letpande and 4 of Indaing). However, it is also confirmed that fuel wood sale is for additional income and it does not have such a large impact to threaten their livelihood.

In light of the above, this project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The following table shows the comparison between planned outputs and actual outputs.

Table 8: Comparison of Planned Outputs and Actual Outputs

	Plan	Actual
Afforestation area	・ Approx. 2,000 ha	・ Approx. 1,500 ha
	・ The Myanmar side was supposed to carry out planting in approx. 500 ha after the completion of the afforestation by the Japanese side.	・ The Myanmar side has not conducted planting in 500 ha of a grazing forest. ・ Afforestation has been completed in protection forest, fuel wood forest and community forest, where the Japanese side was in charge.

	Plan	Actual
Construction of administration facilities	・ Administration and extension office (64 m^2, 1 location) ・ Workshop (70 m^2, 1 location) ・ Water supply equipment (2 sets of a well and an elevated water tank)	・ Same as on the left
Improvement of equipment for land development and maintenance of afforested area	・ A total of 24 types of equipment for land development including 4-ton trucks, backhoes and tractors ・ A total of 13 types of equipment including meteorological observation units and portable wireless communication units	・ Same as on the left

Source: Materials from JICA

3.4.2 Project Inputs

3.4.2.1 Project Cost

Given below are the planned and actual project costs of this project. The project cost was lower than planned.

Table 9: Planned and Actual Project Costs

	Main cost		Total project cost
	Japan side:	Myanmar side:	
Plan	1,508 million yen	5 million yen	1,513 million yen
Actual	1,453 million yen (96% of the planned amount)	4 million yen (80% of the planned amount)	1,457 million yen (96.2% of the planned amount)

Source: Materials from JICA and DZGD

The main cost for the Project was smaller than the planned amount because of the review of labor cost and air-fare and also the difference between bids and planned prices. The cost to be covered by the Myanmar side was within the planned amount as the workshop cost and the document preparation cost were slightly smaller than the plan.

According to the plan, the Japanese side was to cover the cost for a) tree planting, b) construction of forest administration facilities, c) improvement of equipment for forest development and management of afforestation sites, and d) technical support concerning the formulation of a participatory plan for afforestation land development and maintenance, and the Myanmar side was to cover the cost for a) workshop, b) document preparation, c) dispatch of personnel, d) labor cost, and

e) miscellaneous expenses. There was no change with the cost sharing arrangements. The cost covered by the Myanmar side does not include the project cost for grazing forest.

3.4.2.2 Project Period

The project was slightly delayed in some phases due to weather conditions, slight delay in the supply of seedlings, extra time required to hire staff for planting work, etc. Therefore, the total project period slightly exceeded the planned period.

Table 10: Planned and Actual Project Period

Plan	Result
63 months	64.9 months (103% of the planned period)

Source: Materials from JICA

In light of the above, the project period slightly exceeded the plan although the project cost was within the plan. Therefore, the efficiency of the Project is fair.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The Central Committee and the Township Control Committee, which were established at the time of the Project implementation, still hold regular meetings with the same members at the time of the ex-post evaluation[8]. The Village Committee, which was expected to play the most important role in the operation and maintenance of the target area of the Project, still exists in each village and is playing a central role in forest operation and maintenance. During the implementation period of the Project, meetings of the Village Committees were held at the Nyaung Oo Office, but are now held in each village about every two months with the attendance of the range officer from the DZGD Nyaung Oo Office.

It is also considered that the structure of the DZGD Nyaung Oo Office has been developed almost well enough for the operation and maintenance of the target area. At the time of the ex-post evaluation, the office maintains almost the same number of staff as during the Project implementation period, with the director, officers at the top, and range officers, foresters, etc. assigned to each area. In addition, five village residents are employed as forest guards as manpower to supplement daily forest management (as of March 2013). Especially in a dry season, four more village residents are employed as contract workers. Thus the structure to prevent forest fire has been

[8] The Central Committee is considered as an organization to supervise maintenance headed by the DZGD director. The Township Control Committee is headed by the director of the Nyaung Oo Office and conducts monitoring and patrolling.

developed.

In light of the above, both the structure of the government and that of the residents have been developed well enough for the maintenance and management of the target area of the Project.

3.5.2 Technical Aspects of Operation and Maintenance

As for the skill level of the DZGD personnel, almost all members have graduated from the Institute of Forestry and have acquired overall skills in forestry. Many of foresters have also studied at a forestry school. Thus, generally there is no problem with their skills in forestry.

Forest management with participatory approach has been spreading for the last decade or so and the forestry school has a course concerning such forest management. Actual experience in forest management with participatory approach is also being gained. The Nyaung Oo Office holds environmental preservation workshops for local residents and the office staffs serve as workshop coordinators.

Thus they are making efforts for forest management through dialogue with local residents, and it is considered that the skills for the participatory forest management have reached the level where sustainability can be achieved.

[Reference]

In 2009, after the completion of the Project, DZGD started an afforestation program called "1-village 1-acre Program", for afforestation under the ownership of the residents. In this program, selection of tree types and maintenance are conducted with the concept of residents' participation and initiative while DZGD supplies seedlings and provides technical support, and there is a system where plantation care groups consisting of residents carry out maintenance activities. Through the program, 50 ha has been afforested for the last about three and a half years and the number of target villages will be increased in the future. This is a good example to show how DZGD's participatory approach has spread.

3.5.3 Financial Aspects of Operation and Maintenance

The vegetation condition in the target afforestation area of the Project has already passed the stage when feeding damage or withering can be a threat for sustainability. Therefore, the major expense required is for the employment of forest guards to prevent such accidents as forest fire. As stated earlier, judging from the fact that employment of local residents has been increased, such budget is likely to be secured. Although the DZGD Nyaung Oo Office does not have a mid-long term employment plan of village residents as forest guards, considering that six village residents are now employed as forest guards at other projects' sites, it seems that DZGD puts importance on the resident forest guards as an effective form for patrol and maintenance.

3.5.4 Current Status of Operation and Maintenance

As stated in the sections of effectiveness, etc., the planted trees in the target have been growing well and the vegetation coverage rate meets Myanmar's forest criteria. The area is also maintained in good conditions without large forest fire or any such other incidents.

The equipment (such as backhoes and bulldozers) procured through the Project are still effectively used. Cutting edge and cutting blade for bulldozers have been replaced with spare parts and they are maintained in good conditions[9].

In light of the above, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was to promote greening in the Central Dry Zone of Myanmar through afforestation of multipurpose forest. This objective was relevant with Myanmar's development plan and needs at the time of planning and is still relevant at the time of ex-post evaluation, therefore the relevance of the Project is high.

Afforestation in protection forest, fuel wood forest and community forest was carried out as planned, and the trees planted in the target area have grown to the level that can be recognized as forest in terms of both survival rate and coverage rate. The simple roads developed for the implementation of the Project are still maintained by local residents and have generated various positive impacts such as encouragement of traffic within the region and creation of tourism and retail businesses that followed. In light of the above, the Project's effectiveness and impact are evaluated to be high. On the other hand, the Myanmar side did not plant trees in grazing forest because the area available for planting within the target area was reduced. However, the roles expected of the grazing forest are mostly fulfilled by the large-scale fuel wood forest and community forest developed in the Project. The overall efficiency of the Project is evaluated to be moderate because the Project period exceeded the original plan although the Project cost covered by the Japanese side was kept within the budget.

As for the sustainability, the Village Committees that consist of local residents still exist in the target area and the structure of the Nyaung Oo Office has been consolidated. Some residents of the village have also been hired as forest guards. Thus the structure for maintenance has been further improved since the time of project planning and the sustainability is evaluated to be high.

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

[9] The equipment (such as backhoes and bulldozers) provided through the Project was required for the implementation of the Project, and not for the future maintenance of the afforestation sites. It is preferable that the equipment would be used for afforestation projects in other areas controlled by DZGD.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Some of the planting techniques introduced in the Project can probably be used in other areas (e.g., 1. proper watering method and frequency in dry season, 2. installation of fences to keep animals out, and 3. appropriate size of planting holes). It is important to further spread such techniques to afforestation projects in other areas in the Central Dry Zone.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Although the Japanese side carried out planting as planned, the Myanmar side was not able to carry out planned planting because they could not get land. We can learn the following lessons to avoid such situation in the future.

1. Necessity of Land Registration Confirmation

In the basic design study of the Project, proposed sites were selected in consideration of both natural and social conditions. To consider social conditions, sites were selected in the presence of the village chief and residents. However, after full-scale tree planting started, many people started to claim land ownership. Therefore, the Ministry of Forestry rearranged the sites and, after removing all farmland including potential farmland, the protected area became smaller than the area planned at the time of the basic design (no space left for a grazing forest). As a result, the Myanmar side did not carry out planting of grazing forest. The biggest reason for such situation was probably that the Myanmar side did not maintain accurate land registration and started the Project without checking it well. Although land registration requires lots of time and efforts, official land ownership situation has to be clarified before any planting project. The Japanese side should have communicated the importance of this to the Myanmar side when selecting planting sites.

2. Concept for Planning of Afforestation Area

In some cases where checking and verification of land registration cannot be completed in the planning phase, we have to decide the outline in the planning phase and finalize it during the project implementation. In such cases, it is preferable to keep the desired effects in mind, consider risk of reduction of area, and set a large area when planning.

3. Careful Examination of the Project Scope and the Implementation Plan the Government of the Recipient Country Should Have

The effect expected of the grazing forest was fulfilled by other types of forest. This is not an efficient input in terms of effect generation. It is necessary to carefully examine the appropriateness

of the scope (inputs) in the planning phase so that the desired effects will be generated.

In the Project, the planting of grazing forest was not listed in the project cost plan to be covered by the Myanmar side. In addition to the above-mentioned careful examination, it is also important to check and implement a project plan and budges to make sure that the recipient country will carry out all the items as planned.