

**Ex-Post Project Evaluation 2017:
Package II-4 (Cambodia, Thailand, Viet Nam)**

August 2018

JAPAN INTERNATIONAL COOPERATION AGENCY

OPMAC Corporation

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Kingdom of Cambodia

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

“The Project for Flood Disaster Rehabilitation and Mitigation”

External Evaluator: Koichi Akimoto, OPMAC Corporation

0. Summary

The objective of this project was to restore the function of road infrastructure in the disaster area to its pre-disaster condition by rehabilitation and improvement of roads, the drainage system and the national road No. 5 in Kampong Chhnang City and reconstructing 8 decaying bridges on the national road No. 11 in Prey Veng Province, all of which were affected by the flood in 2011, thereby contributing to the mitigation of flood damage and smoother regional transport in the affected areas. The project was consistent with the development plan and development needs of Cambodia, as well as with Japan’s ODA policy. Therefore, the project relevance is high. Meanwhile, the project cost and project period were in accordance with the plan. Therefore, the efficiency of the project is high. As for the project effects, it was confirmed that the project brought positive effects in an increase in traffic volume in the project areas, in a decrease in the maintenance costs of the Kampong Chhnang Department of Public Works and Transport (hereinafter called DPWT) for the project drainage system, in a decrease in the maintenance costs of the Prey Veng DPWT for project bridges, and in a reduction in travel time from BR-1 bridge to BR-18 bridge on the national road No. 11. Improvements in traffic safety and traffic accessibility in the project areas were also observed. In addition, it is considered that there has been a mitigation of flood damage in the project areas, improvements in the hygienic and living environments and improvements in logistics on the national roads No. 5 and No. 11. It is found that these improvements are thanks to the contribution of the project and therefore the effectiveness and impacts of the project are high. The sustainability of project effects is fair since no major problems have been observed in the institutional and technical aspect as well as status of operation and maintenance for the project, but some minor problems have been observed in terms of the financial aspect, due to insufficient budget allocation for periodic maintenance.

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

1. Project Description



Project Locations



Vehicles passing over the national Road No. 5 after improvement.

1.1 Background

Since Cambodia is located downstream on the Mekong River in the Indochina Peninsula and as most of the country is lowland areas, it has one of the highest proportions of flood risk and mortality by flood in the world. The seasonal variation in the water level of the Mekong River has escalated in combination with recent climate change and droughts and floods occur repeatedly every year. During the rainy season of 2011, it rained more than usual in Cambodia and upstream of the Mekong River. Although there was no serious flood disaster in Phnom Penh due to the support including the previous Japan's assistance, there was widespread damage through floods in surrounding areas, and it was reported that over 250 people were lost. One and a half million people suffered damage and 17 percent of paddy fields in the country was damaged, while infrastructure such as roads and bridges also suffered damage. In this situation, the government of Cambodia requested grant aid for rehabilitation and the mitigation of flood disaster from the government of Japan.

Most of Kampong Chhnang city, including the national road No. 5, was flooded for over a month during the flood of 2011. Since the road pavement was a simple asphalt surface paving, most of the roads in the center of the city were seriously damaged. It was also necessary to set up a proper road drainage system as the roads were flooded due to a lack of road drainage facilities in the city. In addition, there were 14 decaying temporary bridges on the national road No. 11, and there were safety concerns because of erosion around the abutments for the bridges, on access roads, and the riverbed during the flood of 2011. Additionally, it was urgently necessary to reconstruct the temporary bridges since they had only one lane and load restrictions, also vehicles required to drive slowly etc. It was planned that assistance from their own funds and Asian Development Bank (ADB) would reconstruct 6 bridges out of the 14 bridges, but there was no reconstruction plan for the remaining 8 bridges.

1.2 Project Outline

To restore the function of road infrastructure in the disaster area to its pre-disaster condition by improving roads, the drainage system and the national road No. 5 in Kampong Chhnang City and reconstructing the bridges on the national road No. 11 which were affected by the flood of 2011, thereby contributing to the mitigation of flood damage and smoother regional transport in the affected areas.¹

Grant Limit / Actual Grant Amount	1,510 million yen / 1,285 million yen
Exchange of Notes Date / Grant Agreement Date	April 2012 / July 2012
Executing Agency	Ministry of Public Works and Transport (herein after called MPWT)
Project Completion	January 2015
Main Contractor	Hazama Ando Corporation (Initially, Hazama Corporation)
Main Consultant	Katahira & Engineers International
Basic Design	January 2012 – August 2012
Related Projects	<p><u>Technical Cooperation</u></p> <ul style="list-style-type: none"> • The Project for Strengthening Capacity for Maintenance of Roads and Bridges (2015 – 2018) <p><u>ODA Loan</u></p> <ul style="list-style-type: none"> • National Road No. 5 Improvement Project (Prek Kdam-Thlea Ma'am Section) (1) (2014 – 2021) <p><u>Grant Aid</u></p> <ul style="list-style-type: none"> • The Project for Flood Protection and Drainage Improvement in the Municipality of Phnom Penh (I – III) (2001 – 2011) • The Project for Urgent Replacement of Bridges in Flood-Prone Areas (2017 – 2020) <p><u>Other International Agencies and Donors</u></p> <ul style="list-style-type: none"> • ADB: Flood Damage Emergency Reconstruction Project (2012 – 2015)

¹ The project objectives at the ex-ante evaluation sheet were expressed as “To restore and improve roads and drainage system in Kampong Chhnang City and the bridges on the national road No. 11 which were affected by the flood of 2011. Thereby contributing to the mitigation of flood damage.” However, this was not based on the logic model (Output → Outcome → Impact). Thus, the evaluator rearranged the project objectives at the ex-post evaluation stage. Even though the Output remains the same as at the ex-ante evaluation sheet: “improving roads and drainage system and reconstructing the bridges”, it complemented the Outcome (to restore the function of road infrastructure) which was not described clearly at the ex-ante evaluation sheet. As for the Impacts, in addition to “the mitigation of flood damage” at the ex-ante evaluation sheet, traffic effect was added (“smoother regional transport”).

2. Outline of the Evaluation Study

2.1 External Evaluator

Koichi Akimoto, OPMAC Corporation

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2017 - August 2018

Duration of the Field Study: November 26 - December 8, 2017 - March 18 - 23, 2018

2.3 Constraints during the Evaluation Study

While the project was implemented for the improvement of roads and drainage system and the reconstruction of bridges, other donors also implemented road improvement / reconstruction projects in parallel with the project for national roads and outer roads which are connected to the project facilities. Therefore, it is considered that these projects also made a certain level of contribution that was reflected in the effectiveness and impacts of this project. For that reason, at ex-post evaluation, it was difficult to separate the direct effects of the project and the contribution (external factors) of the other donors' projects. Therefore, although there is no specific indication later in this report, the effectiveness and impacts confirmed at the ex-post evaluation were achieved both by the project and by the road improvement / reconstruction projects of other donors. In addition to this, although beneficiary interviews were implemented to examine the qualitative effects of the project, the number of interviewees was limited due to the length of the field study period. Thus, the possibility remains that there is opinion bias among the interviewees in respect of the qualitative effects which was not possible to exclude completely in spite of having interviews in various places.

3. Results of the Evaluation (Overall Rating: A²)

3.1 Relevance (Rating: ③³)

3.1.1 Consistency with the Development Plan of Cambodia

At the time of planning, the *National Strategic Development Plan (2009-2013)* based on the *Rectangular Strategy (2004)*, the highest national development strategy in Cambodia, had been published in June 2010. This stated that the improvement and development of infrastructure was one of the 4 side strategies for promoting growth. It also indicated that the improvement and development of transport infrastructure was a priority area in the strategy. Also, the *Rectangular Strategy Phase II (2008)* referred to disaster and flood prevention in terms of water resource management, agriculture and infrastructure development etc.

² A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

³ ③: High, ②: Fair, ①: Low

At the time of the ex-post evaluation, the *Rectangular Strategy Phase III* (2013) included the development of hard infrastructure (including the formulation of master plans for city infrastructure development) as one of the implementation guidelines for activating economic activity to aim at average annual economic growth rate at 7%. The *National Strategic Development Plan* (2014-2018) also stated that infrastructure development was a priority policy action, and one priority area mentioned was the expansion of newly paved roads by 300km to 400km every year in both urban and rural areas of Cambodia. In addition, the improvement and development of transport infrastructure (especially roads) were addressed as a priority area, particularly the high standardization (pavement surface, width extension, drainage maintenance) of 1 digit national roads as a policy target.

Thus, the national development plans of Cambodia both at the time of planning and ex-post evaluation prioritized the improvement and development of road infrastructure. The project was therefore consistent with the development plan of Cambodia.

3.1.2 Consistency with the Development Needs of Cambodia

At the time of planning, as indicated in “1.1 Background”, since the pavements of roads were simple asphalt surface paving in Kampong Chhnang city, most of the city roads were seriously damaged in the flood of 2011, including the national road No. 5. Furthermore, the roads were flooded for over a month due to a lack of road drainage facilities in the city. Meanwhile, there were safety concerns for the 8 bridges on the national road No. 11 because of erosion around the abutments of bridges, on access roads, and the riverbed due to the flood of 2011. According to the *Study on the Road Network Development in the Kingdom of Cambodia* (2006), the proportions of land and marine freight transport in Cambodia were specified as approximately 70% for road, 20% for river and 10% for railway. Although the improvement of 1 digit national roads had mostly been completed except for the part of a section, the improvement of 2 digit roads, which largely contribute to a number of the country’s administrative services and to economic and social activities in rural areas, had been delayed. Also, 90% of all bridges in Cambodia were temporary bridges, and their level of maintenance was very low.

At the time of the ex-post evaluation, since road transport was the main methods of transportation in Cambodia, the development of the road transport infrastructure was continuously put a high priority, as mentioned in the above national development plan. Also, roads and bridges improved by this project were located on the national road No. 5, which is the part of Asian Highway Network from Phnom Penh to Bangkok, and on the national road No. 11 which is a feeder road of the Asian Highway Network (national road No. 1). Thus, it has an important role on the road network system of Cambodia as to improve logistics and ensure traffic safety for the national road in the country. Meanwhile, as Cambodia is prone to floods, it was necessary to improve the road infrastructure for the mitigation of flood damage. According to

the *Data Collection Survey on the Trunk Road Network Planning for the Strengthening of Connectivity through the Southern Economic Corridor* (2013)⁴ by the support of the Japan International Cooperation Agency (JICA), the strengthening and expansion of the road network system in Cambodia was specified as an issue in dealing with rising traffic demand nationally and internationally with the rapid economic development of Cambodia.

The role of the project facilities has continued to be important in terms of the mitigation of flood damage and road safety in the project areas, promoting logistics for Cambodia and neighboring countries. Therefore, the project was consistent with the development needs of Cambodia at the time of planning and ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

At the time of planning, the *Japan's ODA Data for Cambodia* (2012) specified "Development of Economic Infrastructure" as one of the priority areas for assistance from the perspectives of ① To assist achievement of the development goals based on the *Rectangular Strategy*, ② To promote ASEAN integration, to strengthen ASEAN connectivity, and to narrow development gaps in the region, ③ To ensure human security and environmental sustainability. The "Development of Economic Infrastructure" was also given as one of the priority areas for strengthening the basis for economic activities. As the aim of the project was to strengthen the infrastructure facilities of Kampong Chhnang city and the national roads No. 5 and No. 11, the project fell under the focus of the above mentioned "Development of Economic Infrastructure".

Therefore, the project was consistent with one of the priority areas for Japan's ODA policy of the "*Development of Economic Infrastructure*".

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

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The outputs of the project for the Japan side and the Cambodia side were the planned improvements of roads, including 4.6km of the national road No. 5 in Kampong Chhnang City, improvement of 2.6km of the road drainage system in the city, the reconstruction of 8 bridges on the national road No. 11, land acquisition associated with it, the relocation of public facilities etc. These were mostly implemented according to the plan. The outputs of the project for the Japan and Cambodia sides are shown in Table 1 below.

⁴ Regarded as the survey for Road Master Plan Formulation.

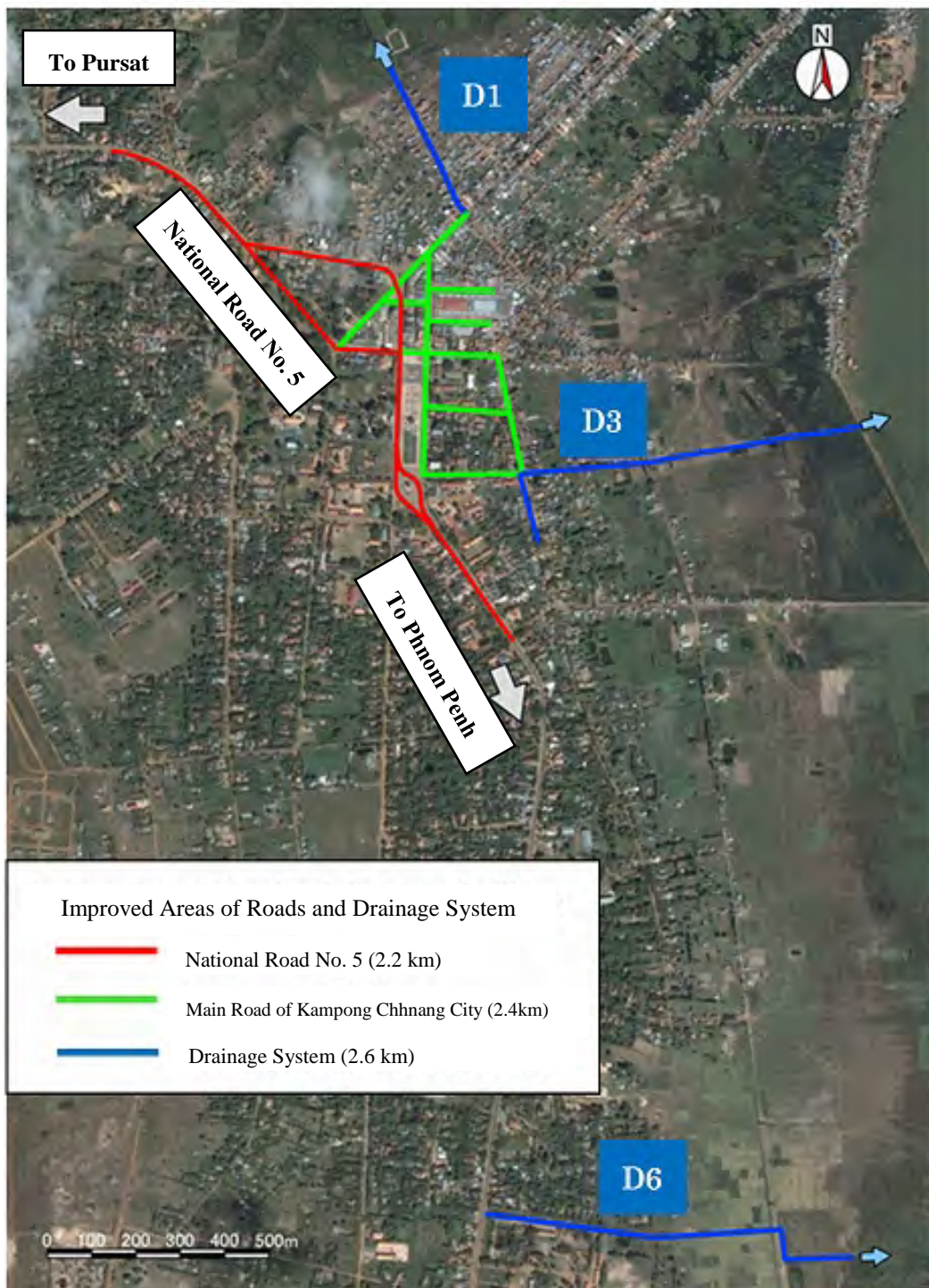
Table 1: Project Outputs (Planned / Actual)⁵

Item	Planned	Actual
[Japan side] Civil Works	<ul style="list-style-type: none"> Improving roads and the national road (NR) No. 5 for 4.6km and the road drainage system for 2.6km in Kampong Chhnang City Reconstruction of the following 8 bridges on the national road No. 11: Total 308m <ul style="list-style-type: none"> * KBAL BOEUNG Bridge (Bridge Number: BR-4) * CHHNAT Bridge (Bridge Number: BR-5) * SAM PUTHOR II Bridge (Bridge Number: BR-7) * MEKON Bridge (Bridge Number: BR-8) * THKOV Bridge (Bridge Number: BR-9) * KOK TROM Bridge (Bridge Number: Clv-1) * EK REAM Bridge (Bridge Number: BR-11) * ROM LECH Bridge (Bridge Number: Clv-2) 	<ul style="list-style-type: none"> Mostly as planned (softground of the roadbed section improved using the replacement method for 2,007m² on NR5(1) and 3,664m² on NR5(2); pavement specification of Drainage Way No. 2 changed to DBST) Mostly as planned (changed location of riverbed and changed plans for the abutment / revetment / bed protection for CHHNAT Bridge (BR-5 Bridge), and cement improvement of the accessroad beds of all 8 project bridges changed to good quality soil replacement)
[Cambodia side] Civil Works	<ul style="list-style-type: none"> Relocation of public facilities (telephone poles, electric/telephone wires / communication lines, other underground facilities) 	<ul style="list-style-type: none"> As planned
Construction of facilities and procurement for Operation & Maintenance	<ul style="list-style-type: none"> Providing work yards, material storage spaces, field offices etc. Securing borrowing pits / spoil banks / industrial waste disposal facilities 	<ul style="list-style-type: none"> As planned Not conducted due to the demand of the main contractor

Source: Documents provided by JICA and response to interview with MPWT

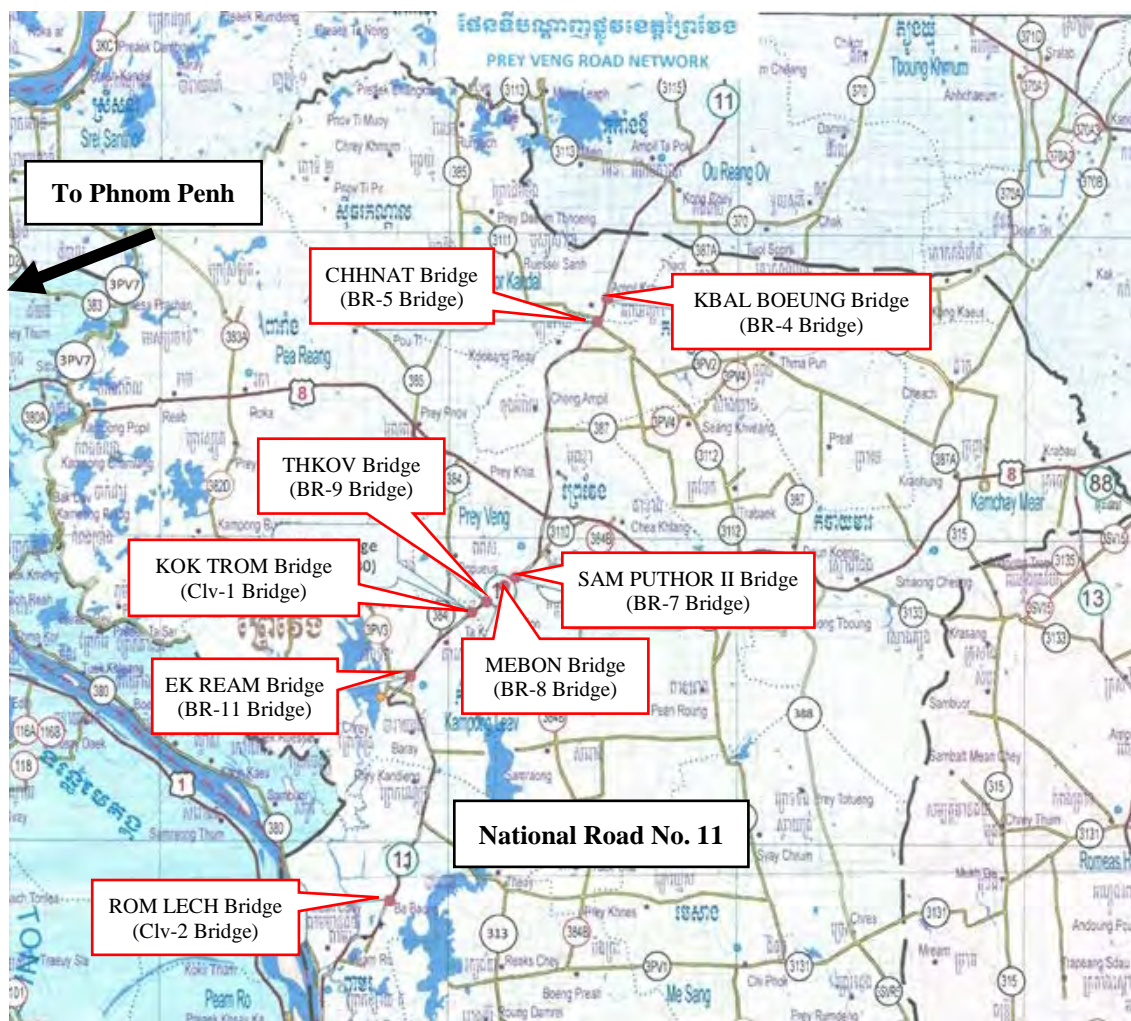
Please refer to figures 1 and 2 below for the site and location of project roads and drainage system in Kampong Chhnang City, and the 8 bridges on the national road No. 11.

⁵ In the preparatory survey report, the names of CHHNAT Bridge (Bridge Number: BR-5) and KOK TROM Bridge (Bridge Number: Clv-1) in Table 1 were SNATE Bridge and TKOV II Bridge respectively. However, each bridge name was confirmed as indicated in Table 1 by the field study and in the completion report.



Source: MPWT

Figure 1: Location Map of Project Roads and Drainage System in Kampong Chhnang City



Source: MPWT

Figure 2: Location Map of Project Bridges on the National Road No. 11

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 1,285 million yen, which was within the planned project budget of 1,513 million yen (85% against the plan). Please refer to the breakdown of each expense for the Japan side and Cambodia side in Table 2 below.

Table 2: Planned and Actual Project Costs

Item	Planned	Actual	Compared to the plan
Japan side	1,510 million yen	1,267 million yen	84%
Cambodia side	3 million yen ^(Note 1)	18 million yen ^(Note 2)	600%
Total	1,513 million yen	1,285 million yen	85%

Source: Documents provided by JICA and documents provided by MPWT

Note 1: The exchange rate used: 1 USD = JPY 77.18 (March, 2012)

Note 2: The exchange rate used: 1 USD = JPY 108.24 (The International Monetary Fund (2017) "International Financial Statistics Year Book 2017", used the average exchange rate of the years 2012 – 2015)

The main reason for the actual project cost at Japanese side being approximately 16% lower than the planned cost was that the the construction cost of the main works was lower than estimated due to competitive bidding. Also the actual project cost for the Cambodian side being 600% higher than the planned cost, was because the costs of land acquisition were higher than expected,⁶ and a private land lease fee was incurred for 63,000 USD separately.

3.2.2.2 Project Period

According to the preparatory survey report for the project, the planned project period was identified as commencing with detailed design (the contract agreement date for the Consultant), which indicated 29 months from September 2012 to January 2015. In fact, the actual project period was 29 months from September 2012 to January 2015, which was implemented as planned (a ratio against the plan of 100%).⁷

Table 3: Planned and Actual Project Period

Planned	Actual
September 2012 (Contract agreement date for Consultant) – January 2015: Total 29 months	Exchange of Notes (E/N) date: April 21 st , 2012
	Grant Agreement (G/A) date: July 30 th , 2012
	Contract agreement date for Consultant: September 11 th , 2012
	Contract agreement date for Contractor (Initially): January 18 th , 2013
	Comencement date: January 25 th , 2013
	Contract agreement date for Contractor (The first amendment; change of the name of contractor): April 15 th , 2013
	Contract agreement date for Contractor (The second amendment; change of contract amount caused by design changes): November 17 th , 2014
	Completion date: January 31 st , 2015

Source: Documents provided by JICA

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

⁶ Though the planned cost was 1 USD/m², the actual cost was 3 USD/m², 8 USD/m², 16 USD/m² (the land acquisition cost differed according to location).

⁷ Since there was no information regarding the starting point of the planned project period in the ex-ante evaluation sheet, the operation sheet indicated in the preparatory survey report was adopted. Moreover, based on the operation sheet, the planned project period did not include the date of the Exchange of Notes and Grant Agreement, and the commencement of the project was indicated as the commencement of detailed design (contract agreement date for Consultant). Therefore, the planned • actual commencement of the project was considered as the commencement of detailed design at the time of ex-post evaluation sheet.

3.3 Effectiveness and Impacts⁸ (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

To measure the operation and effect indicators for the quantitative effects of the project, the maintenance cost (USD/Year) of the Kampong Chhnang DPWT for project roads and the road drainage system was set, together with the periods of flooding of the road shoulder in Kampong Chhnang City. Meanwhile, for the reconstruction of the 8 bridges on the national road No.11, they were set as the maintenance cost (USD/Year) of the Prey Veng DPWT for project bridges and the travel time (BR-1 bridge to BR-18 bridge) on the national road No. 11 due to the improvement in speed of travel. On the other hand, traffic volume through improvement section by the project was not included in the Operation and Effect Indicators in the ex-ante evaluation sheet. However, since the project outcome of the road sector generally analyzes traffic volume, this was added in the Operation and Effect Indicators.⁹ The results of analysis of the operation and effect indicators are shown below.

(1) Traffic Volume around the Project Areas¹⁰

Comparing the traffic volume data of the Kampong Chhnang City areas (national road No. 5) and the Prey Veng City areas (national road No. 11) after project completion (2015), with the traffic data of vicinity areas of the project before project implementation, it can be seen that traffic volume increased after the project, although it was difficult to conduct a narrow analysis because of mismatching of the traffic measurement points (Table 4, 5, 6, and 7).¹¹

Looking at the traffic volume of the Kampong Chhnang City areas on the national road No.5, it can be seen that the total number of traffic volume before (2014) and after the project implementation (2015) remained mostly unchanged, although the volume of full trailers increased between 2.5 times to 4 times at each section. The reason for this increase was that, ① it became easier for full trailers to pass through due to the improvement of roads and the part of national road No. 5 in Kampong Chhnang City, and ② there was an improvement in logistics routes in the surrounding areas with the development of the national road No.5 (Tables 4 and 5). The national road No. 5 links Phnom Penh with Battambang province, which has Cambodia's third largest population¹². Since the national road No .5 is also part of the Asian

⁸ Sub-rating for Effectiveness is to be put with consideration of Impacts.

⁹ Since the main objective of the project was reconstruction, increase of traffic volume was not identified as a primary object. Thus, weight is not placed on the increase of traffic volume as an indicator for the evaluation decision. All of the operation and effect indicators (including traffic volume) are given equal weight. In addition, the increase in traffic volume from before the project is also not considered as an achievement goal for evaluation decision.

¹⁰ As for traffic volume data regarding the quantitative effects of the effectiveness, Tables 4, 5, 6, 7 in this report give the traffic data that was possible to collect at that time to measure the project effects.

¹¹ Because the traffic measurement points for the measurement of traffic volume around the project areas before the project implementation (Table 7) are not known.

¹² National Institute of Statistics (2009) "Cambodia Population Census 2008"

Highway connecting Bangkok (the capital city of the neighboring country, Thailand) and Phnom Penh, it is seen as an important highway. Therefore, it is assumed that the development of the national road No. 5 influenced the improvement of logistics routes in the surrounding areas.

Also, the traffic volume of the national road No. 11 in the Prey Veng City areas increased approximately 10% for each type of vehicle after the project implementation (2015) compared to before the project (2014) (Table 6). It is considered that the reconstruction of the 8 project bridges on the national road No. 11 was one of the reasons for this increase. Meanwhile, it is assumed that the traffic volume of heavy vehicles increased due to the maximum vehicle weight for the 8 bridges was increased to 40 tons from 15 tons by the project (Table 6).

Table 4: Traffic Volume of Kampong Chhnang City Areas
(National Road No. 5, Around Pk¹³ 87km + 300m)

Unit: Number/Day

	2011	2014	2015 (Completion Year)
Cars / 4WD / Passenger Vans	3,098	4,271	4,043
Mini Buses / Buses / Light Commercial Vehicles	548	744	742
Heavy Trucks (2 Axle – 5 Axle Trucks)	504	716	713
Full Trailers (4 Axle – 6 Axle Truck Trailers)	49	75	297
Total	4,199	5,806	5,795

Source: Documents provided by MPWT

Note: The traffic volume at around 87km + 300m north-north west from Phnom Penh on the national road No. 5.

Table 5: Traffic Volume of Kampong Chhnang City Areas
(National Road No. 5, Around Pk 92km + 400m)

Unit: Number/Day

	2011	2014	2015 (Completion Year)
Cars/ 4WD / Passenger Vans	1,935	3,333	3,049
Mini Buses / Buses / Light Commercial Vehicles	356	715	546
Heavy Trucks (2 Axle – 5 Axle Trucks)	429	1,008	859
Full Trailers (4 Axle – 6 Axle Truck Trailers)	48	144	381
Total	2,768	5,200	4,835

Source: Documents provided by MPWT

Note: The traffic volume around 92km + 400m north-north west from Phnom Penh on the national road No.5.

¹³ Pk is an abbreviation of Point kilometer, which describes the distance from the national road starting point.

Table 6: Traffic Volume of Prey Veng City Areas
(National Road No. 11, Around Pk 63km + 250m)

Unit: Number/Day

	2014	2015 (Completion Year)
Cars / 4WD / Passenger Vans	892	957
Mini Buses / Buses / Light Commercial Vehicles	277	306
Heavy Trucks (2 Axle – 5 Axle Trucks)	717	798
Full Trailers (4 Axle – 6 Axle Truck Trailers)	188	210
Total	2,074	2,271

Source: Documents provided by MPWT

Note: The traffic volume near CHHNAT Bridge (BR-5 Bridge) indicated in figure 2 of the report.

Table 7: Traffic Volume of Project Areas before Project Implementation

Unit: Number/Day

	Kampong Chhnang City Main Street (2012)	National Road No. 11 (2012)
Cars / Small Cargo Vehicles	1,221	598
Mini Buses / Buses	92	108
Heavy Trucks	19	150
Full Trailers	0	29
Total	1,332	885

Source: Documents provided by JICA

Note: Measurement points for the above traffic volume are unknown.

(2) Maintenance Cost of the Kampong Chhnang DPWT for Project Roads

As for the maintenance costs of the Kampong Chhnang DPWT for project roads, at the time of planning, each road maintenance item was recorded as an expense for the effect indicators. However, at the time of the ex-post evaluation, it was found that maintenance costs for the project roads had been recorded as expenses which reflected the total labor cost for the maintenance staff of the roads. Therefore, the maintenance information relevant to this indicator were not maintained as the accrual method was different for the time of planning (recorded as inspection items of the maintenance cost for project roads) and the time of the ex-post evaluation (recorded as the labor costs for project roads maintenance). Thus, it was difficult to evaluate the indicator.

(3) Maintenance Cost of the Kampong Chhnang DPWT for the Project Drainage System

The maintenance cost of the Kampong Chhnang DPWT for the project drainage system was 1,332 USD in 2015, and 748 USD and 747 USD in 2016 and 2017 respectively. Thus, the target value was achieved (Table 8).

Table 8: Maintenance Cost of the Kampong Chhnang DPWT for the Project Drainage System

Unit: USD/Year

Indicator	Baseline	Target	Actual		
	2012	2017	2015	2016	2017
		2 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Maintenance cost of the Kampong Chhnang DPWT for the Project Drainage System	About 3,100	About 1,200	1,332	748	747

Source: Documents provided by JICA and documents provided by MPWT

Note: According to MPWT, the above actual maintenance cost after 2015 was the sum of the maintenance cost of drainage systems for several towns in Kampong Chhnang Province including Kampong Chhnang City. However, since there are only a few towns in the province where drainage systems were installed, the above actual maintenance cost of the drainage system can be seen as mostly including the maintenance cost for Kampong Chhnang City, and thus can be evaluated for the achievement.

(4) Period of flooding of the Road Shoulder in Kampong Chhnang City

The ponding period of the road shoulder in Kampong Chhnang City became 0 days after project implementation, which was an achievement of the target value (Table 9).

Table 9: Ponding Period of the Road Shoulder in Kampong Chhnang City

Unit: Day/Year

Indicator	Baseline	Target	Actual		
	2012	2017	2015	2016	2017
		2 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Ponding Period of the Road Sholder	About 50	Almost 0	0	0	0

Source: Documents provided by JICA and response to interview with Kampong Chhnang DPWT

Note: Although the Executing Agency had no data for the period of flooding of the road shoulder, they confirmed that no flooding on the road shoulder had occurred since project completion. It was therefore evaluated as 0 days.

(5) Routine Maintenance Cost of the Prey Veng DPWT for the Project Bridges

The routine maintenance cost of the Prey Veng DPWT for the project bridges was 1,858 USD in 2016, and 1,855 USD in 2017. Thus, the target value was mostly achieved (Table 10).

Table 10: Maintenance Cost of the Prey Veng DPWT for the Project Bridges

Unit: USD/Year

Indicator	Baseline	Target	Actual	
	2012	2017	2016	2017
		2 Years After Completion	1 Year After Completion	2 Years After Completion
Maintenance Cost of the Prey Veng DPWT for the Project Bridges	About 3,500	About 1,800	1,858	1,855

Source: Documents provided by JICA and documents provided by MPWT

Note: The 3,500 USD maintenance cost for the project bridges for 2012 (baseline) which was set at the time of planning included both routine and periodic maintenance costs. Since it is not time to implement periodic maintenance on the project bridges yet, the above maintenance cost of the project bridges (Target and Actual) included only routine maintenance costs.

(6) Travel Time (BR-1 Bridge to BR-18 Bridge) on the National Road No. 11 due to Improvement of Traveling Speed

Travel Time (BR-1 Bridge to BR-18 Bridge) on the national road No. 11 dropped to approximately 70 minutes in 2017 due to improvements in the traveling speed, thus achieving the target value (Table 11).

Table 11: Travel Time (BR-1 Bridge to BR-18 Bridge) on the National Road No. 11 due to Improvement of Traveling Speed

Indicator	Baseline	Target	Actual	
	2012	2017	2016	2017
		2 Years After Completion	1 Year After Completion	2 Years After Completion
Travel Time (BR-1 Bridge to BR-18 Bridge) on the national road No. 11 due to improvement of traveling speed	About 120 Minutes	About 80 Minutes	N/A	About 70 Minutes

Source: Documents provided by JICA and documents provided by Prey Veng DPWT

Note: The above travel time for 2017 was measured by the Prey Veng DPWT at the time of the ex-post evaluation, and it was not measured before 2016.

3.3.1.2 Qualitative Effects (Other Effects)

The ex-post evaluation conducted key informant interviews with local residents and transporters located near the project facilities. Hearings with the Executing Agencies of the project such as MPWT and DPWT were also conducted in order to measure the effectiveness of the project and the qualitative effects of the impacts.¹⁴ The results are shown below.

(1) Improvement in Traffic Safety in the Project Area

[Kampong Chhnang Site]

Before the project started, accidents used to occur frequently due to the many potholes on the project roads in Kampong Chhnang City. The potholes were an obstacle for drivers since they were difficult to see by rainwater on rainy days. After project completion, the number of accidents decreased thanks to the repairing of these potholes. Moreover, improvements in traffic safety have been confirmed as the number of floods has decreased thanks to the installation of the project drainage system. The installation of road traffic signs and center-lines on project roads led not only to a decrease in the number of accidents, but also to a mitigation of traffic congestion. The safety of pedestrians has also improved as sidewalks were installed for the city roads by the project.

On the other hand, street vendors and taxi drivers say that they have recognized an increase in traffic accidents compared to before the project implementation, as vehicles drive at a greater

¹⁴ Kampong Chhnang Site: Key informant interviews were conducted with 2 local residents, 1 street vendor, 1 taxi driver, 2 transporters (5 Male, 1 Female). Prey Veng Site: Key informant interviews were conducted with 3 local residents, 3 street vendors, 3 taxi drivers, 3 transporters (10 Male, 2 Female).

speed on the improved roads in Kampong Chhnang City and careless driving has become noticeable since project completion.¹⁵

[Prey Veng Site]

As the project bridges were made from iron before the project implementation, vehicles needed to drive slowly, especially on the rainy days, since it was easy for them to slip when crossing the bridges. According to a street vendor, crossing the project bridges felt dangerous as some of the bridges had been severely damaged before the project. After the reconstruction by the project, it is no longer necessary for vehicles to drive slowly as the project bridges have been reconstructed and an improvement in traffic safety at the project bridges has been confirmed. In addition, the safety of pedestrians on the bridges has improved as the sidewalks were installed on the bridges by the project.

(2) Improvement of Traffic Accessibility in the Project Areas

[Kampong Chhnang Site]

Before project implementation, the water level on city roads frequently became high on rainy days and it was necessary to wait an average of 10 minutes for a lowering of the water level. An improvement in traffic accessibility has been confirmed since the above problems have not occurred after the installation of the drainage system by the project. Also, the number of bus services has increased since project completion, and the number of small buses (passenger vans) operating in inner-city areas has become vast and countless. Additionally, according to street vendors who regularly use large-sized buses, the number of large-sized buses (for long distance) which connect Kampong Chhnang City and other cities rose from 10/day before the project started to 40/day after project implementation. Moreover, the travel time of large-sized buses decreased due to the improvement of inner-city and outer-city roads. For example, the travel time between Kampong Chhnang City to Battambang City (190km) was 5-6 hours before the project implementation, but shortened to 2-3 hours after project completion.¹⁶

[Prey Veng Site]

Before the project started, as the project bridges had only one lane, it took time to cross. On average, it was necessary to wait 10 minutes for oncoming cars. After the bridges became two lanes through the project, it is now possible to cross without waiting for oncoming cars and thus an improvement in traffic accessibility was confirmed.

¹⁵ These traffic accidents mainly occur through the carelessness of drivers, and they are different to the traffic accidents caused by aforementioned potholes.

¹⁶ Decreased travel time is considered to be mainly thanks to the improvement of road conditions on the whole travel section



Improved National Road No. 5
(in Kampong Chhnang City)



Improved Street Road
(in Kampong Chhnang City)



Installed Drainage System
(in Kampong Chhnang City)



KBAL BOEUNG Bridge
(BR-4 Bridge) after reconstruction



MEBON Bridge (BR-8 Bridge)
after reconstruction



ROM LECH Bridge (Clv-2 Bridge)
after reconstruction

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Traffic Volume around the Project Areas¹⁷

Based on the traffic volume data for the project areas of the national roads No. 5 and No. 11, it can be seen that the overall traffic volume has increased, regardless of the type of vehicles, comparing before (2011 and 2014) and after (2015) project implementation (Table 12, 13, and 14).

Table 12: Traffic Volume of Oudong City Areas
(National Road No. 5, Around Pk 39km + 500m)

Unit: Number/Day

	2011	2014	2015 (Completion Year)
Cars / 4WD / Passenger Vans	4,874	5,992	6,300
Mini Buses / Buses / Light Commercial Vehicles	740	842	1,582
Heavy Trucks (2 Axle – 5 Axle Trucks)	737	992	960
Full Trailers (4 Axle – 6 Axle Truck Trailers)	60	117	107
Total	6,411	7,943	8,949

Source: Documents provided by MPWT

Note: Oudong City is located in between Phnom Penh City and Kampong Chhnang City on the national road No. 5.

¹⁷ There was no indication of quantitative effects for the impacts in either the ex-ante evaluation sheet or the preparatory survey report. This is the traffic data that it was possible to collect at this time and to use to measure the project impacts.

Table 13: Traffic Volume of Pursat City Areas
(National Road No. 5, Around Pk 184km + 500m)

Unit: Number/Day

	2011	2015 (Completion Year)
Cars / 4WD / Passenger Vans	2,967	3,700
Mini Buses / Buses / Light Commercial Vehicles	444	618
Heavy Trucks (2 Axle – 5 Axle Trucks)	570	1,210
Full Trailers (4 Axle – 6 Axle Truck Trailers)	65	198
Total	4,046	5,726

Source: Documents provided by MPWT

Note: Pursat City is located about 90km in a northwestward direction from Kampong Chhnang City on the national road No. 5.

Table 14: Traffic Volume of Neak Luong City Areas
(National Road No. 1, Around Pk 64km + 200m)

Unit: Number/Day

	2011	2014	2015 (Completion Year)
Cars / 4WD / Passenger Vans	2,157	4,104	4,633
Mini Buses / Buses / Light Commercial Vehicles	318	739	865
Heavy Trucks (2 Axle – 5 Axle Trucks)	526	1,192	1,386
Full Trailers (4 Axle – 6 Axle Truck Trailers)	47	458	499
Total	3,048	6,943	7,383

Source: Documents provided by MPWT

Note: Neak Luong City is located at the intersection point of the national roads No. 1 and No. 11.

(2) Mitigation of Flood Damage around the Project Areas¹⁸

Before project implementation, crops were seriously damaged through floods in the Kampong Chhnang site, and many houses were flooded below the floor level during the flood of 2011. At the Prey Veng site, floods of approximately 20 – 30 cm (50cm – 1m depending on the place) occurred before the project started. Therefore, Crops and rice paddies were damaged, and it was necessary to move livestock to different places. It was confirmed that such problems have not happened since project completion¹⁹.



Key informant interview with local residents.

¹⁸ As mentioned above, in order to measure the qualitative effects of the impacts, for item (2), (3), (4), (5) in the impacts section, key informant interviews were conducted with the same group of people indicated in the effectiveness section.

¹⁹ In association with the project mitigation of flood damage was considered to have been achieved by the installation of the drainage system in the Kampong Chhnang site. As for the Prey Veng site, mitigation was considered to have been achieved by the reconstructed bridges having been properly designed, with estimated high-water levels, height of girders, location of abutments etc. for each bridge.

(3) Improvement in the Hygienic Environment of Local Residents around the Project Areas

Before the project started in the project area of Kampong Chhnang site, bad odors used to occur at the time of raining because of pooled rain water and left garbage. Due to the installation of the drainage system by the project and regular garbage collections by the provincial municipality, such bad odors have not occurred since the project and an improvement in hygienic environment has been confirmed.

(4) Improvement in Logistics on National Road No. 5 and National Road No. 11

After project implementation, it was confirmed that the number of large-sized bus services (for long distance) had increased for both the Kampong Chhnang and Prey Veng sites, operating to connect inner and outer-city areas (Kampong Chhnang site: about 10/day before the project, about 40/day after the project; Prey Veng site: about 15/day before the project, about 70/day after the project). It also became possible to operate the bus services according to the schedule and an improvement in logistics on the national road No. 5 and the national road No. 11 was confirmed.

Meanwhile, even though improvements in logistics for both of the project areas was confirmed as mentioned above, street vendors and taxi drivers reported an increase in traffic accidents since traffic volume also increased with the above improvements. Now local residents need to walk carefully, paying attention to passing vehicles when they cross the project roads.

(5) Improvements in the Living Environment around the Project Areas

Before project implementation in both the Kampong Chhnang and Prey Veng project areas, on rainy days, residents were obliged to travel only when necessary since floods occurred often and it was frequently necessary to evacuate. After project implementation, an improvement in the living environment around the project areas was confirmed, and it became possible to go out easily, even on rainy days, as floods no longer happened. Also at the Prey Veng site, one of the local residents was able to visit their paddy fields and farms more frequently since it had become easier for them to go out on rainy days. The production level of their farm crops increased, and their income also increased as they were able to sell more crops than before.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

The project was given a Category B based on the *JICA Guidelines for Environmental and Social Considerations* (2010). This was based on the facts that: ① the project was considered to have no major negative impact on the environment and was not categorized as a large scale project within the road sector etc. as specified in the guidelines, ② the project has neither influencing characteristic nor affecting susceptible region as listed in the guidelines.

Additionally, the preparation of an environmental assessment report was not required for environmental approval and license according to the domestic law of Cambodia.

Through the interviews and hearings with the Executing Agency (MPWT) and construction management consultants in this ex-post evaluation, it was confirmed that environmental monitoring and mitigation measure in relation to air pollution (dust, etc.) / water pollution (turbid water, etc.) / noise (noise from operation of construction machinery, etc.), were conducted by the construction management consultants during construction.²⁰ Also, waste disposal, soil pollution countermeasure, heads-up regarding HIV and AIDS infection, regular learning and meeting for improving labor environment and accident prevention were conducted during the construction. These activities were not continued after the project completion. However, according to interviews with the Executing Agency and local residents close to the project area, there were neither negative impacts on, nor complaints about the natural environment.

(2) Resettlement and Land Acquisition

According to the Executing Agency (MPWT), the total area of land acquisition was 7,100 m² and the number of resettled residents was 23 households in relation to the project implementation. Resettlement and land acquisition were conducted according to the process of Cambodia and the Abbreviated Resettlement Plan.²¹ There were neither negative impacts nor complaints due to resettlement and land acquisition, based on interviews with the Executing Agency and local residents.

(3) Coordination / Demarcation with ADB for Targeting the Project Area

According to the interview with ADB, there was information sharing regarding the project bridges on the national road No. 11 at the formulation stage of the project. There was also a demarcation to prevent overlapping between this project and the ADB project. Since the connection of the neighboring areas and the project areas became smoother through both the reconstruction of bridges for this project and the ADB project, the whole road network of the subject areas has improved.

This project has mostly achieved its objectives. Therefore effectiveness and impacts of the project are high.

²⁰ The environment monitoring was conducted in accordance with the table 3-2-10 in the preparatory survey report.

²¹ According to the preparatory survey report, as for the resettlement policy of main donors such as JICA, World Bank, ADB at that time, the life quality of the affected residents should be recovered to the level of before the project implementation at least. On the other hand, the specific policy or procedure at Cambodia side for recovering the life of affected residents was still under consideration. Since the Executing Agencies of the project made fine adjustment as to pay land acquisition cost 3 USD/m², 8 USD/m², 16 USD/m², depending on the location, also the necessary budget allowance was provided without affecting the project period, it is considered that the project took appropriate and careful actions for the resettlement.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

MPWT is the control authority for the project on the Cambodia side, and the Road Infrastructure Department (herein after called RID) is responsible for supervising the operation and maintenance (herein after called O&M). Direct routine periodic O&M for the project facilities is the responsibility of the Kampong Chhnang DPWT (for the project roads, the project drainage system) and the Prey Veng DPWT (for the project bridges).²² When emergency maintenance or difficult projects are required to be handled by the DPWT, the Equipment & Road Construction Department and the Road Construction & Maintenance Department which are affiliated with MPWT, are in charge of O&M. Tables 15 and 16 below indicate each department for the O&M of MPWT, the Kampong Chhnang DPWT, and the Prey Veng DPWT as of December 2017. The tasks and areas of responsibilities for O&M are clear and no major issues have been observed in terms of the institutional aspects of O&M which is conducting by the Executing Agency now.

Table 15: Organizational Structure for O&M in MPWT

Department	Responsibility	Numbers
RID	In charge of supervising O&M for roads / bridges, conducting training for staff, and periodic maintenance.	About 100
Equipment & Road Construction Department	In charge of conducting the training for heavy machinery operation and construction works for roads / bridges.	About 100
Construction & Maintenance Department	In charge of O&M and construction works for roads / bridges.	About 300

Source: Response to interviews with MPWT

Table 16: Organizational Structure for O&M in Kampong Chhnang DPWT and Prey Veng DPWT

Department	Responsibility	Numbers
Office of Public Works (Kampong Chhnang DPWT)	In charge of routine and periodic O&M	11
Office of Public Works (Prey Veng DPWT)		9

Source: Response to interviews with Kampong Chhnang DPWT and Prey Veng DPWT

3.4.2 Technical Aspect of Operation and Maintenance

Most of the staff in RID in charge of O&M have a higher level of academic background than university level, while more than half the staff of the Kampong Chhnang DPWT and the Prey Veng DPWT also have a higher level of academic background than university level. O&M works of the project facilities are implemented according to the O&M manual, which was prepared by MPWT. Three types of new O&M guidelines (*Road O&M Guidelines, Bridge O&M Guidelines, Bridge Inspection Guidelines, (2017)*) were published in December 2017 by the following JICA

²² Each DPWT implements periodic maintenance activities under the supervision and instruction of RID.

Technical Corporation Project. Moreover, RID conducts the following training in relation to the O&M of the project facilities for MPWT and DPWT technical staff (Table 17).

Table 17: Training of the staff for MPWT and DPWT

Name of Training	Target Staff	Purpose	Frequency
Road O&M Program	45 MPWT Technical Staff 40 DPWT Technical Staff	Capacity Building	Once a Year
Bridge O&M Program	35 MPWT Technical Staff 37 DPWT Technical Staff		

Source: Response to interviews with MPWT

The JICA Technical Cooperation Project, The Project for Strengthening Capacity for the Maintenance of Roads and Bridges (2015-2018) was in progress at the time of the ex-post evaluation.²³ It is expected that the ability for the O&M of roads and bridges on the part of RID and DPWT will improve through the JICA Project. This should include enhancing the capacity for road and bridge inspection and repair, establishing the maintenance cycle, and providing training programs in relation to O&M etc.

According to the Executing Agency (MPWT), there was an opinion that there are not enough laboratories for the official quality inspection of the construction materials²⁴ which are used for repairing potholes and overlay etc. However, it was not possible to confirm the actual issues which occurred during the O&M works (examples which actually happened etc.). Thus, no major issues have been observed in terms of the technical aspect of O&M.

3.4.3 Financial Aspect of Operation and Maintenance

The actual O&M budgets of MPWT, the Kampong Chhnang DPWT and the Prey Veng DPWT for the past 4 years (2014 - 2017) are shown in Tables 18 and 19. Also, MPWT establishes O&M budgets in Chapter 61 and Chapter 21, the details of which are indicated in Table 18. The annual budget and O&M budget for MPWT are funded only by the government of Cambodia, and no subsidy from a special account is provided.

²³ The expected outcomes of “The Project for Strengthening Capacity for the Maintenance of Roads and Bridges (2015-2018)” are follows: (i) The bridge maintenance cycle is established in RID , (ii) Road and bridge inspection and repair capacity of RID is enhanced, (iii) Road and bridge maintenance cycle is introduced to other DPWT and concerned agencies.

²⁴ Asphalt, Laterite (Red Clay), Mixed Aggregate etc.

Table 18: Actual Budget for O&M in MPWT (2014 - 2017)

Unit: Million Dollar				
	2014	2015	2016	2017
Actual Budget for O&M in MPWT	123.75	118.5	133	148.75
Actual Budget for Routine Maintenance in MPWT (Chapter 61)	23	30.75	31.25	41.75
Actual Budget for Periodic Maintenance in MPWT (Chapter 61)	27	14	18.25	18.25
Actual Budget for Emergency Maintenance in MPWT (Chapter 61)	12.5	12.5	13.5	10
Actual Budget for New Construction in MPWT (Chapter 21)	61.25	61.25	70	78.75

Source: Documents provided by MPWT

Table 19: Actual Budget for O&M in DPWT for Project Provinces (2014 - 2017)

Unit: Million Dollar				
	2014	2015	2016	2017
Actual Budget for O&M in the Kampong Chhnang DPWT	2.39	2.39	3.27	2.48
Actual Budget for O&M in the Prey Veng DPWT	0.68	2.62	3.51	3.17

Source: Documents provided by MPWT

According to the interview with the Executing Agency (MPWT), periodic maintenance has been delayed due to the budgetary deficit for periodic maintenance, and as infrastructure facilities have become depleted, in many cases the problems are eventually dealt with by conducting new construction. The periodic maintenance cost of the ODA loan project the National Road No. 5 Improvement Project (Prek Kdam-Thlea Ma'am Section) was expected to be 212 thousand USD/km²⁵ for each 10 years. On this assumption, it is considered that 48 million USD per year would be required only for 1 digit national roads (2,243 km²⁶) which are similar to the road standard of this project, and the budget for periodic maintenance is below the level at the time of the ex-post evaluation.²⁷ Even though no issues were observed for the project facilities at the time of ex-post evaluation, periodic maintenance will be required from a long term perspective. Therefore, there is a possibility of facing some issues relating to the financial aspect of O&M in the future.

3.4.4 Status of Operation and Maintenance

Routine maintenance and periodic maintenance have been conducted according to the inspection items, as mentioned in Table 20, by the Kampong Chhnang DPWT (for the project roads and the project drainage system) and the Prey Veng DPWT (for the project bridges) under the supervision of RID. Since project completion, the project facilities have been kept in good condition and no damages have been observed in terms of the current status according to the visual site inspection at the ex-post evaluation.

²⁵ JICA (2013) "National Road No. 5 Improvement Project (Prek Kdam-Thlea Ma'am Section)" Feasibility Study Report, p.33.

²⁶ At the time of November 2014

²⁷ 212 thousand USD x 2243 km ÷ 10 years ≐ 48 million USD/year

Table 20: Inspection Item of O&M for the Project Facilities

Type of Maintenance	Inspection Item	Frequency
Routine Maintenance	<ul style="list-style-type: none"> • Visual inspection and cleaning for pavements, road shoulders, drainages, bridges, piers • Weeding • Repairing cracks in pavements and pothole • Painting for traffic signs / Road marking 	Everyday
Periodic Maintenance	<ul style="list-style-type: none"> • Overlay for pavements, part resurfacing 	Every 5 – 6 years

Source: Response to interviews with MPWT

Since the design policy of project facilities was to have durability and low-maintenance structure with acceptable costs, the mud reservoir for clog prevention and the waste inflow prevention fence were provided in the project roads drainage system, also put the hinge type grating basin²⁸ for the drainage basin and the maintenance basin which makes easy to conduct visual inspection of basins and opening-closing. In addition, the structure of the project bridges did not have expansion joints that was not required to conduct regular maintenance. It is considered that these design policies were contributed to the efficiency of operation and maintenance activity by the Executing Agency.

Some minor problems have been observed in terms of the financial aspect. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to restore the function of road infrastructure in the disaster area to its pre-disaster condition by rehabilitation and improvement of roads and drainage system in Kampong Chhnang City and by reconstructing 8 decaying bridges the on national road No. 11 in Prey Veng Province, all of which were affected by the flood of 2011, thereby contributing to the mitigation of flood damage and smoother regional transport in the affected areas.

The project was consistent with the development plan and development needs of Cambodia, as well as with Japan's ODA policy. Therefore, the project relevance is high. Meanwhile, the project cost and project period were in accordance with the plan. Therefore, the efficiency of the project is high. As for the project effects, it is confirmed that the project brought positive effects in an increase in traffic volume at the project areas, a decrease in the maintenance cost of the Kampong Chhnang DPWT for the project drainage system, a decrease in the maintenance cost of the Prey Veng DPWT for project bridges, and a reduction in the travel time from BR-1 bridge to BR-18 bridge on the national road No. 11. Improvements in traffic safety and traffic accessibility in the project areas were also observed. In addition, it is considered that there has been a mitigation of

²⁸ Connecting a square block type ditch lid with a frame by a hinge, and making it easy for opening/closing of the lid.

flood damage in the project areas, improvements in the hygienic and living environment, and improvements in logistics on the national roads No. 5 and No. 11. The project is found to have contributed to these improvements, and thus, its effectiveness and impacts are high. The sustainability of project effects is fair since no major problems have been observed in the institutional and technical aspect as well as status of operation and maintenance for the project, but some minor problems have been observed in terms of the financial aspect, due to insufficient budget allocation for periodic maintenance.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Prioritization of Periodic Maintenance Activities

According to the interview with the Executing Agency (MPWT), with the medium to long term view, the road surface has become depleted because of delays in periodic maintenance activities caused by constraints on the budget for periodic maintenance. The problem eventually tends to be dealt with through new construction. Both the national road No. 5 and the national road No. 11 hold an important position in the road network of Cambodia, and the traffic volume of cargo vehicles has increased remarkably in recent years, it is required to conduct periodic maintenance activities on a timely basis from the perspective of reducing the life-cycle cost for roads and bridges. In order to address the budgetary deficit for periodic maintenance, it is recommended that MPWT prioritize appropriately when formulating O&M plans in the future, and when conducting proper periodic maintenance activities for target sections of the project.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) Necessity of Operation / Effect Indicators for an ODA Project

It was not possible to collect one of the useful operation / effect indicators for this project because the interpretation of the indicator by the Executing Agency was different at the time of the ex-ante evaluation and the ex-post evaluation. Even though the collection of data for the operation / effect indicator is not included in the agreement with the government of a recipient country by the project, it is important to have appropriate data for examining project effects for an ODA project. Thus, it is necessary that the Executing Agency is requested to fully understand, record, and steadily execute data collection for the operation / effect indicators.

(2) Importance of Coordination / Demarcation with Other Donors for Targeting Project Areas

The project was to restore the road infrastructure in the affected areas after the flood of 2011. Other donors, such as ADB, also implemented similar projects. There was information sharing regarding the project bridges at the formulation stage, and there was a demarcation for targeting the project area to avoid overlapping of project bridges etc. between the donors. Thus, since it is considered that the whole of the road network in the subject areas has improved with the improvement of the infrastructure facilities connecting project roads and bridges, and that the impact of the project has been seen extensively even outside the project areas, it is expected that same kind of coordination will take place in similar projects in the future.

(3) Suggestion to Design Policy for Roads/Bridges

In terms of O&M for roads/bridges in developing countries, there are cases that faced difficulties in O&M activities due to insufficient budget of executing agencies in general. The design policy of project facilities was to have durability and low-maintenance structure with acceptable costs²⁹. Since it is assumed that the design policies were contributed to the efficiency of operation and maintenance activity by the Executing Agency, it is desirable to apply same kind of considerations to design policy for facilities of similar road/bridge projects.

End

²⁹ Stated in “3.4.4. Status of Operation and Maintenance” of the report.

Kingdom of Cambodia

FY2017 Ex-Post Evaluation of Technical Cooperation Project

“Technical Service Center for Irrigation System Project -Phase 2

/The Improvement of Agricultural River Basin Management and Development Project (TSC3)”

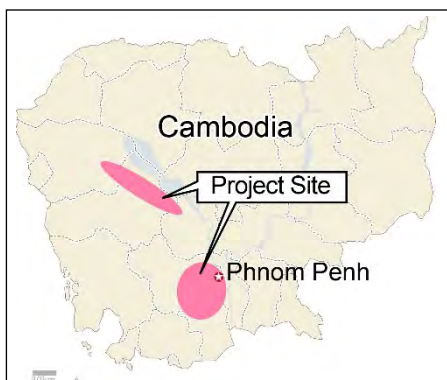
External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

This project aimed at promoting water management and securing agricultural productivity in and around the project sites in 6 provinces through capacity building of the implementing agency and irrigation associations. In Cambodia where the rice crop occupies 80% to 90% of the land area under cultivation, the purpose of this project was consistent with the country’s policy and developmental needs which prioritized the development, maintenance and improvement of irrigation systems as well as the improvement of agricultural productivity. The project purpose was also consistent with Japan’s aid policy, and therefore the relevance of this project is high. Before completion of the project, the implementing agency staff improved their capacity for irrigation system development and management as well as for extended irrigation management. Beneficiary farmers were organized, and their capacity for water management was reinforced. After project completion, Technical Service Center for irrigation System (TSC) has continued to promote capacity building of implementing agency staff through training. Provincial Department of Water Resources and Meteorology (PDWRAM), on the other hand, is maximizing its knowledge of the planning and designing of irrigation systems in order to apply for Japan’s Grant Assistance for Grassroots Human Security Projects. At the time of the ex-post evaluation, the unit yield of rice among the beneficiary farmers at project sites was well maintained. The increase in agricultural income is contributing to improvements in farmers’ livelihoods in general. As the realization of project effects can be confirmed, it is concluded that the effectiveness and impact of this project are high. The actual project period was in accordance with the original plan. The project cost, however, exceeded the original plan, mainly due to the increase in the dispatch of experts. Efficiency, therefore, is fair. There was no indication of significant problems that would affect the sustainability in terms of policies and techniques. From the organizational and financial aspects, the activities of Farmer Water Users Community (FWUC) were not always successful and some FWUC faced difficulties in the collection of irrigation service fees. For these reasons, the sustainability of the project effects is concluded to be fair.

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

1. Project Description



Project Locations



The canal rehabilitated by this Project

1.1 Background

As Cambodia developed in the early 2000s, agriculture was the country's prime industry, with rice as its most important agricultural product forming the backbone of the entire agricultural production. A deficient irrigation infrastructure in the country, however, was a factor that hampered the improvement of rice productivity. The civil war that had continued over two decades had destroyed much of the irrigation infrastructure, while that which existed faced problems of design and construction. Furthermore, it was difficult for the staff of the Ministry of Water Resources and Meteorology (referred to as "MOWRAM" hereafter) to acquire practical irrigation techniques as a result of the inadequate training systems designed for irrigation engineers and technicians.

Considering this situation, the Japan International Cooperation Agency (JICA) supported the improvement of agricultural productivity in Cambodia on the request of the Royal Government of Cambodia (RGC). A previous technical cooperation project, "The Technical Service Center for Irrigation Systems Project (2001-2006)" created the foundation for the spread of irrigation techniques through TSC (a training unit of MOWRAM). The current project consists of 2 independent projects: The Project for the Technical Service Center for Irrigation Systems Project Phase 2 (referred to as "TSC2" hereafter) and the Project for the Improvement of Agricultural River Basin Management and Development Projects (referred to as "TSC3" hereafter), both of which were conceived as follow-up to the afore mentioned "The Technical Service Center for Irrigation Systems Project." This project aimed at expanding the coverage of irrigation technology through TSC and the advancement of these techniques. While TSC2 carried out capacity building in the irrigation sector targeting PDWRAM staff (local branches of MOWRAM) and farmers in and around 3 areas in 3 provinces, TSC3 expanded this further to 11 areas in 6 provinces. It also aimed at capacity development in basin management and a shift from individual irrigation system management, to enable more efficient water resource management.

Table 1: Project Sites of the Current Project

	TSC2	TSC3
Target Provinces	Pursat Province, Kandal Province, and Takéo Province	Battambang Province, Pursat Province, Kampong Chhnang Province, Kampong Speu Province, Kandal Province and Takéo Province
Project Sites	Thlear Maom, Kandal Stung, Thomney	Por Canal, Ream Korn, Wat Chre, Wat Loung, Thlear Maom, Damnak Ampil, Lum Hach, Roleang Chrey, Kandal Stung, Upper Slakou, Thomney

1.2 Project Outline

	TSC2	TSC3
Overall Goal	Livelihood of the farmer's households is improved by stabilizing their agricultural productivity through efficient water resource management in the irrigation areas conducted by the trained engineers and technicians in MOWRAM and PDWRAM.	Agricultural productivity in the target area is stabilized through efficient water resources management realized by improved technical capacity of MOWRAM and PDWRAM in agricultural river basin management and development. ¹
Project Purpose	1. The technical capacity of MOWRAM and PDWRAM is improved. 2. The farmers who have participated in the Project activities at the Pilot Sites ² are able to practice water management in terminal canals.	Irrigation projects are properly planned, implemented, and operated in the target area of the Project.
Outputs	Output 1 The following outputs are expected to be achieved at TSC. 1-1 Establish the training system 1-2 Set up the technical manuals 1-3 Manage the technical information	TSC obtain capacities to implement training and provide technical support for MOWRAM and PDWRAM related to the agricultural river basin management and development.
	Output 2 The technical capacity of the engineers and technicians in MOWRAM and PDWRAM is well trained through the trainings at TSC and on-the-job trainings (OJT) at Model Sites and Pilot Sites.	The engineers and technicians in MOWRAM and PDWRAM obtain knowledge on concepts and technologies related to the agricultural river basin management and development through training.
	Output 3 With the technical assistance of TSC, the following outputs are expected to be achieved at Pilot Sites. 3-1 The trained engineers and technicians in PDWRAM construct the terminal canals, which make it possible for farmers to easily access irrigation water. 3-2 Farmers start to conduct water management activities at the terminal canals in cooperation with PDWRAM.	The capacities of the engineers and technicians of MOWRAM and PDWRAM on planning, survey, design, construction management, operation and maintenance (O&M) of facilities and structures in an irrigation system as a whole are improved through training.
	Output 4	The technical support system of TSC is established to promote implementation of irrigation projects nationwide by PDWRAM.
Total Cost (Japanese Side)	JPY 351 million	JPY 822 million
Period of Cooperation	January 2006 – July 2009	September 2009 – August 2014

¹ In the terminal evaluation report, the summary of the overall goal have minor differences between Japanese and English. However, it is confirmed that the description on the impact of the project were the same in two versions. For this reason, the above table is based on the descriptions in the terminal evaluation report.

² In TSC2, the model sites were for the purpose of OJT training for engineers and technicians while the pilot sites were locations where engineers and technicians had experience from actual practice.

	TSC2	TSC3
Implementing Agency	Ministry of Water Resources and Meteorology (MOWRAM)	
Other Relevant Agencies / Organizations	None	
Supporting Agency / Organization in Japan	The Ministry of Agriculture, Forestry and Fisheries	
Related Projects	[Technical Cooperation] <ul style="list-style-type: none"> • “The Technical Service Center for Irrigation System Project” (2001- 2006) • “Agricultural Productivity Promotion Project in West Tonle Sap” (2010-2015) • “Project for River Basin Water Resources Utilization in the Kingdom of Cambodia” (2014-2019) [ODA Loans] <ul style="list-style-type: none"> • “West Tonle Sap Irrigation Rehabilitation Project” (2011) [Grant Aid] <ul style="list-style-type: none"> • “The Project for the Rehabilitation of the Kandal Stung Irrigation System” (2005) 	

1.3 Outline of the Terminal Evaluation

1.3.1 Achievement Status of Project Purpose at the Terminal Evaluation

The estimated achievement of the project purposes of the evaluated projects as of the terminal evaluation is described in the table below.

Table 2: Achievement status of Project Purposes (as of the Terminal Evaluation)

TSC2	As the majority of indicators set forth for training and terminal canal management had been attained, it was concluded that the project purpose was highly likely to be achieved
TSC3	Based on the lengths of the irrigation canals, the number of trainees, the activity level of FWUC as well as the utilization level of knowledge acquired by the PDWRAM engineers and technicians, it was concluded that the project purpose was likely to be achieved.

1.3.2 Achievement Status of Overall Goal at the Terminal Evaluation (Including other impacts)

The estimated achievement of the overall goals of the evaluated projects as of the terminal evaluation is described in the table below.

Table 3: Estimated Achievement of Overall Goals (as of the Terminal Evaluation)

TSC2	The area of irrigated fields at the national level (2007) was approaching the target, and that the unit yield of rice (2007/08) had already reached the target, it was concluded that the overall project goal was highly likely to be achieved.
TSC3	There was no explicit mention of the estimated achievement of the overall project goal.

1.3.3 Recommendations from the Terminal Evaluation

The recommendations made as of the terminal evaluation of the evaluated projects are detailed in the table below.

Table 4: Recommendations (as of the Terminal Evaluation)

TSC2	(1) Rapid disbursement of the Cambodian official budget, (2) Follow-up on the PDWRAM trainees outside the pilot provinces, (3) Organization of wrap-up workshops to further disseminate the project achievements, (4) Efforts to realize the Road Map for TSC institutionalization, (5) Human Resource Development for TSC personnel, (6) Utilization of project experience and outputs by MOWRAM.
TSC3	(1) Revision of the 2014 TSC plan, (2) Assignment of TSC staff in preparation for the beginning of the new technical cooperation project, (3) Minimization of construction activities in the model sites, (4) Provision of training to newly recruited MOWRAM staff, (5) Transfer to “FWUC for promoting O&M works” in the model sites, (6) Application of the project outputs to similar projects, (7) Improvement of the workforce age structure at MOWRAM, (8) Transformation of TSC as a higher education and research institute.

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

The ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2017–August 2018

Duration of the Field Study: Nov. 12, 2017–Dec. 8, 2017, Mar. 20, 2018–Mar. 29, 2018

2.3 Constraints during the Evaluation Study

The project sites of this project were dispersed across 11 locations in 6 provinces. Due to time constraints on the field study, the external evaluator could only visit 4 sites (Thlear Maom, Damnak Ampil, Rloeang Cherey, Kandal Stung). As the project sites were concentrated in the north-west and the south of Cambodia, 2 sites were selected from each geographical area. The status of the other 7 sites as reported in this document is based on secondary information obtained from field survey assistants or the implementing agency. It should be also mentioned that physical inspection of the construction machinery, part of the high-value machinery supplied by this project, was not conducted as the said machinery was being used in the area inaccessible from the sites of this project for the implementation of other projects.

3. Results of the Evaluation (Overall Rating: B³)

3.1 Relevance (Rating: ③⁴)

There was a continuity between TSC2 and TSC3 in terms of project purpose and activities. The items analyzed for relevance, therefore, were mostly common to the two phases. Analysis and assessment were conducted for the combined results of both phases, at 3 points in time: at the time of planning of TSC2, at the completion of TSC2 and at the time of planning of TSC3, and at the completion of TSC3.

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ③: High, ②: Fair, ①: Low

3.1.1 Consistency with the Development Plan of Cambodia

“*The Second Socio-Economic Development Plan 2001-2005*,” the national development plan at the time of project planning for TSC2, drew attention to the low productivity of the agriculture sector, and concluded that an unstable water supply was making agriculture a high-risk activity. Among the 4 basic strategies of the “*Rectangular Strategy*” (formulated in 2004), strategy 1, “enhancement of the agricultural sector,” aimed at the improvement of agricultural productivity, while strategy 2, “continued rehabilitation and construction of physical infrastructure,” aimed at the expansion of irrigated field area and the efficient use of existing irrigation systems.

At the project completion of TSC2 and the project planning stage of TSC3, based on the above mentioned “*Rectangular Strategy*,” the “*National Strategic Development Plan 2006 -2010*” set out objectives to increase the irrigated field area and the unit yield of rice. The sectoral plan, “*Strategy for Agriculture and Water 2006-2010*,” on the other hand, set the tone for a shift in the unit of water resource management from an administrative unit base to a river basin unit base, eventually formulating an integrated land and water management plan per river basin.

At the project completion of TSC3, “*The Third Rectangular Strategy*” (formulated in 2013) was in place. In this, strategy 1, “Promotion of the Agricultural Sector” aimed at the improvement of agricultural productivity, including rice cultivation, while strategy 2, “Infrastructure Development” aimed at more effective management and operation of irrigation systems (continuous reinforcement of O&M systems). Meanwhile, “*The National Strategic Development Plan 2014-2018*” targeted an increase in rice cultivation area, production quantity and unit yield. It also drew attention to issues facing the irrigation sector including the low participation rate in FWUC and Farmer Water User Groups (FWUG⁵), and the need for the reinforcement of irrigation infrastructure management. Under “*Strategy for Agriculture and Water 2010-2013*” (formulated in 2010), the policy was to introduce a concrete basin-based management structure for integral water resource management.

From the planning phase of TSC2 to the project completion of TSC2 and the planning phase of TSC3 (2009), a development policy was put in place to improve agricultural productivity by realizing a stable water supply from irrigation. At the project completion of TSC3, the development of irrigation infrastructure and the strengthening of irrigation infrastructure management were still recognized as challenges for improvement of agriculture productivity. As both TSC2 and TSC3 aimed at the capacity building of MOWRAM and PDWRAM in the irrigation sector as well as the improvement of agricultural productivity in the project target areas, it can be said that the project purpose was consistent with development policy. Furthermore, TSC3 added basin irrigation management to the TSC training component, which

⁵ FWUC consist, in general, of 3 to 9 FWUG, while each FWUG brings together from dozens up to 1,000 farmers. FWUC make decisions on matters that affect the entire FWUC such as the distribution of water and the collection of irrigation service fees. FWUG, on the other hand, are in charge of practical actions for the management and O&M of terminal canals.

aimed at capacity building for MOWRAM and PDWRAM in this area. This expansion of the training component was in accordance with the policy of the “*Agriculture and Water Strategy*.”

3.1.2 Consistency with the Development Needs of Cambodia

At the planning phase of TSC2, agriculture made up 34% of Cambodia’s GDP (World Bank Data, 2003) and rice was the prime product, occupying 95% of land cultivated for food crops (as of 2005).⁶ Low productivity of rice farming, on the other hand, was a factor that impeded increase in farmers’ revenue, which in turn was one of the causes of urban-rural economic disparity in the country. The existing irrigation infrastructure was not adequately functioning. Reasons for inadequate functioning of irrigation infrastructure were said to be the civil war, that had lasted over a long period of time, and inappropriate infrastructure development. Demand for rehabilitation of the irrigation system was high, yet due to the civil war, there was a shortage in the number of irrigation engineers and technicians with practical experience. In addition, only a few staff at the implementing agency had an academic background in the irrigation sector. It was, therefore, necessary to supplement actual knowledge of irrigation work after recruitment.

At the project completion of TSC2 and at the planning phase of TSC3, agriculture continued to make up 36% of the country’s GDP (World Bank Data, 2009), with rice occupying 87% of the land cultivated for food crops (as of 2009).⁷ Of the irrigation systems (472,000ha in total) known to the Mekong Committee, no more than 256,000 ha (54% of the total irrigated area) was functioning. There were no programs at higher education institutions that taught irrigation techniques comprehensively and practically. The need at the implementing agency for post-recruitment training was therefore high.

As of the completion of TSC3, agriculture still accounted for 31% of Cambodia’s GDP (World Bank Data, 2014), and paddy fields made up 81% of the land cultivated for food crops (2014).⁸ Approximately 80% of the irrigation infrastructure constructed after 1978 was built under the Pol Pot regime, and much of this was known to have had problems in design and construction.⁹ With regard to urban-rural economic disparity, per capita disposal income in rural areas was a third of that in Phnom Penh in 2014.¹⁰ The training of irrigation engineers and technicians by higher education institutions continued to be limited. In particular, the university curriculum was not appropriate, expecting implementing agency staff to acquire practical knowledge in as short a period as one week.

Throughout the project implementation period, the agricultural sector continued to make up more than 30% of the country’s GDP with rice being the principal crop. The irrigation

⁶ National Institute of Statistics (2013), “Statistical Year Book 2013.” The definition of food crop in this statistics data include rice, maize, cassava, sweet potato, vegetable and mung bean.

⁷ National Institute of Statistics (2013) “Statistical Year Book 2013”

⁸ National Institute of Statistics (2013) “Statistical Year Book 2013”

⁹ International Water Management Institute (2013) “Agriculture Water Management Planning in Cambodia”

¹⁰ National Institute of Statistics (2016) “Cambodia Socio-Economic Survey 2015”

infrastructure that is pivotal to rice production, however, was still inadequate at project completion and this was considered as a factor that hampered the improvement of rice productivity. There was no change in the situation before and after the project where TSC was put in charge of practical educational programs for the human resource development of irrigation engineers and technicians. Both TSC2 and TSC3 promoted capacity building in the areas of planning, design, construction and O&M of irrigation infrastructure through TSC in order to improve rice productivity in the project target areas. The project purpose was, therefore, consistent with above mentioned development needs.

3.1.3 Consistency with Japan's ODA Policy

At the planning phase of TSC2, Japan's Country Assistance Program for Cambodia (formulated in 2002) placed importance on balanced development between urban and rural areas. The priority area of the policy included the "realization of sustainable economic development and a stable society," envisaging work on "agriculture and rural development, and agriculture productivity improvement."¹¹ The backdrop to this aid policy was the economic disparity between the capital city and the provinces. Rural development was given priority, as a result, to achieve balanced development. The improvement of agricultural productivity was indispensable for poverty alleviation in rural areas. Improvement of water management systems as well as the development of FWUC/FWUG were proposed as concrete measures. At the planning phase of TSC3, aid to the country was still based on the above-mentioned country assistance program.

The overall goals of TSC2 were the stabilization of agricultural production and the improvement of farmers' livelihoods, while that of TSC3 was the stabilization of agricultural productivity in the target areas. The achievement of these overall goals of TSC2 and TSC3 would contribute to the priority area of the Country Assistance Policy, "agricultural and rural development, and agriculture productivity improvement." It is concluded, therefore, that there was a consistency between the evaluated project and Japan's aid policy.

This project was highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Effectiveness and Impact¹² (Rating: ③)

3.2.1 Effectiveness

The project purpose of TSC2 was to build up the capacity of MOWRAM and PDWRAM staff as well as that of beneficiary farmers for knowledge and skills related to the respective irrigation systems in 3 provinces. TSC3, on the other hand, expanded the project target area, and in its

¹¹ Ministry of Foreign Affairs (2002). "Country Assistance Program for Cambodia"

¹² Sub-rating for Effectiveness is to be put with consideration of Impact.

project purpose aimed at building the capacity for basin irrigation management. The project purpose of TSC2 was an important goal as foundation for the implementation of TSC3. For this reason, after the purposes of TSC2 and TSC3 were assessed individually, the level of overall achievement was evaluated giving them equal weightage.

3.2.1.1 Project Output

(1) TSC2

As indicated in the following table, it is concluded that the 3 sets of outputs set were achieved.

Table 5: Achievement of Outputs (TSC2)

Outputs	Actual
The following outputs are expected to be achieved at TSC. 1-1 Establish the training system 1-2 Set up the technical manuals 1-3 Manage the technical information	Achieved. The following items were completed before the end of TSC2: (a) Curricula for 38 courses. (target:33 courses), (b) 14 types of training materials (target: 14 types), (c) List of technical manuals and book collection (target: creation of a list of technical manuals and book collection), (d) 9 types of technical manuals (target: 8 types), (e) technical information library (target: completion of technical information library).
The technical capacity of the engineers and technicians in MOWRAM and PDWRAM is well trained through the trainings at TSC and on-the-job trainings (OJT) at Model Sites and Pilot Sites.	Achieved. Before the completion of TSC2, the length of terminal canal which the implementing agency planned and rehabilitated reached 8,200 m (target: 4,490m). 604 engineers and technicians of MOWRAM and PDWRAM attended 38 training courses (target: 520 technicians), 465 engineers and technicians of MOWRAM and PDWRAM as well as 194 representatives of farmers attended the OJT at the model sites/ pilot sites (target 510 participants among engineers, technicians and farmers). 30 counterparts of PDWRAM in 3 provinces participated in the OJT along with canal rehabilitation (target: 21 counterparts).
With the technical assistance of TSC, the following outputs are expected to be achieved at Pilot Sites. 3-1 The trained engineers and technicians in PDWRAM construct the terminal canals, which make it possible for farmers to easily access irrigation water. 3-2 Farmers start to conduct water management activities at the terminal canals in cooperation with PDWRAM.	Achieved. Before the completion of TSC2, 18.3 km of terminal canals (the tertiary and distribution canals) was developed (target: 5km or longer). PDWRAM finalized the basic design of 3 pilot sites (target: 3 pilot sites). As a result of 65 workshops and FWUC/FWUG meetings at the model sites and respective pilot sites, O&M activities for the irrigation canals (weeding, mud removal, repair of earth canals, slope protection, etc.) were conducted in 3 pilot sites (target: onset of operation and maintenance activities in 3 pilot sites.)

Source: Project completion report of TSC2, and the terminal evaluation report for TSC2

(2) TSC3

As indicated in the following table, it is concluded that the 4 sets of outputs were either achieved or mostly achieved.

Table 6: Achievement of Outputs (TSC3)

Outputs	Actual
TSC obtain capacities to implement training and provide technical support for MOWRAM and PDWRAM related to the agricultural river basin management and development.	Mostly achieved. According to interviews conducted with the implementing agency, as of the completion of TSC3, 70% of staff members assigned to TSC were involved in trainings, although this was somewhat below the target (90%). The majority of PDWRAM staff (96%) who received training at TSC reported that they were satisfied with the contents of the training (target: satisfaction rate 80%).
The engineers and technicians in MOWRAM and PDWRAM obtain knowledge on concepts and technologies related to the agricultural river basin management and development through training.	Achieved. As of the completion of TSC3, 20 training courses on the above-mentioned area were conducted for MOWRAM and PDWRAM engineers and technicians (target: 15 courses). On average, 88.7% of participants in these 20 courses attained the objectives of the training courses, which exceeded the target success rate (60%).
The capacities of the engineers and technicians of MOWRAM and PDWRAM on planning, survey, design, construction management, operation and maintenance (O&M) of facilities and structures in an irrigation system as a whole are improved through training.	Achieved. Before the completion of TSC3, 32 training courses were conducted (target: 12 courses). Training covered the life cycle of irrigation systems (from planning to O&M). Advanced courses were also provided. On average 91.4% of participants in these 32 courses attained the objectives of the training courses, which exceeded the target success rate (60%).
The technical support system of TSC is established to promote implementation of irrigation projects nationwide by PDWRAM.	Achieved. During the project period, PDWRAM engineers and technicians formulated 31 irrigation project plans with the help of TSC (Target: 30 projects).

Source: Project completion report of TSC3, the terminal evaluation report for TSC3, interviews with staff of the implementing agency.

3.2.1.2 Achievement of Project Purpose

(1) Achievement of Project Purpose (TSC2)

TSC2 had 2 project purposes: firstly, to build the capacity of implementing agency staff in technical areas, and secondly to build the capacity of farmers in the area of the O&M of irrigation canals. Implementing agency staff who participated in the training had their level of technical skill raised and were satisfied with content of the training. It is therefore concluded that the project purpose 1 was achieved. Furthermore, FWUG and beneficiary farmers who have O&M activities for canals have exceeded the target numbers. It is therefore concluded that the project purpose 2 also was achieved. Thus, TSC2 achieved its project purposes.

Table 7: Achievement of Project Purpose (TSC2)

Project Purpose	Indicator	Actual
Project Purpose 1 The technical capacity of MOWRAM and PDWRAM is improved.	1-1: More than 60% of engineers and technicians who participated in the training and OJT achieve the assigned target in the curricula.	Achieved. During the mid-term evaluation of TSC2, the detailed indicators and targets were set with the criteria: (a) Participants will self-evaluate their levels of technical skills and report improvements of at least 1 grade in the five-grade scale. (b) Examination scores will be 60 points, and (c) There will be the intention to use the acquired skills. According to the post-training questionnaire for 38 training courses (number of valid responses 582), 72% of participants reached the target.
	1-2: More than 80% of trainee is satisfied with the training courses and management system.	Achieved. According to the post-training questionnaire with 38 training courses (number of valid responses 589), 93% of participants were satisfied with the training.
Project Purpose 2 The farmers who have participated in the Project activities at the Pilot Sites are able to practice water management in terminal canals.	2-1: No less than 9 water user groups are active in water management.	Achieved. Before completion, 10 FWUG in total in each pilot site had started water management. FWUG play a role in the actual O&M of irrigation systems. Activities such as the formulation of canal O&M plans, and channel excavation were initiated by group leaders and local authorities.
	2-2: No less than 360 farmers start the water management works learned at the Project.	Achieved. At completion, 461 farmers were participating in water management work at the pilot sites. At the pilot sites, canal cleanup activities and repair work (weeding of tertiary and distribution canals, mud removal and watercourse repair) were conducted. In Kandal Stung, water distribution rules were agreed with the participation of farmers. In Pursat, farmers drew a water resource map ¹³

(2) Achievement of Project Purpose (TSC3)

During the implementation of the project, targets were not set for the TSC3 project purpose indicators. For the purpose of the ex-post evaluation, the targets were retroactively set, based on the similar indicators of TSC2 and the amount of cooperation, and the assessment was carried out working against those.¹⁴ As described in the following table, the design and implementation of the irrigation projects at model sites, the length of the extension of terminal canals and the number of engineers and technicians who received training at TSC all reached their targets. Effects were also observed to a certain extent in terms of the number of FWUG created and the number of their activities. Thus, TSC3 largely achieved its project purpose.



Workshop
(provided by the implementing agency)

¹³ A map that identifies water flow, risk points for flood and drought, and points with noticeable soil erosion.

¹⁴ In concrete terms, the targets of similar indicators set for TSC2 were multiplied by the increase rate of the amount of cooperation (2.34 times, TSC2: JPY 351 million, TSC3: JPY 822 million)

Table 8: Achievement of Project Purpose (TSC3)

Project Purpose	Indicator	Actual
Project Purpose Irrigation projects are properly planned, implemented, and operated in the target area of the Project.	1-1: Number of the newly formulated irrigation projects in the target area, which are planned and designed based on the water supply circulation.	Achieved. Before the end of the project, irrigation projects were designed and implemented at model sites in 8 areas. Based on the target set for TSC2 (basic design formulated at 3 sites), the target for TSC3 would have been 7.
	1-2: Total length of rehabilitated irrigation canal of the project	Achieved. Before the end of the project, a total canal of 144,535m (of which 11,137m was secondary canal and 133,398m was tertiary and distribution canals) had been developed. Based on the target set for TSC2 (5km of terminal canal developed), the target for TSC3 would have been 11.7km.
	2: Number of PDWRAM engineers and technicians who obtained appropriate operation skills through TSC training, and Number of PDWRAM engineers and technicians who conducted any activities in the target areas of the project after training.	Achieved. Before the end of the project, 1,305 engineers and technicians received training at TSC. Before the terminal evaluation, 39 PDWRAM engineers and technicians carried out activities related to this project (rehabilitation work, O&M workshops, etc.). Based on the target set for TSC2 (520 and technicians trained at TSC), the target for TSC3 would have been to train 1,217 engineers and technicians.
	3: Number of farmers group (water user committee and so on) for maintenance are newly established, and periodical O&M activities.	Partially achieved. Before the end of the project, 9 FWUG were set up at 3 model sites. O&M activities carried out by farmers' organizations before the end of the project totaled 17. As there was no similar indicator in TSC2, the achievement level was concluded to be fair.

3.2.2 Impact

The model project sites of TSC3 include model sites and pilot sites of TSC2. The indicators of the overall goals of TSC3 were set exclusively for the areas focused on by the project. It is considered that these indicators demonstrate the project effects more directly than those of TSC2 which targeted the whole of Cambodia. The overall goals of TSC2 and TSC3 were each assessed first, but, for the reasons given above, the achievement level of the overall goals of TSC3 was given more weight in the final evaluation conclusion.

3.2.2.1 Achievement of Overall Goal

(1) Achievement of Overall Goal (TSC2)

The irrigated field area and unit yield of rice in Cambodia as a whole were set as indicators of the overall goal of TSC2. As indicated in Tables 9 and 10 below, the target was met for the year after project completion. Irrigated areas continued to increase after project completion. The unit yield of rice is maintained above 3.0t/ha, which is above the target. Thus, TSC2 has achieved its overall goal. It is expected that the effects of the project will influence the whole country as the TSC training targeted PDWRAM staff in the country as a whole. It is assumed, however, that external factors influence the fluctuation of indicators as the project was conducted mainly in 3 provinces by utilizing model sites and pilot sites in. According to data

collected from the implementing agency, the unit yield in the project target provinces (average of Kandal, Takéo, and Pursat) improved from 2.96t/ha at the outset of the project (2005/2006) to 3.59t/ha (2015/2016) after project completion.

Table 9: Achievement of Overall Goal (TSC2)

Overall Goal	Indicator	Actual
Overall Goal Livelihood of the farmer's households is improved by stabilizing their agricultural productivity through efficient water resource management in the irrigation areas conducted by the trained engineers and technicians in MOWRAM and PDWRAM.	1: Irrigated area is increased to 810,300ha in 2010 as indicated as a target of the National Strategic Development Plan 2006-2010	Achieved. The area of irrigated fields at the national level in 2010 was 906,038ha, which reached the target. The irrigated field area has since continued to increase (see Table 10)
	2: Unit yield of rice is improved to 2.50t/ha in 2010 as indicated as a target of the National Strategic Development Plan 2006-2010.	Achieved. According to agricultural statistics, the unit yield of rice (national average) was 3.0t/ha in 2010, 3.2t/ha in 2011, 3.1t/ha 2012 and 3.2t/ha in 2013. ¹⁵ According to data collected from the implementing agency, national average for the 2015/2016 season also reached 3.1t/ha.

Table 10: Irrigated Area in Cambodia

Year	Irrigated Area (ha)	Year	Irrigated Area (ha)
1998	408,000	2008	815,855
1999	413,963	2009	838,338
2000	429,486	2010	906,038
2001	485,870	2011	944,834
2002	510,030	2012	1,014,590
2003	561,149	2013	1,077,416
2004	587,397	2014	1,148,893
2005	629,191	2015	1,230,348
2006	711,371	2016	1,285,561
2007	762,487	2017	1,320,409

Source: Answers for the questionnaire to the implementing agency

(2) Achievement of Overall Goal (TSC3)

The unit yield of rice at the model sites and the field areas where appropriate irrigation had been made possible were set as indicators for the overall goal of TSC3. The target for the unit yield of rice (3.0t/ha) set during the project period had been achieved by the end of the project. The results of the quantitative survey (a summary of which appears in “Column: Quantitative Survey” later in this report) demonstrated, as indicated in Table 12, that there had been no significant change in the unit yield at the time of the ex-post evaluation. The indicator still exceeds the above-mentioned target. The field area where appropriate irrigation had been made possible (cultivated area where rice is planted once or more per year) also increased as some model sites continued irrigation development after project completion (see the table below).

¹⁵ National Institute of Statistics (2013) “Statistical Year Book 2013”

Interviews with farmers at the model sites¹⁶ revealed that agriculture extension services from local offices of the Ministry of Agriculture, Forestry and Fisheries,¹⁷ NGO, and the JICA technical cooperation project “Agricultural Productivity Promotion Project in West Tonle Sap” helped many farmers to introduce high yield varieties and double cropping. As for qualitative changes, it was found that the use of pumps decreased in general after project implementation, and, in turn, fuel costs also showed a declining trend. Before the project, farmers frequently used pumps to draw water from water sources such as ponds and wells. In areas with insufficient water outside the model sites, no change in this aspect has been observed and pumps continue to be in use. At the model sites, there is less need to draw water during water shortage seasons thanks to the irrigation system development. The cost of fuel for pump operation is decreasing accordingly. The unit yield of rice and the irrigated field area both suggest stability of agricultural productivity. Thus, TSC3 has achieved its overall goal.

Table 11: Achievement of Overall Goal (TSC3)

Overall Goal	Indicator	Actual
Overall Goal Agricultural productivity in the target area is stabilized through efficient water resources management realized by improved technical capacity of MOWRAM and PDWRAM in agricultural river basin management and development.	1: Unit yield of rice and other crops in the target area of the project is improved to reach the national target.	Achieved. The unit yield of rice at the outset of the project (2009) was 2.74t/ha (model site average) against the national-level target of 3.0t/ha. The unit yield of rice at the end line survey ¹⁸ in 2012 at 11 model sites was 3.24t/ha (average among respondents). The quantitative survey of the ex-post evaluation in 2017 revealed the unit yield of rice as 3.11t/ha (average among respondents), which more or less maintains the 2012 level (see Table 12). In the quantitative survey, a slight decrease in the land area under cultivation can be accounted for by : (a) decrease in water quantity in Damnak Ampil and Lum Hach due to construction work on other projects, ¹⁹ (b) reporting of the situation in non-project land by some farmers in their responses to the end line survey, and (c) beneficiary farmers who passed down their land to their heirs as gifts while they are still alive due to old age, etc.
	2: Irrigated field area is increased due to the efficient water utilization and distribution in the target area of the project (including double cropping and triple cropping)	Achieved. At the completion of TSC3 (2014), the total field area with appropriate irrigation at 8 model sites where construction works were conducted was 3307ha (of which 349ha was good for double cropping, and 12ha good for triple cropping). According to data collected from the implementing agency, the total field area with appropriate irrigation at 8 model sites as of 2017 had increased to 3,958ha (of which 960ha was good for double cropping and 400ha good for triple cropping.) As Kandal Stung accounts for the majority of the increase in the irrigated fields, continuous irrigation development in the said site can be considered as the main reason for the increase in land area. Securing an adequate amount of water is an important factor in continuously improving the rice productivity. The expansion of the irrigated field area indicates that this requirement is being met at the model sites.

¹⁶ A qualitative survey (13 beneficiary farmers, 6 beneficiary/non-beneficiary famers who have land under cultivation both in and out of the model sites, 8 non-beneficiary farmers. Of 27 interviewees, 19 were men and 8 were women) was conducted at the model sites of TSC3 (Kandal Stung, Thlear Maom, Damnak Ampil, and Roleang Chrey).

¹⁷ MOWRAM is not in charge of agriculture extension services.

¹⁸ Data collection for the end line survey was conducted in 11 model sites of TSC3 in late 2013. As a part of data collection, a questionnaire survey was carried out with PDWRAM, FWUC/FWUG, and beneficiary farmers.

¹⁹ At the time of the ex-post evaluation, the implementing agency was planning remedial works at these two sites.

Table 12: Rice Production in the Model Sites (quantitative survey results)

	2012 Production (t)	2017 Production (t)	Difference (t)	2012 Cultivated area (ha)	2017 Cultivated area (ha)	Difference (ha)	2012 Unit yield (t/ha)	2017 Unit yield (t/ha)	Difference (t/ha)
Valid Response	124	110	-14	124	110	-14	124	110	-14
Average	7.60	6.88	-0.72	2.39	2.18	-0.21	3.24	3.11	-0.13
Standard deviation	9.44	11.81	2.37	2.47	3.51	1.04	1.23	1.13	-0.10
Median	4.27	3.65	-0.62	1.5	1.2	-0.30	3.43	3.14	-0.29

Source: The quantitative survey in this ex-post evaluation

[Column] Quantitative Survey

(1) Outline of survey

The ex-post evaluation conducted a follow-up study to the end-line survey as a quantitative survey. The survey aimed at assessment of the project effects after project completion. The outline of the survey is as follows:

Study population: beneficiary farmers in the model sites of TSC3 (11 locations in six provinces)

Target households: households in the end-line survey (130 households)

Data collection period: December 25, 2017 – January 9, 2018

Data collection method: Questionnaire survey (face-to-face questionnaire)

Dropout rate: 11.5% (15 dropout households ÷ 130 households in the end-line survey)

Main questions: Questions related to cultivated area, production amount, household expenditure by item, changes in household incomes, etc.

(2) Analytical method and survey result

Statistical tests to compare two independent samples were conducted in order to assess differences between the end line survey and the quantitative survey of the ex-post evaluation. Type of statistical tests were selected in consideration of a) difficulties in precisely pairing samples in both surveys using respondents' names and b) the distribution of data to be tested. The tests show that there was no change in rice production but that there were some changes in household spending (see the table below). Given the results of descriptive statistics, it is suggested that household expenditure increased after project completion (see Table 15).

Data	Type of test	Significance level	Difference
Production amount of rice	Brunner-Munzel Test (two-tailed)	5%	No
Cultivated area of rice	Brunner-Munzel Test (two-tailed)	5%	No
Unit yield of rice	Welch's t-test for 2 independent samples (two-tailed)	5%	No
Household healthcare expenditure	Brunner-Munzel Test (two-tailed)	5%	Yes
Household educational expenditure	Brunner-Munzel Test (two-tailed)	5%	No
Total household expenditure	Brunner-Munzel Test (two-tailed)	5%	Yes

(3) Notes

- The cultivated areas in the end line survey contain not only the areas within the model sites in the quantitative survey but also the areas cultivated by beneficiary farmers outside the model sites. Therefore, the cultivated areas of rice in the end line survey tend to be larger than those in the current quantitative survey.
- The target households were selected in the baseline survey²⁰ and the sampling was conducted with consideration of bias regarding in the size of a farm. Nevertheless, it was

²⁰ The baseline survey collected data from beneficiary farmers at 11 model sites of TSC3 in 2010.

not confirmed that random sampling was carried out rigorously. Thus, over/underestimation of the differences between the two groups cannot be ruled out.

- Due to the above limitations, the test results are considered to be merely one part of the evidence. The judgment made reflected other information such as descriptive statistics of this quantitative survey and the answers to the questionnaire of the implementing agency.

(3) Realization of Project Outputs and Project Purpose

- The current situation of the training conducted by TSC

TSC continued with training activities after the completion of TSC3. As shown in the following table, this training holistically covers the life cycle of irrigation systems (from planning to O&M). TSC training provides implementing agency staff with the opportunity to acquire practical knowledge in a short period of time. At the time of the ex-post evaluation, technical manuals made during the project were being utilized as training materials. The implementing agency also said that all training materials were available in Khmer except for the GIS related lectures where the translation of technical terms had proved difficult.

Table 13: The Situation of Training Given by TSC at the Time of Ex-post Evaluation

Training contents	2015*	2016*	2017*
Crop water requirement	1		
Construction management and supervision	1		
Design and drawing for irrigation canals and canal structure	1		
O&M of irrigation facilities	1	1	
Basics of topographic and route surveys		1	
Participation of farmers in sustainable irrigation system management		1	1
Irrigation planning by GIS		1	
Basic administration of FWUC committees		1	1
Enhancement of agricultural extension services with rice cultivation technology			1
Data collection methodology for agricultural river basin management using remote sensing.			1
FWUC strengthening at model sites			8
Total	4	5	12

Source: MOWRAM

Note: *The data was collected between April and the following March.

PDWRAM staff trained by TSC are involved in the formulation of irrigation projects and continue to coach FWUC/FWUG (for O&M, group management and the collection of irrigation service fees) at the model sites in which TSC3 conducted rehabilitation works. Interviews with PDWRAM staff revealed that the surveying techniques and map drawing techniques were used for rehabilitation work and O&M planning. Knowledge about participatory irrigation management seemed to be used more frequently in assisting farmers.

- Project formulation for Grant Aid for Grassroots Human Security

Of 6 provinces supported by TSC3, the PDWRAM of 4 provinces are formulating project plans to apply for Grant Assistance for Grassroots Human Security Projects, which Ministry of Foreign Affairs of Japan supports. Plans formulated by PDWRAM will be reviewed by TSC. TSC also supports the revision of plans where necessary. Of all projects formulated by PDWRAM in the target provinces since 2015, 5 projects from 3 provinces were approved (see the following table). This proves that the implementing agency has acquired the ability to formulate irrigation project plans autonomously and with the appropriate quality. Sustainable improvement in agricultural productivity via the formulation of these irrigation projects can be expected. Interviews with PDWRAM staff revealed that capacities acquired during the project is being used in the formulation of the irrigation project plans. It was also reported that knowledge of GIS in particular was very effective.

Table 14: Approval of Grant Aid for Grassroots Human Security in the Target Provinces

Province	2015	2016	2017
Battambang	1 project		
Pursat	1 project	1 project	1 project
Kampong Chhnang			1 project

Source: Answers for the questionnaire to the implementing agency

3.2.2.2 Other Positive and Negative Impacts

(1) Impact on natural environment

The project carried out infrastructure development for irrigation. The construction work involved mainly small-scale rehabilitation of existing infrastructure (irrigation canals, dam dykes). No negative impact on the natural environment was observed through the interviews with the implementing agency or during the site surveys at 4 model sites.²¹



Terminal canal rehabilitated by this Project

(2) Resettlement and Land Acquisition

According to the responses to the questionnaire filled out by the implementing agency, there was no resettlement of residents or land acquisition in this project. No complaint was reported regarding resettlement or land acquisition during the field surveys at the 4 model sites or in the

²¹ In this ex-post evaluation, the irrigation facilities rehabilitated by this project were inspected at four sites (Kandal Stung, Thlear Maom, Damnak Ampil, and Roleang Chrey).

interviews with residents. It is considered, therefore, that there was no negative impact deriving from relocation or land acquisition.

(3) Livelihood changes among beneficiary farmers

In the quantitative survey, data on household expenditure was collected in order to define the changes in farmers' livelihoods after project completion (see Table 15). Total household expenditure (Riel-base, adjusted for inflation) increased in both average and median terms between 2012 and 2017. The quantitative survey also collected opinions on changes in agricultural and non-agricultural income after project completion, and a majority reported an increase in both (see Table 16). According to beneficiary farmers of Roleang Chrey, their expenditures could have remained the same or increased very little if their agricultural incomes had not increased. Health-related expenditure saw a significant increase between 2012 and 2017, while education-related expenditure decreased somewhat in the same period. According to interviews with the beneficiary farmers, education-related expenditure tends to fluctuate according to the number and age of children. It is considered, in other words, that it is largely influenced by factors other than income.

Table 15: Household expenditure in the model sites (quantitative survey results)

	2012 Health expenditure (Riel)	2017 Health expenditure (Riel)	Difference	2012 Education expenditure (Riel)	2017 Education expenditure (Riel)	Difference	2012 Total expenditure (Riel)	2017 Total expenditure (Riel)	Difference
Valid Response	130	115	-15	130	115	-15	129	115	-14
Average	557,669	1,277,193	719,524	1,189,938	1,166,244	-23,694	12,345,033	15,795,793	3,450,760
Standard deviation	1,048,658	2,798,995	1,750,337	1,741,635	1,596,370	-145,264	7,995,961	9,246,845	1,250,885
Median	275,000	436,600	161,600	697,500	611,241	-86,259	9,966,000	13,401,788	3,435,788

Source: The quantitative survey in this ex-post evaluation

Table 16: Change in income after project completion (quantitative survey results)

Answer	Agricultural Income		Non-Agricultural Income	
	Responses	%	Responses	%
Increased	42	36.5%	21	18.6%
Moderately increased	51	44.3%	75	66.4%
Same	13	11.3%	14	12.4%
Moderately decreased	7	6.1%	3	2.7%
Decreased	2	1.7%	0	0.0%
Total	115	100.0%	113	100.0%

Source: The quantitative survey in this ex-post evaluation

This project has largely achieved the project purpose of improving the technical capacity of employees in the implementing agency and the capacity of farmers for the O&M of irrigation canals, and the overall goal in terms of improvement and stability in agricultural production at the model sites. Therefore, effectiveness and impact of the project are high.

3.3 Efficiency (Rating: ②)

Actual project expenditure differed greatly between TSC2 and TSC3. Both also faced different types of problems during their respective implementation. With this in mind, assessment was carried out for each phase, in order to present the efficiency of each project.

3.3.1 Inputs

Plan and actual inputs of the project are shown in the following table.

Table 17: Inputs of TSC2 (Plan and Actual)

Inputs	Plan	Actual (at the Project Completion)
(1) Experts	3 Long-term (No target indicated for M/M) Short-term as necessary in 6 areas (15 M/M per year)	4 Long-Term (111 M/M) 14 Short-Term (35 M/M)
(2) Trainees received	No target indicated for the number of trainees	12 persons
(3) Equipment	Survey equipment (total stations, reflectors, levels drawing tables), training equipment, etc.	Office equipment, vehicles, equipment for design, survey, monitoring of water gates, construction, etc.
(4) Third Country Training	No target indicated for the number of trainees	3 persons
(5) Local Costs	JPY 55 million	JPY 97 million
Japanese Side Total Project Cost	Total JPY 360 million	Total JPY 351 million
Cambodian Side Total Project Cost	No target indicated	Total JPY 24 million (Local cost charge)

Source: the ex-ante evaluation sheet of TSC2, preparatory study report of TSC2, and project completion report of TSC2

Table 18: Inputs of TSC3 (Plan and Actual)

Inputs	Plan	Actual (at the Project Completion)
(1) Experts	3 Long-term (No target indicated for M/M) Short-term as necessary in 7 areas (No target indicated for M/M)	6 Long-Term (181 M/M) 26 Short-Term (65 M/M)
(2) Trainees received	No target indicated for the number of trainees	33 persons
(3) Equipment	Vehicles, equipment for surveys and experiments, office and training equipment	Office equipment, vehicles, construction machinery (including heavy machinery), survey equipment
(4) Third Country Training	No target indicated for the number of trainees	7 persons
(5) Local Costs	JPY 70 million	JPY 265 million
Japanese Side Total Project Cost	Total JPY 370 million	Total JPY 822 million
Cambodian Side Total Project Cost	No target indicated	Total JPY 69 million (local cost charge)

Source: The ex-ante evaluation sheet of TSC3, preparatory study report of TSC3, and project completion report of TSC3

3.3.1.1 Elements of Inputs

(1) TSC2

Japanese side: A comparison of the planned and actual inputs demonstrated that the dispatch of short-term experts was shortened, while the local cost charge absorbed by Japan increased.

These differences resulted from the inclusion in the project scope of canal development in pilot sites. During implementation, the target of the OJT training by TSC2 was expanded from model sites to pilot sites. Based on this development, the decision was made to include the canal development of the pilot sites in the project scope as terminal canal development was deemed effective for OJT.

Cambodian side: Inputs were made by the implementing agency by way of the assignment of 50 counterparts in total, the provision of project office and related equipment, and the absorption of local costs (labor costs, office expenses, facility maintenance costs, etc.)

(2) TSC3

Japanese side: A comparison of the planned and actual inputs demonstrated that the local costs absorbed by the Japanese side increased as construction equipment, including heavy machines, was later added to the items for equipment provision. At the planning phase, the securing of funds by Cambodia for the irrigation project in the project target areas was placed as an external factor: It was assumed that canal development in the model sites would be covered by the ODA loan project, the “West Tonle Sap Irrigation Rehabilitation Project” (Loan agreement signed in 2011. Under implementation as of the ex-post evaluation). There was a delay, however, in the said ODA loan project, and this project was forced to add to its scope irrigation infrastructure development in 8 model sites that was not in the original plan. The training of PDWRAM and farmers was not sufficient in itself for the realization of the project effects that were assumed by the overall goal of the project (increase of unit yield of rice in model sites and an expansion in the area of irrigated fields). The development of irrigation infrastructure was necessary. Due to non-negligible constraints for project implementation (budget, project period, implementing agency staff), however, some rehabilitation work was foregone in provinces that had multiple model sites. In three such model sites where the repair work was not conducted under the project, irrigation infrastructure is still not fully developed. However, it is inferred that there would have been a higher chance of impediment in the realization of project effects if TSC3 had not expanded its project scope. The additional expenditure, therefore, is considered to have been appropriate.

Cambodian side: Inputs were made by the implementing agency in terms of the assignment of 16 counterparts in total, the provision of project office and related equipment, and the absorption of local costs (project activity costs).

3.3.1.2 Project Cost

(1) TSC2

The actual project cost on the Japan side (amount of cooperation) was JPY 351 million against a planned cost of JPY 360 million (98% of the plan). This was within the original plan. The reason why the actual total project cost was slightly below the planned cost is considered to have been because the increase in local costs absorbed by the Japan side was balanced out by the decrease in the dispatch period of short-term experts.

(2) TSC3

As mentioned before, irrigation infrastructure development components that were not in the original plan were later added to the project scope. Adding the direct costs of irrigation infrastructure development work (specifically, JPY 130 million for construction work at model sites and an increase of JYP 78 million for equipment provision) to the original planned amount (JPY 370 million), the planned project cost for the Japan side (amount of cooperation) totals JPY 578 million.

Compared with the planned amount after adjustment, the actual project cost was JPY 822 million (142% of the planned amount), which exceeded the plan. This increase in project cost that exceeded the plan was mainly due to the increase of short-term experts. The reasons for the latter are: (a) the project coverage of TSC3 encompassed diverse aspects from water source development to terminal cultivated land management, and (b) guidance was required for restoration work after the flood disaster of 2011.

3.3.1.3 Project Period

(1) TSC2

For TSC2, the actual and planned project periods were 3 years and 7 months²² (100% of the planned period) as planned. The opinion of the implementing agency is that the timing of the dispatch of experts was mostly appropriate.

(2) TSC3

For TSC3, the actual and planned project periods were 5 years (100% of the planned period) as planned. The opinion of the implementing agency is that the timing of the dispatch of experts was mostly appropriate.

While the project period remained within the plan, the project cost exceeded the plan. Therefore, efficiency of the project is fair.

²² The ex-ante evaluation defined the project period as 3 years and 6 months. However, the Agreement with the Cambodian government specified the period between January 10, 2006 and July 9, 2009. The judgement was based on the period in the Agreement.

3.4 Sustainability (Rating: ②)

As mentioned before, there was a continuity between TSC2 and TSC3 in terms of project purpose and activities. Since the assessment items overlap, the assessment data available at the time of the ex-post evaluation was used and analyzed to assess both phases integrally.

3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

This project aimed at capacity building of the implementing agency for the management of irrigation systems and basin irrigation. It also aimed at the securing of O&M capacity for irrigation systems on the part of irrigation associations. There was no renewal of the country's development policy between project completion and the ex-post evaluation, and therefore no change in the policy landscape. In terms of legislation, sub-decrees regarding FWUC/FWUG and river basin management were passed respectively in 2015 in relation to the *Law on Water Resource Management* (formulated in 2007). The sub-decree on organizations for irrigation management defined the structure of FWUC committees, their roles, authority and management procedures, while the sub-decree on river basin management set out the structure of river basin management committees, their roles and concrete actions.

At the time of the ex-post evaluation, as mentioned above ("3.1.1 Consistency with the Development Plan of Cambodia), the policy prioritized effective O&M of irrigation systems. It further recognized improvement in the management of irrigation associations and the reinforcement of irrigation infrastructure management as policy challenges. The capacity building tackled in this project was necessary for the implementation of this policy and, as such, it is expected that there will be continuous government efforts in this field. The content of the sub-decree, on the other hand, suggests that there will be further legislation to delineate FWUC activities and river basin management. Based on the developmental policy and the contents of laws and regulations, it is considered that a conducive policy landscape has been secured for the sustainment of the project effects.

3.4.2 Institutional / Organizational Aspect for the Sustainability of Project Effects

For the implementing agency to sustain the capacity related to irrigation systems or river basin management, it is necessary that it, and especially that TSC responsible for training, secures the appropriate organizational environment. For the sustainment of the irrigated field area and the unit yield of rice at model sites, it is a prerequisite to have FWUC/FWUG function and to have irrigation canals appropriately managed. As mentioned above, FWUC make decisions on issues affecting the whole organization such as water distribution and irrigation service fee collection, while FWUG take on the actual O&M work for terminal canals.

The responsibilities for the O&M of irrigation infrastructure at the time of the ex-post evaluation were shared, in principle, as follows: (a) MOWRAM headquarters manages from the

water source of large and medium scale irrigation infrastructure (200 ha and above) to the secondary canals, (b) PDWRAM manages from the water source of small scale irrigation infrastructure (below 200ha) to the secondary canals, and (c) FWUC/FWUG manage tertiary and distribution canals.

At the planning phase of TSC2, TSC was a temporary unit created for the implementation of the project. By the project completion of TSC3, however, it had become an official department of the implementing agency. At the time of the ex-post evaluation, there had been no change in the organizational status of TSC. As described in the table below, the number of MOWRAM employees has remained stable since 2015, while that of TSC has increased. In the interviews with the implementing agency, it was reported that the personnel required to continue TSC training had been secured.

Table 19: Number of Staff in the Implementing Agency

	2015	2016	2017
MOWRAM	709 staff	843 staff	848 staff
in TSC*	35 staff	44 staff	43 staff
in PDWRAM	579 staff	553 staff	572 staff

Source: Answers from the questionnaire with the implementing agency

Note: *Including the staff in other departments serving as a lecturer

According to the explanation of the implementing agency, FWUC had been set up in all model sites by the time of the ex-post evaluation. During the site survey (at 4 model sites), it was also confirmed that each site had FWUC. At one site, there were regular FWUC meetings to make decisions on important issues (the approval and collection of irrigation service fees, canal cleaning, water distribution, etc.). At two sites, there were regular FWUC meetings, but the attendance of FWUC committee members was poor, which made decision making on important issues difficult. At one site, FWUC meetings were not held. According to the interviews with PDWRAM staff and beneficiary farmers, the changes of FWUC committee members whose attendance are poor does not take place as per procedure, and due to this difficulty, decision making on important issues tends to be prolonged. In cases where the arrangement of water distribution becomes disputed within FWUC, PDWRAM supports the reconciliation of differences among farmers. Some canal cleaning is planned by FWUC, but farmers' self-help efforts cover the majority of the cleanings of tertiary and distribution canals as well as small scale repair work. In the interviews with beneficiary farmers, it was reported that some repair work, for example on intake gates, was difficult for farmers to carry out by themselves.

The organizational system of TSC was put in place to sustain training within the implementing agency. On the other hand, FWUC are not very active in irrigation canal management and O&M and PDWRAM sometimes has to guide the water distribution arrangements. O&M work that is too difficult for farmers to do by themselves is also a challenge.

3.4.3 Technical Aspect for the Sustainability of Project Effects

In order that implementing agency staff and beneficiary farmers can sustain the skills obtained during the project, it is important that they have the opportunity to use their knowledge continuously, and that training and other support continue to be provided. The situation of the implementing agency staff and beneficiary farmers at the time of the ex-post evaluation is described below.

TSC staff: TSC staff enjoy an environment in which they carry out training based on the documents made in this project, while also maintaining their skill level through actual work (see Table 13). In an interview with TSC staff, it was pointed out that while they could maintain their skill levels through receiving lectures, the opportunities to gain new knowledge were dependent on the availability of donor support. There has been no issue in technical transfer, by the way, as there has been little staff change at TSC since the project.

MOWRAM headquarters and PDWRAM staff: As stated before, the training given by TSC encompasses irrigation planning to O&M. As such, opportunities are available for staff to learn a wide range of irrigation related skills in a continuous manner. In an interview with PDWRAM staff, it was reported that GIS skills, etc. are continually being used for the design of new irrigation systems and the formulation of operation and maintenance plans.

Beneficiary farmers: Of the total length of tertiary and distribution canals improved under TSC3, 90% was completed with the participation of farmers. It is considered, therefore, they have the technical capacity to conduct the O&M of tertiary and distribution canals. It was confirmed in the interviews with beneficiary farmers that they were engaged in O&M work (cleaning, small-scale repair work) themselves as and when necessary. During the project implementation, training was given to FWUC committee members regarding canal management, but TSC continues with training to reinforce FWUC/FWUG at model sites.

As the project provided a variety of machinery, during the ex-post evaluation, physical inspections of expensive equipment (unit price above USD 10,000) were conducted to discern whether or not there were mechanical problems. The result of the inspections is as follows.

Survey equipment: It was confirmed in the site field survey (TSC and PDWRAM in 3 provinces) that total stations²³ were used for training purposes at TSC and for the formulation of irrigation system plans at 2 PDWRAM. They can be repaired at the mechanical service center in Phnom Penh.

²³ Survey equipment that measures different topographical data such as distance, angles etc. simultaneously

Construction machinery/vehicles: The implementing agency explained that they knew the current location of construction machinery and vehicles provided by the project, and that the construction machinery was being used for construction work on other projects. There has been no problem finding spare parts or conducting maintenance for the construction machinery and vehicles provided by the project.



Total station

Considering the training activities carried out by TSC during and after the completion of the project, the actual work carried out by PDWRAM, and the repair work of farmers during the project, it is concluded that the necessary skills for O&M were obtained during the project, and that a favorable environment for the maintenance of technical capacity has been obtained.

3.4.4 Financial Aspect for the Sustainability of Project Effects

The requisite for the implementing agency to sustain capacity obtained in the irrigation sector is to secure by themselves a budget for the continuation of activities; especially for training at TSC. Furthermore, to sustain the irrigated field areas and the unit yield of rice at model sites, it is necessary to collect irrigation service fees from beneficiary farmers and for these to be allocated for maintenance costs.

The government budget allocated to the implementing agency has been stable since the completion of the project (see the table below). The budget allocation to TSC is on the rise and the budget for training activities is regularly secured. In addition, since 2015, some budget has been allocated to support FWUC/FWUG and for the O&M of canals. This suggests that budget is provided for activities that are not directly related to infrastructure investment.

Table 20: Government Budget for the Implementing Agency

Unit: US Dollar

	2014	2015	2016	2017
Rehabilitation and construction of irrigation systems	35million	33million	34million	41million
Establishment and strengthening of FWUC	0	1.6million	2.4million	1.4million
O&M of irrigation infrastructure	0	8.0million	9.0million	12.8million
Budget of TSC	50,000	62,500	75,000	87,500

Source: Answers for the questionnaire to the implementing agency

When verification took place with PDWRAM staff and FWUC committee members at 8 sites where the canal construction took place, it was found that irrigation service fees were collected at only two sites, Thomney and Roleang Chrey. Interviews with PDWRAM staff and FWUC

committee members revealed some of the reasons for the difficulties in fee collection: (a) Water supply is limited due to the lack of water during the dry season, (b) Farmers downstream who are affected by water shortages most severely, are not satisfied with the amount of water supply, (c) Beneficiary farmers refuse to pay the fee as other farmers use water without paying, and (d) Irrigation service fees cannot be decided as FWUC committee members do not attend meetings due to second jobs and seasonal migration. As the sub-decree on organizations for irrigation management does not have a clause on punishment for non-payment of irrigation service fees, it can be inferred that it is difficult to make FWUC enforce the collection of irrigation service fees. It was also said that the O&M work that requires a budget (application of lubricant oil to intake gates, for example) was impeded as fees were not collected.

Regarding TSC, its organizational budget is on the increase, and this situation allows TSC to continue capacity building in the irrigation sector. The budget for the O&M of irrigation canals is also being increased. More than half the model sites, however, have not been able to collect irrigation service fees. Therefore, it is considered that the rehabilitation of irrigation systems that requires a budget will be problematic in the medium and long term.

Some minor problems have been observed in terms of the organizational and the financial aspects. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed at promoting water management and securing agricultural productivity in and around the project sites in 6 provinces through capacity building of the implementing agency and irrigation associations. In Cambodia where the rice crop occupies 80% to 90% of the land area under cultivation, the purpose of this project was consistent with the country's policy and developmental needs which prioritized the development, maintenance and improvement of irrigation systems as well as the improvement of agricultural productivity. The project purpose was also consistent with Japan's aid policy, and therefore the relevance of this project is high. Before completion of the project, the implementing agency staff improved their capacity for irrigation system development and management as well as for extended irrigation management. Beneficiary farmers were organized, and their capacity for water management was reinforced. After project completion, TSC has continued to promote capacity building of implementing agency staff through training. PDWRAM, on the other hand, is maximizing its knowledge of the planning and designing of irrigation systems in order to apply for Japan's Grant Assistance for Grassroots Human Security Projects. At the time of the ex-post evaluation, the unit yield of rice among the beneficiary farmers at project sites was well maintained. The increase in agricultural income is contributing to improvements in farmers' livelihoods in general. As the realization of

project effects can be confirmed, it is concluded that the effectiveness and impact of this project are high. The actual project period was in accordance with the original plan. The project cost, however, exceeded the original plan, mainly due to the increase in the dispatch of experts. Efficiency, therefore, is fair. There was no indication of significant problems that would affect the sustainability in terms of policies and techniques. From the organizational and financial aspects, the activities of FWUC were not always successful and some FWUC faced difficulties in the collection of irrigation service fees. For these reasons, the sustainability of the project effects is concluded to be fair.

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

4.2 Recommendations

4.2.1 Recommendations to the implementing agency

- Support for FWUC management

One of the reasons behind the difficulty in collecting irrigation fees at model sites is the inadequate functioning of FWUC, which hampers decision making on irrigation service fees. PDWRAM at model sites in 6 provinces should take following measures immediately for the resolution of this issue: (a) Send reminders to FWUC committee members who are frequently absent, or change members as required. (b) Support the proceedings of the meetings. (c) Monitor the decisions made by the committees. It is also recommended that the MOWRAM headquarters continue to supervise the improvement of FWUC committee management supported by PDWRAM.

- Remedial works and monitoring of water quantity

After the completion of the project, Damnak Ampil and Lum Hach faced a decrease in the quantity of irrigation water due to construction work on other irrigation infrastructure development projects. The unit yield of rice has been declining as a result. It is planned that remedial works are implemented in the future. To ensure the actual implementation of construction and the recovery of water quantity, it is desirable that the MOWRAM headquarters monitor the impact of construction work of other projects on the above-mentioned model sites.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Partnership with other projects and an agency to provide agriculture extension services

A precondition for the introduction of double cropping and new varieties is that the beneficiary farmers deepen their knowledge of advanced agricultural techniques such as variety selection,

fertilization, and pesticide application. While the implementing agency of this project was in charge of infrastructure development for irrigation, the Ministry of Agriculture, Forestry and Fisheries was responsible for agricultural extension services. Interviews with beneficiary farmers at the model sites showed that agriculture extension services provided through the local offices of the Ministry of Agriculture, Forestry and Fisheries, NGOs and JICA's technical cooperation project "Agriculture Productivity Promotion Project in West Tonle Sap" created the momentum for double cropping and the introduction of high-yield varieties. To promote the realization of project effects, it is desirable that coordination be sought with agricultural sector projects by JICA and other donors, and also with government agencies that provide agriculture extension services at both the project formation phase and the project implementation phase of irrigation projects. When an implementing agency for infrastructure development of irrigation is not responsible for agriculture extension services, it is highly recommended to consult and coordinate with other government agencies in charge of agriculture extension services from the project formation phase.

End

Kingdom of Thailand

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project

“Chao Phraya River Crossing Bridge at Nonthaburi 1 Road”

External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

The objectives of this project were to alleviate traffic congestion and to improve transportation efficiency in the Bangkok Metropolitan Area by constructing a bridge crossing the Chao Phraya River at a site in Nonthaburi Province where serious traffic congestion prevailed, thereby contributing to the activation of industries and improvement of the urban environment. The relevance is high, as the objective was consistent with Thailand’s development policies and development needs as well as with Japanese ODA policies. The efficiency of this project is fair, as although the project cost was within the plan, the project period exceeded the plan. The operation and effect indicators of this project, such as an increase in the annual average daily traffic volume, a saving in vehicle operating cost and value of travel time, have attained their target values. An alternative route connecting the west and east sides of Nonthaburi Province over the Chao Phraya River was constructed by this project, and this has alleviated traffic congestion to some extent at peak hours on the adjacent Phra Nang Klao Bridge. This project had a certain effect on the relaxation of traffic congestion and on improvement in transport efficiency. Also, on the west bank of the Chao Phraya River in Nonthaburi Province, this project had a certain positive impact on the promotion of regional development, especially housing development. No negative impact on the natural environment was observed, and land acquisition and resident resettlement were appropriately executed in accordance with the related domestic laws and regulations of Thailand. Therefore, the effectiveness and impact of this project are high. Meanwhile, no problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system, and therefore, the sustainability of the project’s effect is evaluated to be high.

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

1. Project Description



Project Location



Maha Chesadabodindranusorn Bridge
constructed by this project

1.1 Background

In 2008, the Bangkok Metropolitan Area,¹ comprising the Bangkok Metropolitan Administration (BMA) and its five surrounding provinces, accommodated a population of approximately 10.07 million people and was the political and economic center of Thailand. Although the population growth of the entire Bangkok Metropolitan Area had been only around 1.5% in recent years, Nonthaburi Province and Pathum Thani Province surrounding the BMA recorded a population growth of approximately 14% and 26% respectively in the five years from 2003, which indicated a rapid acceleration of suburbanization. Also, the number of registered motor vehicles in the BMA increased by 1.4 times in nine years, from 4.02 million in 1998 to 5.71 million in 2007. As indicated by these figures, along with the economic recovery of Thailand after the Asian Financial Crisis, industrial activity in urban areas was revitalized, and traffic congestion in the Bangkok Metropolitan Area became aggravated owing to a transportation system that heavily relied on automobiles. Moreover, air pollution from motor vehicles was recognized as a problem, and efforts towards reducing the environmental load became a pressing issue.

Nonthaburi Province, the target area of this project, is divided into east and west areas on either side of the Chao Phraya River. Major provincial government agencies, such as the provincial government office, police station and general hospital were located in the east area, and the

¹ The Bangkok Metropolitan Area is composed of the Bangkok Metropolitan Administration (BMA) and its five surrounding provinces (Nonthaburi Province, Samut Prakan Province, Pathum Thani Province, Samut Sakhon Province, and Nakhon Pathom Province).

population density of the east area was higher than that of the west area. While 43% of the provincial population is in the east area, it accounts for 12% of the total land area of Nonthaburi Province. On the other hand, in the west area, there had been rapid development (including past Japanese ODA Loan projects) of an expressway network and a mass transportation network² and further commercial and residential development in the area was expected.

There were three bridges, Phra Nang Klao Bridge,³ the New Phra Nang Klao Bridge, Rama V Bridge⁴ connecting the areas of Nonthaburi Province, but there was the problem of traffic congestion in the mornings and evenings. Especially, in Nonthaburi Province, there was the need for improvement of air pollution through the alleviation of traffic congestion as the maximum concentration of ozone caused by exhaust gas emissions of motor vehicles was 1.75 times that of the environmental standard.

1.2 Project Outline

The objectives of this project were to alleviate traffic congestion and to improve transportation efficiency in the Bangkok Metropolitan Area by constructing a bridge crossing the Chao Phraya River at a site in Nonthaburi Province where serious traffic congestion prevailed, thereby contributing to the activation of industries and improvement of the urban environment.

Loan Approved Amount/ Disbursed Amount	7,307 million yen / 7,306 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	September 28, 2010 / September 28, 2010
Terms and Conditions	Interest Rate 0.95% Repayment Period 20 years (Grace Period 6 years) Conditions for Procurement General Untied
Borrower / Executing Agency	Kingdom of Thailand / Department of Rural Road (DRR), Ministry of Transport
Project Completion	December 2014
Main Contractors	Sumitomo Mitsui Construction Co., Ltd. (Japan) / Italian-Thai Development Public Company Limited (Thailand) (JV)
Main Consultant	—

² The Japanese ODA Loan “Mass Transit System Project in Bangkok (Purple Line) (I) (II)” (Loan Agreement Year: 2008 and 2010)

³ Phra Nang Klao Bridge was constructed by the Japanese ODA Loan “Nonthaburi and Pathumthani Bridges Construction Project” (Loan Agreement Year: 1981)

⁴ Rama V Bridge was constructed by the Japanese ODA Loan “Wat Nakorn-In Bridge and Connecting Road Construction Project (I) (II)” (Loan Agreement Year: 1995 and 1996).

<p>Related Studies (Feasibility Studies, etc.)</p>	<ul style="list-style-type: none"> • Feasibility study on the Chao Phraya River crossing bridges in the Bangkok Metropolitan Area (Thai government, 1995) • Preparatory survey for the Chao Phraya River crossing bridge at Nonthaburi 1 Road construction project (supplemental feasibility study) (JICA, February 2010)
<p>Related Projects</p>	<ul style="list-style-type: none"> • The Project for Bridge Master Plan and Bridge Maintenance Ability in Rural Area (2011-2013) • Dispatch of Advisors for “Chao Phraya River Crossing Bridge at Nonthaburi 1 Road” (May-July 2010)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki (OPMAC Corporation)

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted as follows:

Duration of the Study: August 2017 - August 2018

Duration of the Field Study: November 12 – 25, 2017, March 18 – 24, 2018

2.3 Constraints during the Evaluation Study

This project identified “improvement of the urban environment” as one of its impacts, and based on the descriptions contained in the appraisal documents, it might be seen to have accounted for “improvement of air pollution caused by exhaust gas emissions of motor vehicles in Nonthaburi Province”. In order to measure the improvement effects, it was necessary to collect data on “the maximum concentration of ozone resulting from exhaust gas emissions of motor vehicles in Nonthaburi Province” before and after project implementation. However, it is uncertain whether such data could have been provided by the Ministry of Natural Resources and Environment of the Thai government. Even if data had been available, it would have been very difficult to scientifically prove a causal relationship between the project and any change in the concentration of ozone since various external factors apart from gas emissions might affect the change. Therefore, this ex-post evaluation does not verify the impact on “improvement of the urban environment”.

3. Results of the Evaluation (Overall Rating: A⁵)

3.1 Relevance (Rating: ③⁶)

3.1.1 Consistency with the Development Plan of Thailand

At the time of the appraisal, enhancement of transport and logistics efficiency and environmental protection were raised as one of the objectives of *the 10th National Economic and Social Development Plan (2007-2011)*. The Plan also indicated the necessity for qualitative and quantitative improvement of the transport and logistic network which was a primary element in the improvement of Thailand's production structure for the strengthening of the country's productivity and competitiveness. It included development of the transport network by advancing each mode of transport mode, together with connecting roads, the promotion of effective transportation to reduce production costs, and the development of an efficient transport network between the Bangkok Metropolitan Area and its vicinities.

In addition, in *the Road and Bridge Sector Master Plan (2004)*, this project was positioned as a top priority project for improvement of the transport network connecting areas on both sides of the Chao Phraya River. Moreover, *the Strategic Plan of the Ministry of Transport (2005-2009)* identified the mitigation of traffic congestion in Bangkok and its vicinities, the improvement of the road network for better mobility, and the development of a road network linking to the mass transportation network as important strategic items.

At the time of ex-post evaluation, based on the concept of "Sufficiency Economy Philosophy", *the 12th National Economic and Social Development Plan (2017-2021)* aimed at reducing inequality in income and poverty, strengthening competition, improving the natural environment, enhancing administrative efficiency, and enhancing the social status of Thailand in the international society, setting the country out to become a "high-income country" as defined by the World Bank by 2026. Under the Plan, 10 development strategies were crafted. The 7th strategy, the "Promotion of Infrastructure and Logistics" included the improvement of regional road transportation capacity, that is, bottlenecks of traffic.

Furthermore, in *the Bridge Master Plan 2031* (prepared in 2012), a construction of 10 new bridges is planned in addition to the existing 22 bridges crossing the Chao Phraya River.⁷ In the Plan, the construction of two new bridges was due to be carried out between 2012 and 2016, with one of these bridges being covered by this project. As for the other bridge (Kiret Kang Bridge), although detailed design had already been completed, the commencement of construction works had been suspended as of November 2017 as budgetary approval by National Assembly was delayed. In the Plan, a forecast of traffic movement between the areas on both sides of the Chao Phraya River was conducted, and it was concluded that in the case that the

⁵ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁶ ③: High, ②: Fair, ①: Low

⁷ Plan to build 2 bridges from 2012 to 2016, 8 bridges between 2017 and 2021, and 1 bridge from 2022 to 2031.

construction of the 10 new bridges in the Plan does not progress, the total volume of traffic crossing the Chao Phraya River would continuously increase from 1.75 million PCU⁸/day in 2011 to 2.03 million PCU/day in 2021, and to 2.36 million PCU/day in 2031 (Table 1). Thus, the necessity of fostering transportation capacity of both sides of the Chao Phraya River remains confirmed.

Table 1: Forecast of Traffic Volume crossing the Chao Phraya River

Unit: PCU/day

Item	2011	2021		2031	
	Baseline	Master Plan Not Conducted	Master Plan Conducted	Master Plan Not Conducted	Master Plan Conducted
Traffic Volume	1,775,000	2,032,000	2,273,000	2,361,000	2,614,000

Source: Bridge Master Plan 2031, Ministry of Transport

3.1.2 Consistency with the Development Needs of Thailand

At the time of the appraisal, transportation between the west bank area of Nonthaburi Province and Bangkok city was limited to only the three bridges, Phra Nang Klao Bridge, New Phra Nang Klao Bridge, and Rama V Bridge causing problems of traffic congestion in the mornings and evenings. Also, in the Bangkok Metropolitan Area, a deterioration of air pollution became a serious problem, in particular, with the maximum concentration of ozone caused by exhaust gas emissions of motor vehicles in Nonthaburi Province being 1.75 times that of the environmental standard. This was recognized as an environmental problem. To respond to this situation, in addition to the existing bridges in Nonthaburi Province, there was a need to construct new bridges in order to achieve a relaxation of traffic congestion during the morning and evening peak hours.

At the time of the ex-post evaluation, the population, the gross provincial product (GPP) and the number of registered vehicles in Nonthaburi Province had been in an upward trend (Table 2). Even with the above-mentioned Bridge Master Plan 2031, it is predicted that the total traffic volume crossing the Chao Phraya River will rise in the future.

Table 2: Population, GPP, and No. of Registered Vehicles in Nonthaburi Province

Item	2012	2013	2014	2015	2016
Population (persons)	1,141,673	1,1156,271	1,173,870	1,193,711	1,211,924
GPP (million Baht)	199,005	219,491	268,806	287,685	N.A.
No. of registered vehicles	149,644	152,323	155,06	161,090	165,544

Source: Nonthaburi Province Statistical Office.

⁸ PCU (Passenger Car Unit) represents the “number of vehicles in terms of passenger cars” calculated by converting vehicle units of different types (e.g., trucks, buses, motorcycles) into passenger car units and multiplying the latter by a certain coefficient.

Meanwhile, thanks to the Japanese ODA Loan “Mass Transit System Project in Bangkok (Purple Line) (I) (II)”, the Purple Line, a Mass Rapid Transit (MRT) line, which runs from Khlong Bang Phai station in the northwest part of Nonthaburi Province to Bang Sue station in the northern part of Bangkok city (23km) opened in August 2016 and further connected with the MRT Blue Line⁹ in August of 2017. The Purple Line is expected to accommodate commuters from Nonthaburi Province to Bangkok city, however, owing to challenges such as a lack of connectivity with other rail lines, the number of passengers has been limited to 40,000 to 50,000 per day. As explained above, the speed of modal shift is slow, the means of the transportation between Nonthaburi Province and Bangkok city still heavily relies on automobiles. Therefore, there is a continuously high need for Maha Chesadabodindranusorn Bridge constructed by this project in terms of responding to the growing volume of traffic crossing the Chao Phraya River at the time of ex-post evaluation.

3.1.3 Consistency with Japan’s ODA Policy

At the time of the appraisal, *Japan’s Economic Cooperation Program for the Kingdom of Thailand* (revised in May 2006) set “mutual benefits” as a basic attitude for cooperation and attempted to promote cooperation such as “(i) Deepening and closing of interactions between Japan and Thailand, and sharing of the societal values of both countries”, “(ii) Stability, development and peace building in the Asian region”, “(iii) Establishment of trade and investment environments and strengthening of economic cooperation”, “(iv) Transfer of knowledge, technology and the experience of Japan”, and “(v) Enhancement of Japan and Thailand’s presence in the international society”. Following the Program, JICA pursued a policy to boost the facilitation of logistics in order to revitalize economic activities in industries stated in the “Trade Promotion Program”.

Considering that this project aimed at mitigating traffic congestion and improving transportation efficiency, the project was contributing to “(iii) Establishment of trade and investment environments and strengthening of economic cooperation” as well as with *JICA’s Trade Promotion Program*. Also, the project introduced a bridge construction method named Extradosed Bridge¹⁰ which had found many practical applications in Japan, with the method being introduced in Thailand for the first time. This was consistent with “(iv) Transfer of knowledge, technology and the experience of Japan”.¹¹

⁹ Between Bang Sue station and Hua Lamphong station (20.8km).

¹⁰ The extradosed bridge is a type of prestressed concrete bridge with an outer cable structure supporting the main girder with main tower and diagonal bracing. It has characteristics which combine a cable-stayed bridge and a girder bridge.

¹¹ There is a long history between the bridges over the Chao Phraya River and the Japan's ODA. Since the first Japanese ODA loan was extended to construction of Phra Pin-Klao Bridge in 1971, the Japanese government has supported many bridge construction projects over the Chao Phraya River. The target bridge of this project is the 14th bridge constructed by the Japanese ODA loan out of 22 bridges on the river.

Taking into account the situation described above, the project was consistent with Japan's ODA Policy at the time of the appraisal.

In light of the above, this project has been highly relevant to Thailand's development plan and development needs, as well as to Japan's ODA Policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

A comparison between the Plan and Actual of the project output summary for the target project is shown in Table 3.

Table 3: Project Output (Plan/Actual)

Item	Plan	Actual
(1) Bridge	Total length 460 m A 6-lane	Same as planned
(2) Road	Total length: 4.3 km including the length of the bridge A 6-lane	Same as planned
(3) Interchanges	Two locations	Same as planned
(4) Flyover	One location	Same as planned
(5) Consulting services (excluded from the scope of Japanese ODA Loan)	Detailed design, assistance in procurement, construction supervision, assistance in environmental and social considerations including environmental monitoring <Work Volume> International Expert: 40 M/M Local Expert: 40 M/M Supporting Staff: 1,403 M/M	Same as planned International Expert: 40 M/M Local Expert: 40 M/M Supporting Staff: 1,436 M/M

Source: JICA internal documents and DRR internal documents

The project outputs were produced as planned. Even though the consulting services were outside the scope of the Japanese ODA Loan, the works planned were conducted with self-financing on the Thailand side.

A bridge constructed by the project (Maha Chesadabodindranusorn Bridge) utilized a bridge construction method known as extradosed bridge, which was used in Thailand for the first time. An extradosed bridge has a less oppressive feeling than a cable-stayed bridge, and where the construction is of a middle-scale bridge with a length of about 100 to 200m, the extradosed bridge is superior to bridges constructed using other methods as it also reduces construction costs. Japan has much experience of constructing extradosed bridges, as the project implementation was through a joint venture between Japanese and Thai contractors, technology transfer was made from the Japan side to the Thailand side.

At the time of the appraisal, it was planned that a JICA expert would be dispatched to the project to provide support such as (i) review of shop drawings, design change/alterations, construction methodology, and quality assurance plans, and (ii) periodic site inspections to confirm progress, safety and quality of works during project implementation. This ex-post evaluation could not confirm whether detailed activities had been carried out by the JICA expert as work completion reports were not available. However, according to interviews with people involved in the project, it seems that at least, the JICA expert was actually dispatched during project implementation and it is likely that support was provided for (ii) periodic site inspections to confirm progress, safety and quality of works. It is considered that this work played a role in complementing and supporting construction supervision and environmental monitoring in terms of quality management which were conducted under the scope of the consulting services.

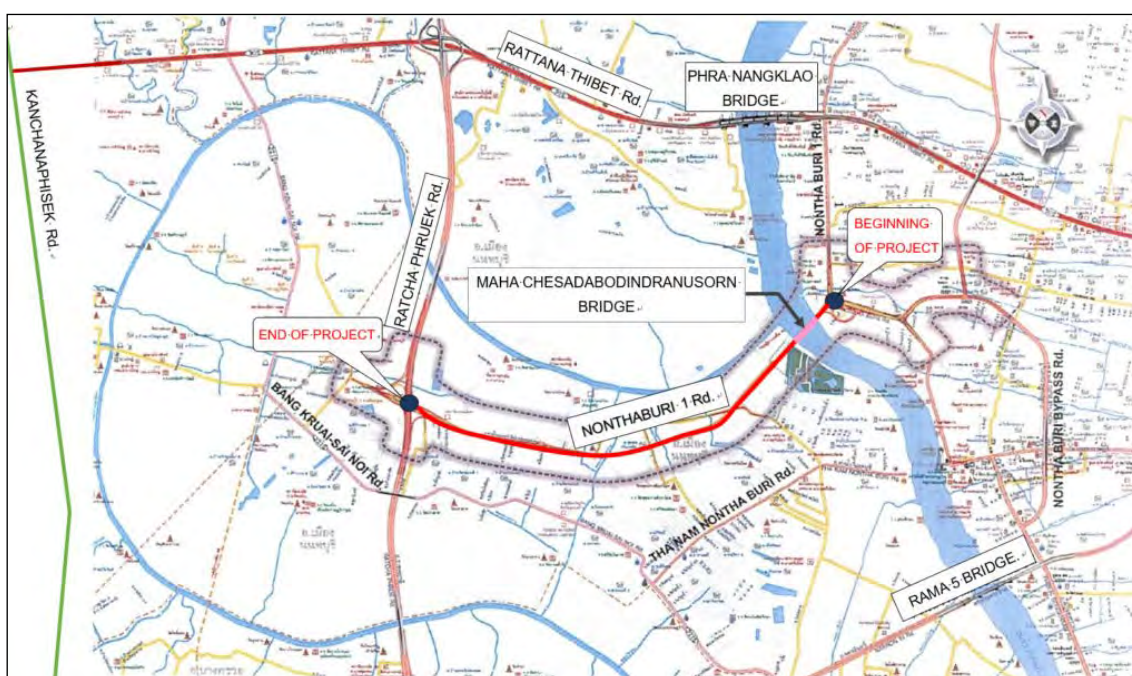


Figure 1: Project Site

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 17,347 million yen against the planned cost of 20,470 million yen (ratio against the plan: 85%) and was within the plan (Table 4).

Table 4: Project Cost (Plan/Actual)

	Plan			Actual		
	JICA	Thai Gov.	Total	JICA	Thai Gov.	Total
	Million Yen	Million Yen	Million Yen	Million Yen	Million Yen	Million Yen
1. Civil works	7,165	3,070	10,235	7,165	3,072	10,237
2. Price escalation	89	1,518	1,607	0	0	0
3. Contingency	53	557	610	141	0	141
Subtotal	7,307	5,145	12,452	7,306	3,072	10,378
4. Consulting services	0	360	360	0	403	403
5. Land acquisition and resettlement	0	6,050	6,050	0	6,055	6,055
6. Administration costs	0	377	377	0	12	12
7. VAT	0	809	809	0	216	216
8. Import Tax	0	78	78	0	0	0
9. Interest during construction	0	300	300	0	263	263
10. Commitment charge	0	44	44	0	20	20
Total	7,307	13,163	20,470	7,306	10,041	17,347

Source: JICA internal documents and DRR internal documents

Note: The exchange rates used: 1 Baht = 2.75 Japanese yen (February 2010) at the time of the appraisal and 1 Baht = 2.88 Japanese yen (the average from 2010 to 2014) at the time of the ex-post evaluation.

The most significant factor in the reduction of the project cost was a saving in the cost of civil works. The actual total civil work cost, including price escalation and contingency, was 10,378 million yen against the planned cost of 12,452 million yen, which was a reduction of 2,074 million yen. This reduction was a result of international competitive bidding. Also, because of a change in the design, a relocation of utilities (electricity distribution lines) along with bridge/road construction works became unnecessary, and 20 million Baht (around 58 million yen) was saved, which was another factor contributing to a reduction in the project costs.

According to the DRR, an executing agency of the project, the DRR and the consultant strictly managed the project budget in cooperation with each other, issuing 39 variation orders for changes in the design and building structures so as not to exceed the budget. Also, the DRR completed payment for the constructor on time. These efforts by the executing agency for project management seem to have contributed to a project implementation within the planned budget.

3.2.2.2 Project Period

The actual project period was 52 months (from September 2010 to December 2014) against a planned project period of 38 months (from September 2010 to October 2013) (ratio against the plan: 137%). The actual therefore exceeded the planned (Table 5.)

Table 5: Project Period (Plan/Actual)

Item	Plan	Actual
Signing of L/A	September 2010	September 2010
Land Acquisition and resettlement	January 2010 - April 2011 (16 months)	January 2010 - April 2011 (16 months)
Consulting Services	November 2011 - October 2013 (24 months)	May 2012 - October 2014 (30 months)
Procurement of main contractors ^(Note)	March 2010 - April 2011 (14 months)	April 2010 - February 2012 (23 months)
Civil Works	May 2011 - October 2013 (30 months)	May 2012 - December 2014 (32 months)
Warranty Periods	October 2013 - October 2015 (24 months)	December 2014 - December 2016 (24 months)
Project Completion	October 2013	December 2014

Source: JICA internal documents, DRR internal documents

Note: The commencement for procurement of the main contractors was at the starting point of Pre- Qualification.

Of the 14-month delay in the project period, 9 months was due to a delay in procurement on the part of the main contractors, which was a significant cause. Three companies bid for the tender after the pre-qualification process, but it took a long time from the evaluation of tenders, to approval by the Government of Thailand, to the final signing of agreements with the chosen contractors. Also, a certain amount of time was taken up in passing through the approval processes within the DRR for the tender of consultants which meant a delay in the consultant starting their services. This was considered another of the reasons for the 14-months delay. It should be noted that the consulting services were mainly construction supervision and were conducted in parallel with the procurement of the main contractors. While the commencement of civil works and consulting services lagged, the lag was only 2 months, and the actual time spent on civil works was 32 months against the plan of 30 months.

The civil works for this project were completed in December 2014, and the project target bridge and road began to be utilized in the same month. By agreement, the warranty period of the contractor was 2 years after completion and, in principal, the period was from December of 2014 to December of 2016. However, in response to distortions of tiles on the bridge and laser receivers (monitoring equipment for cables) after project completion, the warranty period was extended for 6 months, and it ended in June 2017.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

The Economic Internal Rate of Return (EIRR) for the project at the time of the appraisal was 22.1%. The preconditions for the calculation of EIRR are shown in Table 6. The Financial Internal Rate of Return (FIRR) was not calculated at the time of the appraisal. The recalculation of EIRR was conducted at the time of the ex-post evaluation, and the result was almost the same as at the time of the appraisal, showing 22.5%.

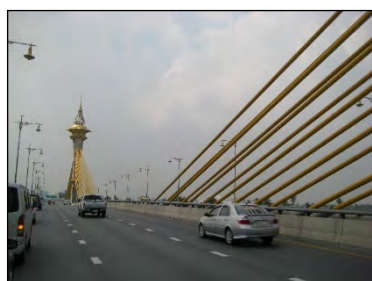
Table 6: EIRR at the Time of the Appraisal of this Project

Item	Description
Financial Internal Rate of Return (FIRR)	FIRR was not calculated because the collection of the fee was not conducted.
Economic Internal Rate of Return (EIRR)	22.1%
Cost	Project Cost (except VAT), Operation and Maintenance Cost
Benefits	Effect of savings in running costs, effect of saving in running time
Project Life	20 years

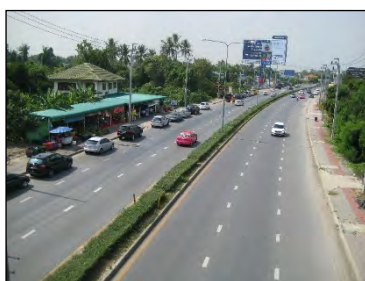
Source: JICA internal documents

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

Bridge, Road, and other facilities constructed by this project



Maha Chesadabodindranusorn Bridge



Nonthaburi 1 Road



Interchange at the east bank side

3.3 Effectiveness and Impacts¹² (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) Annual Average Daily Traffic Volume (AADT)

For the annual average daily traffic volume (AADT), a target value of two years after project completion of the project target bridge (Maha Chesadabodindranusorn Bridge) was set at the time of the appraisal. The AADT from 2015 and 2016 for the target bridge and the adjacent Phra Nang Klao Bridge and Rama V Bridge are shown in Table 7 below.

¹² Sub-rating for Effectiveness is to be put with consideration of Impacts.

Table 7: Annual Average Daily Traffic Volume

Unit: PCU/day

	Baseline	Target	Actual	Actual	Actual	Actual
	2009	2015	2014	2015	2016	2017
	Appraisal	2 years after project completion	Project completion year	1 year after project completion	2 years after project completion	3 years after project completion
Maha Chesadabodindranusorn Bridge (Reference)	—	46,800	N.A.	27,313	47,034	N.A.
Phra Nang Klao Bridge (Old)	N.A.	—	N.A.	46,695	33,768	N.A.
Phra Nang Klao Bridge (New)	N.A.	—	N.A.	81,278	66,278	N.A.
Phra Nang Klao Bridge (Total)	N.A.	—	N.A.	127,973	100,046	N.A.
Rama V Bridge	N.A.	—	N.A.	84,427	85,827	N.A.

Source: JICA internal documents and DRR internal documents.

Note1: The commencement of operation of Maha Chesadabodindranusorn Bridge was December 2014.

Note2: The actual data for 2015 was measured in March 2015 (3 months after project completion), that for 2016 was measured on 23rd March 2016 (1 year and 4 months after project completion).

The AADT from 2016 for Maha Chesadabodindranusorn Bridge was 47,034 PCU/day, achieving the target value of 46,800 PCU/day in the target year (2 years after project completion). Meanwhile, the AADT for Maha Chesadabodindranusorn Bridge reached 47,034 PCU/day in 2016 from 27,313 PCU/day in 2015, an increase of 19,721 PCU/day for one year. Phra Nang Klao Bridge (the total for the old and new bridges) saw a reduction in 27,927 PCU/day from 127,973 PCU/day in 2015 to 100,046 PCU/day in 2016. Rama V Bridge saw a rise in 1,400 PCU/day for the same period.

Based on the above, it could be thought that around 70% of the reduced traffic volume for Phra Nang Klao Bridge from 2015 to 2016 might have been due to a detour to Maha Chesadabodindranusorn Bridge. On the other hand, considering that the 2016 actual value was measured in March 2016, there is little possibility that the MRT Purple Line, which opened in August 2016, had an effect on the reduction in the traffic volume of Phra Nang Klao Bridge for the same period.

It should be noted that Nonthaburi 1 Road finishes at the intersection of Ratcha Phruek Rd. at present, but that the DRR plans to extend Nonthaburi 1 Road approximately 4 km to Kanchana Phisek Rd. (National Road No. 9) running parallel to the west side of Ratcha Phruek Rd. In the future, if this plan is realized, it is expected that the traffic volume for Nonthaburi 1 Road and Maha Chesadabodindranusorn Bridge will further increase.

(2) Savings in Vehicle Operating Cost (VOC), Savings in Value of Travel Time (VOT)

For savings in vehicle operating cost (VOC) and value of travel time (VOT), target values for 2 years after project completion were set respectively at the time of the appraisal. Table 8 shows

the costs for the savings in VOC and VOT after project completion, which was calculated with the recalculation of the above-mentioned EIRR. The costs for the savings in VOC and VOT for 2 years after project completion achieved each of the target values set.

Table8: Savings in Vehicle Operating Cost and Savings in Value of Travel Time

Unit: Million Baht/year

	Baseline	Target	Actual	Actual	Actual	Actual
	2009	2015	2014	2015	2016	2017
	Appraisal	2 years after project completion	project completion year	1 year after project completion	2 years after project completion	3 years after project completion
Savings in Vehicles Operating Cost (VOC)	—	278.2	N.A.	252.5	279.6	345.6
Savings in Value of Travel Time (VOT)	—	2,064.9	N.A.	1,873.6	2,075.2	2,276.8

Source: JICA internal documents.

Note: The commencement of operation of Maha Chesadabodindranusorn Bridge was in December 2014.

(3) Traffic Volume and Volume to Capacity Ratio at Peak Hours (Additional Indicator)

The ex-post evaluation used the traffic volume and volume to capacity ratio at peak hours for Maha Chesadabodindranusorn Bridge and 2 adjacent bridges as additional indicators to measure the relaxation of traffic congestion. They were not, however, included into the operation and effect indicators set at the time of the appraisal. The results can be seen in Table 9.

The actual data for the predicted value for three years after project completion (2017) for Maha Chesadabodindranusorn Bridge and the 2 nearby bridges could not be obtained. Therefore, while referring to the predicted value for three years after project completion, it was decided that this ex-post evaluation would analyze mainly the change in traffic volume and volume to capacity ratio at peak hours for each bridge in the year 2015 to 2016.

The traffic volume at peak hours of Phra Nang Klao Bridge decreased by about 22% from 8,284 PCU/hour in 2015 to 6,494 PCU/hour in 2016, and the volume to capacity ratio at peak hours also reduced from 1.11 in 2015 to 0.87 in 2016. As of 2016, the volume to capacity ratio was less than the predicted value of 0.91 in 2017 for a temporary period of time. However, there is a possibility that the congestion of Phra Nang Klao Bridge may turn back gradually in the future. Meanwhile, the traffic volume at peak hours of Rama V Bridge decreased by about 9% from 5,714 PCU/hour in 2015 to 5,219 PCU/hour in 2016, and the volume to capacity ratio at peak hours was slightly reduced from 1.27 in 2015 to 1.16 in 2016. However, the volume to capacity ratio exceeded the baseline value of 1.01 in 2009, and it can be seen that the traffic volume at peak hours on Rama V Bridge has escalated at a level exceeding the assumption made at the time of the appraisal.

Table 9: Traffic Volume and Volume to Capacity Ratio at Peak Hours

Unit: Traffic volume at peak hours: PCU/hour,

Volume to capacity ratio at peak hours: Traffic volume/traffic capacity

	Baseline	Predicted	Actual	Actual	Actual	Actual
	2009	2016	2014	2015	2016	2017
	Appraisal	Three years after project completion	Project completion year	1 year after project completion	2 years after project completion	3 years after project completion
Maha Chesadabodindranusorn Bridge (6 Lanes)						
Peak Traffic Volume	—	3,159	N.A.	2,215	3,957	N.A.
Volume to Capacity Ratio at Peak Hours	—	0.70	N.A.	0.49	0.88	N.A.
Phra Nang Klao Bridge (10 Lanes)						
Peak Traffic Volume	2,465	6,796	N.A.	8,284	6,494	N.A.
Volume to Capacity Ratio at Peak Hours	0.82	0.91	N.A.	1.11	0.87	N.A.
Rama V Bridge (6 Lanes)						
Peak Traffic Volume	4,564	3,945	N.A.	5,714	5,219	N.A.
Volume to Capacity Ratio at Peak Hours	1.01	0.88	N.A.	1.27	1.16	N.A.

Source: JICA internal documents and DRR internal documents.

Note1: The operation of Maha Chesadabodindranusorn Bridge started in December 2014.

Note2: The actual data for 2015 was measured in March 2015 (3 months after project completion), that for 2016 was measured on 23rd March 2016 (1 year and 4 months after project completion).

Note3: Peak hours are defined as morning peak hours (07:00-08:00).

Note4: The 2009 baseline data for Phra Nang Klao Bridge is only for old Phra Nang Klao Bridge (4 lanes).

Based on these facts, comparing the actual data for 2015 and 2016, it can be seen that the volume to capacity ratio at peak hours for Phra Nang Klao Bridge was eased by approximately 22% after completion of the project. This is highly likely to be because some of the traffic for Phra Nang Klao Bridge started to detour to Maha Chesadabodindranusorn Bridge. On the other hand, a notable effect on improvement of the volume to capacity ratio at peak hours for Rama V Bridge as a result of the project cannot be observed. Rather, the volume to capacity ratio at peak hours for Rama V Bridge had deteriorated in comparison with that at the time of the appraisal. Regarding the relaxation of the volume to capacity ratio at peak hours for Phra Nang Klao Bridge between 2015 and 2016, considering that the actual data for 2016 is based on the data surveyed in March 2016, there no influence of the MRT Purple Line which opened in August 2016 can be detected.

(4) Number of Traffic Accidents (Additional indicator)

This ex-post evaluation conducted data collection and analysis on the number of traffic accidents as an additional indicator, despite the fact that the indicator was not included in the operation and effect indicators set at the time of the appraisal.

In terms of the “Number of Traffic Accidents” for the target bridge and two adjacent bridges, there were difficulties in collecting data as neither the DRR nor the local police station stored accurate records. The number of traffic accidents shown in Table 10 is the traffic accident data

provided by Road Accident Victims Protection Co. Ltd.,¹³ but this covers only the number of traffic accidents for which insurance payout was requested from insurance companies. According to the data, two traffic accidents were recorded on Maha Chesadabodindranusorn Bridge, in 2015 and 2017, respectively. The primary cause of the accidents was speeding by the driver. However, as there was a DRR statement that there were a number of minor collisions with either other cars or objects, it is thought that the actual number of the traffic accidents exceeds the actual value in Table 10.

Table 10: Number of Traffic Accidents

	Unit: Number/Year							
	2010	2011	2012	2013	2014	2015	2016	2017
					Project completion year	1 year after project completion	2 years after project completion	3 years after project completion
Maha Chesadabodindranusorn Bridge	—	—	—	—	0	2	0	2
Phra Nang Klao Bridge	0	0	0	0	0	0	0	0
Rama V Bridge	0	0	0	0	0	0	0	0

Source: Road Accident Victims Protection Co. Ltd.

In 2017 the DRR started the operation of an Accident Report Management System (ARMS) which collects, records and analyzes traffic accident information for the roads under DRR management nationwide. At the moment, ARMS deals only with traffic accident data for rural roads and does not cover data for traffic accidents taking place on roads and bridges in Bangkok city, including those of the project. According to the DRR Traffic Safety Bureau, 12 bridges across the Chao Phraya River under DRR management are to be covered by ARMS from March 2018.

Meanwhile, users of Maha Chesadabodindranusorn Bridge reported that the design of the interchange on the east side of the bridge is complicated, and that it is difficult for users unfamiliar with it to use the Bridge smoothly. Also, as it is hard to read the traffic signs at the entry point from the general road to the bridge and at the branch point, there are spots where accidents frequently occur. The DRR confirmed several safety issues, including the design of the east side interchange, through an impact survey of the target bridges and roads which was carried out in 2015. Based on results of the survey some remedial measures have already been implemented such as the installation of barriers at junction and branching points of the bridge. Also, there is too much information on one signboard, making it difficult for drivers to see necessary information at a glance. The DRR therefore plans to rewrite the information on the signboards by the end of 2018 so as to make it simple and easier to comprehend.

¹³ Road Accident Victims Protection Co. Ltd is a company established based on the Protection for Motor Vehicle Accident Victims Act B.E. 2535 and provides services for motor vehicle accident victims across the country. Currently 59 insurance companies are its stockholders.

3.3.2 Qualitative Effects (Other Effects)

(1) Alleviation of Traffic Congestion

The Rattana Thibet Road, a main trunk road, where Phra Nang Klao Bridge is located, crosses from the east to the west side of Nonthaburi Province and carried a high volume of traffic on a daily basis. The traffic congestion in the direction of Bangkok is particularly intense, especially at peak hours in the morning.

According to a representative of the taxi association of Nonthaburi Province, to pass through a 4 km section from Phra Nang Klao Bridge to the Khae Rai Intersection (in the direction of Bangkok city) where the Rattana Thibet Road and the Tiwanon Road intersect, used to take 1.5 to 2 hours at morning peak hours and this was the most heavily jammed section in Nonthaburi Province. With the construction of Maha Chesadabodindranusorn Bridge and Nonthaburi 1 Road by the project, drivers became able to avoid this most congested section.

As already mentioned, it was found that the volume to capacity ratio at peak hours decreased by 22% for Phra Nang Klao Bridge during the year from 2015 to 2016. It is assumed that the development, through the project, of an alternative route providing a detour from Rattana Thibet Road, including Phra Nang Klao Bridge, had a certain effect on alleviating the traffic congestion on this road.

(2) Improvement of Transport Efficiency

In Nonthaburi Province there are many canals and water transportation using the canals is frequently used. Residents of the target area of the west bank area, therefore, generally use boats rather than using the existing busy Phra Nang Klao Bridge and Rama V Bridge when visiting the east bank area where the provincial government office, major public facilities and commercial areas are concentrated. Since the east bank area has a large market, farmers in the west area have used boats as means of transportation to carry farm products and fruit. Following completion of the project however, farmers began to use overland methods of transport, improving convenience and safety in mobility and transportation.

Also, for the west bank area of Nonthaburi Province, improvements in accessibility to the center of the Province and to the east side of the Chao Phraya River where Bangkok city is located are an absolutely necessary condition for daily commuting and economic activities. Traffic congestion on Rattana Thibet Road including Phra Nang Klao Bridge was relaxed by the project to a certain extent, and this led to shorter traveling time for users of the roads.

Thus, this project seems to have had a certain effect on improving transport efficiency between the west and the east bank areas of Nonthaburi Province on either side of the Chao Phraya River.

3.4 Impacts

3.4.1 Intended Impacts

(1) Promotion of Regional Development in the West Bank Area of the Chao Phraya River in Nonthaburi Province

<Promotion of Housing Development>

Before the project, the project target area along Nonthaburi 1 Road was mainly agricultural land. However, during the implementation of this project, housing development proceeded along Nonthaburi 1 Road in the west bank area of the Chao Phraya River, and primarily new residential areas were formed. Large-scale housing development projects were implemented at 5 locations alongside Nonthaburi 1 Road during the project, and 738 houses were constructed (Table 11). Apart from this, there were also individual houses newly constructed along the road. Following these, commercial and service industries such as restaurants, gas stations, shops and car repair shops, newly opened along the road. According to the Bang Krang Sub-District Office, the project target area has been changing

from a traditional rural community to an emerging urbanized community.

However, since, in the Nonthaburi Province land plan, the area around Nonthaburi 1 Road in the west bank area of the Chao Phraya River is designated as a low-density housing area, the purpose of land use is limited to housing, commercial and service, and the construction of factories and so on is not approved. Also, some areas are limited to agricultural land. Therefore, the target area of the project seems to have been gradually developed as a dormitory town for the Bangkok Metropolitan Area.

<Population Growth>

The area of Nonthaburi 1 Road covered by the project belongs to the administrative division of the Bang Krang Sub-District in the Mueang Nonthaburi District. The registered population in the area expanded by more than 2,200 in the five years from 2012 to 2017. This is on a par with the 40% of the 5,757 increase in the Mueang Nonthaburi District during the same period. The annual average population growth rate in the Bang Krang Sub-District during the same period was 2.4%, exceeding that of 1.5% in Nonthaburi Province (Table 12).

Table 11: New Housing Projects

Name of Housing Projects	No. of Houses
Thanasiri Ratchaphruek – Thanam Non	175
CASA Villa-Ratchaphruek-Rama 5	133
Manthana - Ratchaphruek	206
Bangkok Boulevard	161
Airi (Ananda)	63
Total	738

Source: Survey by the evaluator



New Housing Project (Thanasiri)

Table 12: Population in the Bang Krang Sub-District and Nonthaburi Province

Unit: Persons

Item	2012	2013	2014	2015	2016	2017	Growth rate
Bang Krang Sub-District ^(Note)	19,631 (9,806)	20,007 (10,181)	20,678 (10,457)	21,151 (11,665)	21,592 (11,808)	21,887 (11,986)	2.4%
Nonthaburi Province	1,141,673	1,151,271	1,173,870	1,193,711	1,211,924	N.A.	1.5%
- Mueang Nonthaburi District	357,355	358,006	359,882	362,450	363,112	N.A.	0.4%
- Bang Kruai District	116,261	118,981	122,033	125,549	129,439	N.A.	2.7%
- Bang Yai District	126,562	130,826	135,171	138,982	143,094	N.A.	3.1%
- Bang Bua Thong District	252,179	255,655	59,337	263,625	268,521	N.A.	1.6%
- Sai Noi District	59,494	60,322	61,229	62,573	63,865	N.A.	1.8%
- Pak Kret District	229,822	232,481	236,218	240,532	243,893	N.A.	1.5%

Source: Bang Krang Sub-District Office and Nonthaburi Province Statistical Office.

Note: Bang Krang Sub-District belongs to Mueang Nonthaburi District. The numbers enclosed in brackets is the number of households.

<Rise in Land Prices>

Before and after implementation of the project, land prices along Nonthaburi 1 Road rose sharply. This ex-post evaluation surveyed land price data (official price) after completion of the project in 2012 and 2016 at 3 selected places along Nonthaburi 1 Road, to find that prices had risen 1.3 to 1.5 times in 4 years (Table 13). However, the land price shown below is the official price, and the market price actually traded is higher than this. According to the Bang Krang Sub-District Office, although the land price (market price) for the areas within 100 meters of Nonthaburi 1 Road was 5-6 million Baht/rai (1 rai = 1,600 m²) before the project, it is currently 35-45 million Baht/rai, about a 7-fold increase. According to the Nonthaburi Real Estate Association, not only this project, but the opening of the MRT Purple Line in August 2016 was also a factor in the recent rise in land price.

Table 13: Official Land Price at Selected 3 Locations along Nonthaburi 1 Road

Unit: Tarangwah, 1 Tarangwah=4m²

Item	Location	2012	2016	Plot No.
Gas Station	Approximately 1.8 km from the intersection with Ratcha Phruet Road	19,500	30,000	23
Bang Krang Sub-District Office	Approximately 1.3 km from the intersection with Ratcha Phruet Road	20,000	30,000	34, 35
Commercial Building	Approximately 500 m from the intersection with Ratcha Phruet Road	30,000	40,000	92

Source: Department of Land, Nonthaburi Province.

<Increase in Tax Revenue>

In the five years from 2012 to 2017, the tax revenues of the Bang Krang Sub-District increased by about 1.8 times. This increase had been largely due to a rise in the tax revenues from land and housing taxes following the advance of housing development (Table 14).

Table 14: Tax Revenue of Bang Krang Sub-District

Item	Unit: 1,000Baht					
	2012	2013	2014	2015	2016	2017
Land and Housing Tax	2,161	3,054	3,840	4,580	4,850	4,984
Local Maintenance Tax	161	138	120	119	135	110
Signboard Tax	2,173	3,207	3,412	3,758	2,952	3,014
Total	4,495	6,399	7,372	8,457	7,937	8,108

Source: Bang Krang Sub-District Office

<Promotion of the Regional Economy>

According to the taxi association of Nonthaburi Province, the route newly constructed by the project between both areas of the Chao Phraya River within the Province has enabled taxies to conduct their businesses more efficiently. Additionally, through the housing development in the area alongside Nonthaburi 1 Road, new customer segments have appeared, and the number of passengers and taxi company sales within the Province have increased. For the taxi company interviewed, there had been a 50 to 60 increase in the number of passengers per shift (12 hours for a shift and 2 shifts per day) and sales had risen by 20 to 25% since the project.

To sum up, in the area surrounding Nonthaburi 1 Road targeted by the project, positive impacts were observed such as the promotion of housing development, population growth, rises in land price, and increases in tax revenue and in the sales for taxi companies in the Province. Therefore, this project is considered to have brought a certain positive impact on the promotion of regional development in the west bank area of the Chao Phraya River in Nonthaburi Province.

3.4.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

This project was given a Category A based on the *JBIC Guidelines for Confirmation of Environmental and Social Considerations* (April 2002) for the bridge sector and the sensitive sectors, characteristics and areas (large-scale involuntary resettlement). An Environmental Impact Assessment (EIA) report on this project was not obligatory under Thai domestic law but was prepared in October 2005. However, it was assumed that the project area was not located in or near sensitive areas such as national parks and that therefore undesirable effects on the natural environment were minimal.

During project implementation, an environmental monitoring and an analysis for air, noise and vibration were conducted by the contractor every 3 months, and its monitoring results satisfied the environmental standard value of Thailand. This ex-post evaluation checked documents including the environmental monitoring report and interviewed related persons. It was found that environmental monitoring was carried out according to prescribed procedures, and it was confirmed that no particular problems with air, noise and vibration, occurred during

implementation. Environmental monitoring was conducted by the DRR for two years after completion of the project, but periodic environmental monitoring has not been implemented since then. The DRR is to take necessary measures each time there is a complaint about the environment from the local administration or residents. However, at the time of the ex-post evaluation, there had been no complaints about the environment related to the project.

Therefore, no negative impact on the natural environment is observed.

(2) Land Acquisition and Resettlement

In this project, land acquisition of about 23 ha occurred, which affected 447 households. Of these, 133 households were subject to resettlement (Table 15). The resettlement procedure was based on the resettlement implementation plan, and the resettlement of all 133 households was physically completed before the start of construction.

Table 15: Land Acquisition and Resettlement associated with this Project

Target Area	Private Land	Affected Households	Resettled Households
Interchange at the starting point	4.87 ha	78	43
Interchange at the ending point	6.78 ha	120	34
Bridge and Access Road	11.39 ha	249	56
Total	23.04 ha	447	133

Source: JICA internal documents

Compensation procedures for the land acquisition and resettlement were conducted in accordance with related laws such as *the Land and Property Exploitation Act BE 2530*¹⁴ and the guidelines of the Ministry of Transport. The compensation was basically a monetary compensation based on a replacement cost. The project did not prepare a resettlement area for resettled residents. The targets of compensation included land, buildings, trees, crops, moving costs, a certain amount of income losses to business owners, and compensation for tenants. The income restoration programs for resettled residents were not conducted.

On the other hand, according to the DRR, 47 lawsuits concerning the land acquisition and resettlement of the project have been filed against them, and 39 cases were pending at the administrative tribunal at the time of ex-post evaluation. The purpose of the lawsuits is mainly to demand an increase in the compensation price due to dissatisfaction with the proposed compensation price. However, these did not result in delays in land acquisition.

¹⁴ Based on the Land and Property Exploitation Act BE 253, the Compensation Estimation Committee was established, and the Committee verified the land ownership and evaluated the compensation price. The Committee members were the Governor of Nonthaburi Province, and representatives of Nonthaburi Land Department Officer, related municipality and district governments, DRR, and so on.

(3) Measures against Communicable Diseases such as HIV/AIDS

In this project, programs for measures against communicable diseases such as HIV/AIDS were implemented for construction workers as follows (Table 16).

Table 16: Prevention Program for Communicable Diseases such as HIV/AIDS

Contents	Timing, Times, Others
Implementation of baseline survey	November 2012
Implementation of advocacy campaigns for HIV/AIDS prevention	5 times
Implementation of institutional capacity building workplace policy	4 times
Implementation of peer education	23 times
Implementation of condom promotion	Distribution of 9,000 condoms
Monitoring and evaluation for preventive activities	2 times (Nov. 2013, Jan. 2014)

Source: DRR internal documents.

(4) Safety Management

One Thai worker was injured during the construction work on the elevated road on August 20, 2013, and thereafter, the worker died in hospital.¹⁵ After the accident occurred, in addition to the existing safety and health committee consisting of representatives of each company/contractor of the joint venture, a safety management committee, which mainly consists of the project managers and vice project managers, was established to analyze the causes of the accident, review the work process, hold safety management workshops, and to provide safety education to strengthen the safety supervision system.

In light of the above, the expected effects of this project have been mostly realized as planned. Therefore, the effectiveness and impacts of this project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional / Organizational Aspect of Operation and Maintenance

The operation and maintenance of the project facilities is handled by the Road Maintenance Bureau under the Department of Rural Roads (DRR), Ministry of Transportation. The DRR started maintaining the project facilities on July 15 2017 when the facilities were officially handed over from the contractor to the DRR after completion of the defect liability period. In the Road Maintenance Bureau, there are seven divisions: (i) planning, (ii) road maintenance, (iii) administrative, (iv) road assets, (v) system development, (vi) bridge maintenance (target area:

¹⁵ While pulling up a gondola lift for stretching work along with precast concrete construction works, the place to pull up the lift became skewed to one side of the girder for construction. The lock of wire rope caught the girder and the lift tipped to the wrong angle. However, the worker continued to hang the lift from the crane to the girder. Thereafter, the catch was disengaged during the work, the lift sprang up and he was injured when it smashed against the girder. The reason for the accident was considered to be a lack of communication between him and the operator.

the Bangkok Metropolitan Area), and (vii) bridge maintenance (target area: the whole country, excluding the Bangkok Metropolitan Area).

The Ratcha Phruet Road Maintenance Sub-office, which is the site office of the DRR, takes the responsibility for daily inspection of the target facilities. There are 20 staff members in the sub-office. None of them are bridging engineers, but the sub-office is able to inspect the bridge in cooperation with technical staff dispatched from the Road Maintenance Bureau. Meanwhile, the bridge has a monitoring system for its cable, which is managed by the Bridge Construction Bureau.

The total number of DRR staff is 4,700, including the 173 staff in the Road Maintenance Bureau. The DRR organogram is illustrated in Figure 2. According to the DRR, there is no major concern about the sufficiency of the number of staff. Therefore, no major issues have been observed in terms of the institutional aspects of operation and maintenance in the DRR.

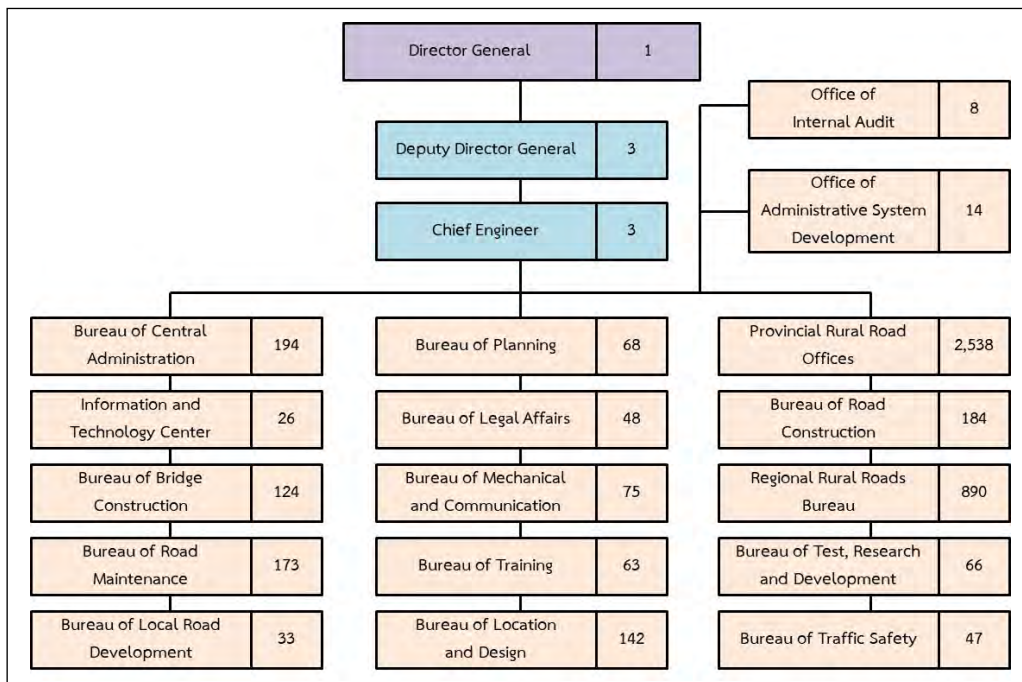


Figure 2: DRR Organogram

3.5.2 Technical Aspect of Operation and Maintenance

The Road Maintenance Bureau has a sufficient technical level with sufficient experience in maintaining local roads and small and medium-sized local bridges. In the Bureau, there is equipment for bridge maintenance, and the Training Bureau regularly conducts training on the maintenance of local roads and local bridges, on inspection of bridge damage, on the operation of maintenance equipment, and so on. Meanwhile, the specialized technology of large bridges such as Maha Chesadabodindranusorn Bridge is owned by the Bridge Construction Bureau

which operates and maintains large-scale bridges in cooperation with the Road Maintenance Bureau. On Maha Chesadabodindranusorn Bridge, a monitoring system for the tension and deflection of its cables has been installed, and the bridge is continuously monitored by the DRR site office (sub-office) and the Bridge Construction Bureau. This project provided training on monitoring systems to the DRR, and the DRR acquired the skills necessary for operation methods.

Two JICA Technical Cooperation projects, “A Survey for the Bridge Maintenance Planning (the Chao Phraya River crossing bridges) (2010-2011)” and “the Project for Bridge Master Plan and Ability Bridge Maintenance in Rural Area (2011-2013)” were conducted. In these technical cooperation projects, the following capacity development of DRR staff was carried out: (i) Formulation of a long-term bridge maintenance and management plan for 12 bridges managed by the DRR including Chao Phraya River Bridge, (ii) Preparation of a bridge inspection plan for 8,000 bridges under DRR jurisdiction in the Bangkok Metropolitan Area, (iii) Support for developing a Bridge Maintenance Management System (BMMS), and (iv) Preparation of a flood recovery countermeasure manual. According to the DRR, the methods of maintaining a cable-stayed bridge as passed on through the technical cooperation projects is useful because there was hitherto no experience in the DRR. The "Bridge Inspection Manual" created by the technical cooperation projects has also been in use continuously. The BMMS, however, is not currently used for various reasons. The DRR independently invented a new BMMS integrated with the database within the DRR and this is used at present.

The DRR has been conducting inspections of bridge damage and an evaluation survey¹⁶ from 2016 to 2018 for 12 bridges over the Chao Phraya River which are under DRR management, entrusting this to Thammasat University. The survey of 7 bridges have already been completed, and those of the remaining 5 bridges, including the target bridge for this project, are due to be completed by September 2018. Maintenance plans and maintenance budget plans for the 12 bridges, including the target bridge of the project, will be formulated later, based on the above survey results. Also, after the completion of this survey, training for technology transfer of bridge maintenance will be provided by Thammasat University to DRR staff. Thus, no major issues have been observed in terms of the technical aspects of operation and maintenance in the DRR.

3.5.3 Financial Aspect of Operation and Maintenance

The maintenance budget for roads and bridges under the DRR nationwide is shown in Table 17. According to the DRR Financial Bureau, the required maintenance budget was received and allocated based on the accumulation for each project every year, and there has been no problem with the allocation of the maintenance budget throughout the DRR. Although at the time of the

¹⁶ Development of Finite Element Monitoring Bridge Health and Evaluation System (Phase I, Phase II, and Phase III).

appraisal, an annual maintenance cost of 15 million Baht (about 5 million yen) was assumed for the project facilities, the DRR only started to maintain the project facilities officially after the termination of the warranty period in July 2017. The maintenance of the project facilities at the time of the ex-post evaluation was limited only to daily maintenance, and no significant expenditure has occurred so far.

As described above, based on the results of the damage inspection and evaluation survey currently underway, a maintenance budget plan for Maha Chesadabodindranusorn Bridge will be formulated after September 2018. Beyond the fiscal year of 2019, the maintenance budget of the facilities will be formally incorporated as part of the DRR budget.

Table 17: Operation and Maintenance Budget of DRR

Unit: Million Baht

	2014		2015		2016		2017	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Maintenance fee of more than 10 million Baht per project ^(Note1)	3,465	3,465	4,400	4,400	4,322	4,322	5,500	5,500
Maintenance fee of less than 10 million Baht per project ^(Note2)	11,181	11,181	12,254	12,254	11,046	11,046	10,324	10,324
Total	15,850	15,850	16,654	16,654	15,369	15,369	15,824	15,824

Source: DRR

Note1: Regular inspections, emergency inspections, large-scale repairs such as overlay

Note 2: Mainly daily inspections

Table 18 shows the profit and loss statements of the DRR for the past three years from 2015 to 2017. Although the budget revenue and borrowing from the government, which was the main source of the revenue, varied from year to year, the over 50,000 million Baht revenue was secured every year. As for expenses, there were fluctuations every year, but personnel expenses, pensions, utility expenses, depreciation expenses and other expenses have been increasing every year. As the infrastructure assets such as roads and bridges owned by the DRR increased from 157,750 million Baht in 2015 to 174,957 million Baht in 2017, the depreciation expenses also increased, from 16,927 million Baht in 2015 to 18,917 million Baht in 2017. However, every year, the revenue exceeded the expenditure, and the marginal profit was carried forward to the next fiscal year. Meanwhile, the long-term debt declined from 11.6 million Baht in 2015 to 9.2 million Baht in 2017.

Thus, no major issues have been observed in terms of the financial aspects of operation and maintenance in the DRR.

Table 18: Profit and Loss Statement of the DRR

Unit: Baht

	2015	2016	2017
Revenue			
Budget revenue	53,277,568,186	47,272,851,395	50,344,855,746
Income from loans and other government revenues	2,909,540,962	12,481,817,750	300,108,715
Income from subsidies and donations	1,756,204	2,341,290	1,737,187
Other Income	0	0	49,858,753
Total	56,188,865,352	59,757,010,435	50,696,560,401
Expense			
Staff costs	2,195,700,010	2,310,237,142	2,342,165,436
Pensions	225,265,997	278,450,819	301,127,589
Remuneration	869,350	1,348,473	630,436
Usability costs ^(Note1)	17,974,210,045	21,800,533,323	18,646,232,257
Material costs	1,006,791,275	1,201,027,013	1,196,911,649
Utility costs	79,228,029	79,907,302	80,997,820
Depreciation	16,927,753,686	18,125,828,752	18,917,466,737
Cost of subsidies and donations ^(Note2)	251,473,528	206,218,297	166,761,403
Other expenses	59,395,492	29,151,325	43,901,169
Total	38,720,687,412	44,032,702,446	41,696,194,496
Balance (Profit/Loss)	17,468,177,940	15,724,307,989	9,000,365,905

Source: DRR

Note 1: Usability costs includes training costs, traveling costs, maintenance costs, lump-sum costs, consulting service fees, meeting costs, public relations costs, etc.

Note 2: The registration and membership fees for member organizations.

3.5.4 Status of Operation and Maintenance

As mentioned above, the DRR has officially been in charge of the maintenance of the project facilities since July 2017. The maintenance at the time of the ex-post evaluation was limited to daily maintenance, but the facilities are kept in a good condition. The maintenance plan for Maha Chesadabodindranusorn Bridge will be put together after September 2018.

Thus, no major issues have been observed in terms of the status of operation and maintenance in the DRR.

No major problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objectives of this project were to alleviate traffic congestion and to improve transportation efficiency in the Bangkok Metropolitan Area by constructing a bridge crossing the Chao Phraya River at a site in Nonthaburi Province where serious traffic congestion prevailed, thereby contributing to the activation of industries and improvement of the urban environment. The

relevance is high, as the objective was consistent with Thailand's development policies and development needs as well as with Japanese ODA policies. The efficiency of this project is fair, as although the project cost was within the plan, the project period exceeded the plan. The operation and effect indicators of this project, such as an increase in the annual average daily traffic volume, a saving in vehicle operating cost and value of travel time, have attained their target values. An alternative route connecting the west and east sides of Nonthaburi Province over the Chao Phraya River was constructed by this project, and this has alleviated traffic congestion to some extent at peak hours on the adjacent Phra Nang Klao Bridge. This project had a certain effect on the relaxation of traffic congestion and on improvement in transport efficiency. Also, on the west bank of the Chao Phraya River in Nonthaburi Province, this project had a certain positive impact on the promotion of regional development, especially housing development. No negative impact on the natural environment was observed, and land acquisition and resident resettlement were appropriately executed in accordance with the related domestic laws and regulations of Thailand. Therefore, the effectiveness and impact of this project are high. Meanwhile, no problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system, and therefore, the sustainability of the project's effect is evaluated 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 Executing Agency

(1) Improvement of safety measures at the interchange of the target bridge

The designs of the junction and branching points in the east area interchange of the Maha Chesadabodindranusorn Bridge of the project are complicated, and users who are unfamiliar with them have difficulty in getting used to them. This is also a risk that causes accidents. For this reason, the DRR will install barriers at the junction and branching points and plans to take measures such as improving road signs during the year 2018. It is expected that the DRR will continue to improve the safety of the target bridges and roads of the project.

(2) Establishment of a method for recording and managing of traffic accident information

On the target bridges and roads, the DRR did not conduct the recording and managing of the number of accidents at the target bridges. In Thailand, organizations such as the police, the Department of Highways (DOH), the Ministry of Transportation, the Expressway Authority of Thailand (EXAT), the Ministry of Health (records of injured persons mainly sent to hospitals) and insurance companies, collect and record information on traffic accidents. However there is no system that can share and comprehensively use this information.

The DRR started the operation of an Accident Report Management System (ARMS) from 2017, and it is planned to include as subjects of ARMS the 12 bridges across the Chao Phraya River under DRR control since March 2018.

Recording and analyzing traffic accidents including the causes of accidents, damage and occurrence points is important for improving the safety of bridges and roads. It is recommended that the DRR utilize and expand ARMS and that it consider cross-organizational sharing and use of traffic accident information on roads and bridges in cooperation with related organizations such as local police authorities and insurance companies.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

None

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
(1) Bridge	Total length: 460 m A 6-lane	Same as planned
(2) Road	Total length: 4.3 km including the length of the bridge A 6-lane	Same as planned
(3) Interchange	Two locations	Same as planned
(4) Flyover	One location	Same as planned
(5) Consulting Service (excluded from the scope of Japanese ODA Loan)	Detailed design, Assistance for procurement, Construction supervision, Assistance for environmental and social considerations including environmental monitoring <Work Volume> International Experts: 40 M/M Local Experts: 40 M/M Supporting Staff: 1,403 M/M	Same as planned International Experts: 40 M/M Local Experts 40 M/M Supporting Staff: 1,436 M/M
2. Project Period	September 2010 – October 2013 (38 months)	September 2010 – December 2014 (52 months)
3. Project Cost		
Amount Paid in Foreign Currency	1,121 million yen	N.A.
Amount Paid in Local Currency	19,349 million yen (7,036 million baht)	N.A. N.A.
Total ODA Loan Portion	20,470 million yen 7,307 million yen	17,347 million yen 7,307 million yen
Exchange Rate	1 baht = 2.75 yen (As of February 2010)	1 baht = 2.88 yen (Average between 2010 and 2014)
4. Final Disbursement	January 2017	

Socialist Republic of Viet Nam

FY 2017 Ex-Post Evaluation of Japanese ODA Loan Project
“Small-Scale Pro Poor Infrastructure Development Project (III)”

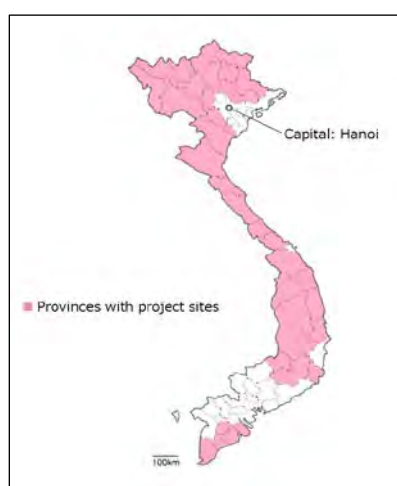
External Evaluator: Takako Haraguchi, OPMAC Corporation

0. Summary

The objectives of this project were to facilitate the transportation of goods to markets, to improve access to public services (electricity and water supply), and to increase agricultural productivity by conducting small-scale infrastructure improvement (subprojects) in road, electricity, water supply, and irrigation in rural areas in 36 provinces in Viet Nam, thereby contributing to poverty reduction. The relevance of these objectives is high, as they are consistent with Viet Nam's development policy and development needs as well as with Japanese aid policy that all aim to reduce poverty in rural areas through small-scale infrastructure development. The effectiveness and impact are high, as a total of 141 subprojects, with some exceptions, have mostly achieved the targets concerning their utilization and effects and produced such impacts as the improvement in agricultural income, the reduction in agricultural cost, and the betterment of quality of life. However, the degree to which the project cost exceeded the plan was disproportionate to the implementation of additional subprojects, and the project period significantly exceeded the plan. Therefore, the efficiency of the project is low. On the other hand, the sustainability is high, as no major problems were observed in the institutional aspects, technical aspects, and financial aspects of operation and maintenance.

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

1. Project Description



Project Locations



The traveling time from a mountain village to the district center was reduced from three days on foot to three hours and a half by motorcycle after the completion of a road subproject. (Kon Tum Province)

1.1 Background

The poverty rate in Viet Nam had decreased from 37.4 percent to 13.4 percent between 1998 and 2008 due to factors such as the economic growth during the 1990s. However, while the urban poverty rate was 6.7 percent in 2006, the rural poverty rate was high, at 16.1 percent, thus urban-rural gaps existed.¹ Those gaps were influenced by geographical factors (inhabiting geographically disadvantageous areas) and factors related to social overhead capital (inadequate infrastructure and services), among other factors.

The Japan International Cooperation Agency (JICA) had assisted the government of Viet Nam's rural development efforts through a series of projects targeting urgent small-scale infrastructure development: "Rehabilitation Loan," "Rehabilitation Loan (II)" (Fiscal Years 1993 and 1994), and "Rural Infrastructure Development and Living Standard Improvement Project (I)" including the phases (II) and (III) of the same project (Fiscal Years 1995, 1996, and 1998) (hereafter, "SPL I," "SPL II," and "SPL III"; "SPL" stands for Sector Program Loan). In addition, JICA had also implemented "Small-Scale Pro Poor Infrastructure Development Project (I)" and its (II) project (Fiscal Years 2002 and 2005) (hereafter, "SPL IV" and "SPL V") to assist small-scale infrastructure development that targeted poor areas with a greater emphasis.² While the ex-post evaluations for SPL I and SPL II acknowledged the effects such as the improved accessibility to social services in areas where subprojects in road, electricity, and water supply were implemented, there still remained many impoverished areas with an inadequate level of infrastructure development. In comparison to other agricultural regions, poverty was particularly severe in mountainous and remote North West and Central Highland where ethnic minorities are concentrated.

1.2 Project Outline

The objective of this project is to facilitate the transportation of goods to markets, to improve access to public services (electricity and water supply), and to increase agricultural productivity by conducting small-scale infrastructure improvement in road, electricity, water supply, and irrigation in rural areas in Viet Nam, thereby contributing to poverty reduction.

¹ Figures according to the General Statistics Office of Viet Nam.

² For the ease of reading, standardized projects names are used here; refer to "1.2 Project Outline" for official names.

Loan Approved Amount / Disbursed Amount	17,952 million yen / 17,280 million yen
Exchange of Notes Date / Loan Agreement Signing Date	October 2009 / November 2009
Terms and Conditions	<p>Interest Rate 1.2% (road, electricity, irrigation, and Rural Promotion Center), 0.55% (water supply), 0.01% (consulting services)</p> <p>Repayment Period 30 years (road, electricity, irrigation, Rural Promotion Center, consulting services), 40 years (water supply) (Grace Period 10 years)</p> <p>Conditions for Procurement General Untied</p>
Borrower / Executing Agency	The Government of the Socialist Republic of Viet Nam / Ministry of Planning and Investment (MPI)
Project Completion	Not completed as of March 2018
Main Contractor(s) (Over 1 billion yen)	—
Main Consultant(s) (Over 100 million yen)	Nippon Koei Co., LTD. (Japan) / Thai Engineering Consultants Co., Ltd. (Thailand) (JV)
Related Studies (Feasibility Studies, etc.)	“Special Assistance for Project Formation (SAPROF) for Small-Scale Pro Poor Infrastructure Development Project (III) (SPL 6), Socialist Republic of Viet Nam” (September 2008)
Related Projects	<p>[Japanese ODA Loan]</p> <ul style="list-style-type: none"> • “Rehabilitation Loan” (January 1994) • “Rehabilitation Loan (II)” (April 1995) • “Rural Infrastructure Development and Living Standard Improvement Project” (March 1996) • “Rural Infrastructure Development and Living Standard Improvement Project (II)” (March 1997) • “Rural Infrastructure Development and Living Standard Improvement Project (III)” (March 1999) • “Small-Scale Pro Poor Infrastructure Development Project” (March 2003) • “Small-Scale Pro Poor Infrastructure Development Project (II)” (March 2006) <p>[Technical Cooperation]</p> <ul style="list-style-type: none"> • “Master Plan Study on Improvement of Rural Living Conditions in Northwestern Mountainous Region in Viet Nam” (2007—2008) <p>[The World Bank]</p> <ul style="list-style-type: none"> • “Poverty Reduction Support Credit (Operation)” (2001, 2003, 2004, 2005) <p>[The Asian Development Bank]</p> <ul style="list-style-type: none"> • “Support to Implementation of Poverty Reduction Program” (2004, 2005, 2006, 2007, 2008)

This project, known as SPL VI, consisted of a total of 141 subprojects in 118 districts in 36 provinces.³ Each subproject was implemented by the District People's Committee (the district-level executing agency) via the Department of Planning and Investment (hereafter, "DPI") (the province-level executing agency), under the direction of the Ministry of Planning and Investment (hereafter, "MPI") (the national executing agency).

2. Outline of the Evaluation Study

2.1 External Evaluator

Takako Haraguchi, OPMAC Corporation⁴

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2017-August 2018

Duration of the Field Study: November 19-December 2, 2017, and March 4-March 10, 2018

2.3 Constraints during the Evaluation Study

Although it was necessary in ex-post evaluation to grasp the status of each subproject, data regarding the status at and after the end of 2015 have not been collected at the central (MPI) and provincial (DPI) administrative levels. For this reason, data were collected by individually sending a questionnaire (hereafter, "subproject questionnaire") to the executing agency (District People's Committee) of each subproject. Although the subproject questionnaire was returned by 117 out of 141 cases (83 percent response rate), missing data and uncertain information could not be verified in detail due to the limited duration and budget of ex-post evaluation, except for the subprojects in the six⁵ provinces targeted for site visits. For this reason, among the evaluation results, those results based on the aggregate of all questionnaire responses may not be as reliable as the survey results of the visited subprojects.

³ Target provinces: (Red River Delta Region) Ninh Binh Province, (North East) Ha Giang Province, Cao Bang Province, Bac Kan Province, Tuyen Quang Province, Lao Cai Province, Yen Bai Province, Thai Nguyen Province, Lang Son Province, Bac Giang Province, Phu Tho Province, (Northwest Mountainous Region) Dien Bien Province, Lai Chau Province, Son La Province, Hoa Binh Province, (North Central Coast Region) Thanh Hoa Province, Nghe An Province, Ha Tinh Province, Quang Binh Province, Quang Tri Province, Thua Thien Hue Province, (South Central Coast Region) Quang Nam Province, Quang Ngai Province, Binh Dinh Province, Phu Yen Province, (Central Highland Region) Kon Tum Province, Gia Lai Province, Dak Lak Province, Dak Nong Province, Lam Dong Province, (South East) Ninh Thuan Province, (Mekong River Delta Region) Tra Vinh Province, Hau Giang Province, Soc Trang Province, Bac Lieu Province, Ca Mau Province.

⁴ Participated from i2i Communication, Ltd.

⁵ On-site interviews were conducted for 24 subprojects (10 road; two electricity; six water supply; four irrigation; and two Rural Promotion Centers) in a total of 17 districts among the 30 target subprojects in 23 target districts in six target provinces : Thai Nguyen Province and Phu Tho Province in the North East; Thanh Hoa Province in the North Central Coast Region; Dien Bien Province in the Northwest Mountainous Region; Kon Tum Province in the Central Highland Region; Soc Trang Province in the Mekong River Delta Region. The selection of the provinces was done in a manner to include the target locations of pilot projects (Dien Bien Province and Thanh Hoa Province) and the priority regions (the Northwest Mountainous Region and the Central Highland Region) as well as to take into consideration the geographical balance (the North East and the Mekong River Delta Region).

3. Results of the Evaluation (Overall Rating: B⁶)

3.1 Relevance (Rating: ③⁷)

3.1.1 Consistency with the Development Plan of Viet Nam

At the time of appraisal, the government of Viet Nam was attempting to improve the living standards of farmers, eliminate famine, and continuously reduce the number of the poor by promoting the development of basic infrastructure (roads, electricity distribution networks, water supply, irrigation, etc.) especially in rural areas, under the long-term *10-year Socio-Economic Development Strategy (2001-2010)* and the mid-term *8th Five-Year Socio-Economic Development Plan (2006-2010)*. Furthermore, the government was seeking socio-economic development especially in ethnic minority communes and those communes located in mountainous areas under the *Socio-Economic Development Programme for Extremely Difficult Communes in Ethnic Minorities and Mountainous Areas (Program 135) (2006-2010)*.

At the time of ex-post evaluation, the *Socio-Economic Development Strategy (Sustainable Development Strategy) (2011-2020)* and the *Five-Year Socio-Economic Development Plan (2016-2020)*, which respectively succeeded the aforementioned long- and mid-term plans, continue to accelerate poverty reduction through infrastructure development prioritizing poor areas and a synergy between infrastructure and social services. In areas with particularly high poverty rates, small-scale infrastructure development in roads, small-scale irrigation, schools, water supply, electrification, etc. is promoted by Vietnamese government's *Program 135 (2016-2020)* and *National Target Program on Poverty Reduction (2016-2020)*, as well as the *New Rural Development Program (2016-2020)* of the Ministry of Agriculture and Rural Development.

3.1.2 Consistency with the Development Needs of Viet Nam

Although a downward trend of the poverty rate exists in Viet Nam, poverty rates in the target provinces and districts of this project continue to be relatively high (Table 1), and the needs for poverty reduction have been present at the time of both appraisal and ex-post evaluation. In the electricity sector among the four target sectors of this project (road, electricity, water supply, and irrigation), the needs for developing new electricity distribution facilities have diminished since the time of appraisal as electrification has mostly been completed by the time of ex-post evaluation.⁸ However, there continue to exist villages where further development in other sectors is needed.

The selection of the target provinces and districts of this project, which attempted to assist areas where needs for poverty reduction are high, seems mostly appropriate. However, although

⁶ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁷ ③: High, ②: Fair, ①: Low

⁸ In 2016, the average electrification rate was 99 percent in the country and 97 percent in the target provinces of this project (the General Statistics Office of Viet Nam data).

this is limited to a single case, the target areas of an irrigation subproject included an area where the hill tribes that had settled in that area traditionally disliked to increase production through double cropping; consequently, the irrigation facilities developed in this project are not adequately used in that area. The site visits and interviews indicated that the target areas were impoverished and there were significant needs for poverty reduction, and the provincial and district governments also were promoting a settlement policy and irrigated agriculture in the target areas of this subproject; however, the selection may not have been appropriate considering social aspects.

Table 1: Change in poverty rate

Unit: %

	2008	2010	2012	2013	2014	2015	2016 (Tentative)
National average ⁽¹⁾	13.4	14.2	11.1	9.8	8.4	7.0	5.8
Average among the target provinces of this project ⁽¹⁾	23.3	25.9	20.9	18.9	16.0	13.7	11.5
Average among the target districts of this project ⁽²⁾	n/a	28.9	24.2	21.7	17.9	22.5	21.9

Source: (1) Calculated from the General Statistics Office of Viet Nam data; (2) calculated from the District People's Committee questionnaire responses (valid responses from 62 of 118 districts).

3.1.3 Consistency with Japan's ODA Policy

At the time of appraisal, by recognizing "Agriculture and Rural Development/Local Development" as a priority area of "Improvements in Living and Social Conditions and Corrections of Disparities," which was one of the four pillars of assistance efforts for Viet Nam, the *Country Assistance Program* (July 2009) of the Ministry of Foreign Affairs stated that those efforts would prioritize the development and management of basic and productive infrastructure (water supply, village roads, electrification, agricultural water utilization, flood control, etc.) in impoverished areas. In addition, the *Country Assistance Implementation Report* (April 2009) of JICA promoted a policy, as part of "Improvement in Living and Social Conditions and Corrections of Disparities," to assist the creation of a just society by alleviating poverty and overcoming economic vulnerability among income strata below or near poverty line, and by redressing the discrepancies widened by economic growth.

In light of the above, this project has been highly relevant to Viet Nam's development plan and Japan's ODA policy, and mostly to Viet Nam's developing needs. Therefore, its relevance is high.

3.2 Efficiency (Rating:①)

3.2.1 Project Outputs

The outputs of the projects included new installation and rehabilitation (subprojects) of small-scale infrastructure in rural provinces and consulting services. Among the 36 target provinces, subprojects were preferentially selected for high priority provinces that consisted of 14 highly

impoverished covering the northwestern mountainous region and the "Development Triangle."⁹ In addition, pilot projects involving the multi-faceted construction of Rural Promotion and Training Center (hereafter, "Center") that would serve as the center of infrastructure development and training for multiple sectors were implemented in Tuan Giao District in Dien Bien Province and Hoang Hoa District in Thanh Hoa Province to improve livelihood through the promotion of agricultural production.¹⁰

The number of subprojects has increased by 39 and decreased by two (cancelled). Consequently, the number of target provinces, the number of target districts, and the number of subprojects were 100 percent, 127 percent, and 136 percent, respectively, of those at the time of appraisal (Table 2). The increase in the number of subprojects was a response to the needs by utilizing the unused balance of the Japanese ODA Loan created by exchange rate fluctuations, and is judged to be appropriate because it was confirmed that those subprojects were proposed by the executing agencies in accordance with the selection standards for subprojects (needs, feasibility, etc.) used in appraisal and were properly approved by JICA following technical assessment among consultants.

Table 2: The Number of Target Provinces, Districts, and Subprojects

Sector	Plan			Actual			Status of Increase or Decrease (reasons)
	Province	District	Subprojects (pilot projects)	Province	District	Subprojects (pilot projects)	
Road	34	57	52 (2)	36	87	89 (2)	Increased in 27 out of 36 provinces (used remaining balance)
Electricity	14	16	14 (0)	14	14	14 (0)	No change
Water Supply	16	17	16 (1)	17	17	17 (1)	A cancellation in Lai Chau Province (A mining development project, the condition for the subproject, was postponed.) Increased by one in Kon Tum Province and Ca Mau Province (used remaining balance)
Irrigation	16	16	18 (2)	15	16	18 (2)	No change
Center, etc.	2	2	4 (4)	2	2	3 (3)	A cancellation in Dien Bien Province (no prospects for organizing and securing a budget for operation and maintenance)
Total	36	93	104 (5)	36	118	141 (4)	

Source: Ex-ante evaluation sheet; documentation provided by JICA; documentation/questionnaire responses provided by the executing agencies

Note: The numbers for the target provinces/districts and pilot projects for each sector show cumulative totals and differ from the actual totals.

⁹ The "Development Triangle" is the least developed region located in a mountainous region where three countries-Cambodia, Laos, and Viet Nam-meet; in Viet Nam, it corresponds to Gia Lai Province, Kon Tum Province, Dak Lak Province, and Dak Nong Province in the Central Highland Region.

¹⁰ In other target districts, only a single subproject was selected from one of the sectors among road, electricity, water supply, and irrigation.

When the scope of individual subprojects that were implemented is compared to those at the time of appraisal, there were cases in which the scope expanded in response to strong needs, while there were cases in which the scope became narrower when a project with urgent needs had partially been undertaken using domestic funds or under projects with other development partners, and when there was shortage of funds on the Vietnamese side.¹¹

Based on the reporting from the executing agencies as well as the on-site evaluation of 24 subprojects, the completion status of outputs is evaluated to be mostly satisfactory, although there is one incomplete subproject at the time of ex-post evaluation (new construction and improvement of roads in Thanh Son District, Phu Tho Province). This subproject has been delayed due to the shortage of funds on the Vietnamese side (which in turn caused a delay in land acquisition and design changes to avoid part of the planned land acquisition, as well as the insufficient capacity of the contractors and consequent hiring of new contractors to replace some of the original contractors. As a result, the subproject did not complete the pavement for approximately 2 kilometers of the total of 17 kilometers. In addition, the road including the finished sections was damaged by flood and landslide disasters in October 2017. At the time of ex-post evaluation, the District People's Committee, which is the subproject's executing agency, is conducting repairs using the disaster recovery budget of the district and province. According to the District People's Committee, although the Committee is attempting to resume the main construction upon the completion of the repair with a goal of completing it by the end of 2018, it has not secured a required amount of budget for the main construction. With that being said, at the time of ex-post evaluation, the entire length of the road including the sections with unfinished pavement is open and is traveled by vehicles.

Consulting services—assistance on detailed design, assistance on tendering and contracts, assistance on construction management strengthening of organizational capacity for project implementation as well as operation and maintenance, assistance on collecting baseline values for operation and effect indicators, etc., for subprojects—were carried out as planned. In response to the increase in the number of subprojects, the work volume grew to 150 percent of the plan for foreign consultants and 143 percent of the plan for Vietnamese consultants.

¹¹ For the road length in the road sector, for example, among 52 original subprojects, two cases added length (+2.7 km in total) and 11 cases reduced length (-29.17 km in total). As a result, the average road length per road subproject of approximately 17 km at the time of appraisal has been reduced to an average of approximately 12 km among all subprojects.



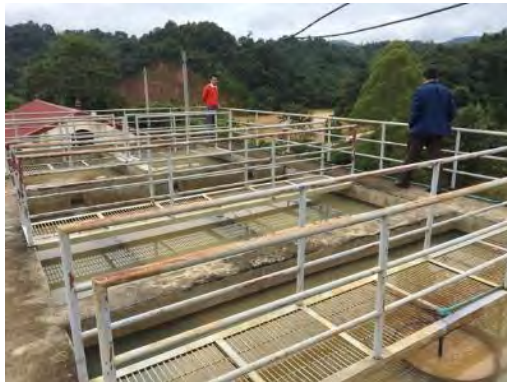
Electricity subproject. Power lines in low-income areas (Soc Trang Province)



Irrigation subproject. Reservoir and dam head works (Kon Tum Province)



Road subproject. Flood damages (Phu Tho Province)



Water supply subproject. Water treatment plant (Dien Bien Province)



Pilot project. Center facilities (Dien Bien Province)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 31,278 million yen and exceeded the plan (145 percent of the plan; the Japanese ODA Loan portion was within the plan). The project cost increase was due to an increase in the Vietnamese-side funds—caused mainly by the rise in construction cost reflecting material price hike and the implementation of additional subprojects—and the delay caused by shortage of funds resulted in further inflation of the construction cost. The land price had increased during the delay, raising the cost of land acquisition. The increase in the project cost was evaluated to be disproportionate to the increase in the outputs, as the construction cost for the outputs planned at the time of appraisal (hereafter, "original") was 146 percent of the plan,¹² and the cost for the outputs that were additionally implemented (hereafter, "additional") was also higher than the plan that had existed at the time of detailed design.¹³

¹² The planned construction cost for the original outputs at the time of appraisal was 13,335 million yen (approximately 2.26 trillion VND) compared to the actual cost of 19,533 million yen (approximately 4.95 trillion VND).

¹³ The planned cost for the additional road subprojects at the time of detailed design was 1,301 million VND, while the actual cost was 1,376 million VND.

3.2.2.2 Project Period

Due to such reasons as the increase in subprojects and the delay in the disbursement on the Vietnamese side, the project period significantly exceeded the plan (210 percent or more of the plan; see Table 3). Sixty percent of the original subprojects had been completed by the end of 2013, which was immediately after the scheduled project completion date in the plan at the time of appraisal, and 80 percent of the original subprojects had been completed by the end of 2014. Furthermore, all additional subprojects had been completed by the end of 2016. Since there is one incomplete subproject at the time of ex-post evaluation as mentioned above, however, we must see the project as a whole as incomplete in light of the definition of project completion ("commencement of the service") as well as the rating standards for JICA's project evaluation.¹⁴

Before the consulting services were terminated in December 2015, the executing agencies and consultants had created an action plan and monitoring sheet for each incomplete subproject. Although it was planned for 2016 and onward that executing agencies of subprojects would renew those materials, the DPI would put them together and report to the MPI, and the MPI would report to JICA, none of those did materialize; nor did JICA urge the MPI. Interviews at the time of ex-post evaluation revealed that JICA Viet Nam Office and the MPI assumed that this project had completed upon the completion of loan disbursement (February 2016).

Table 3: Planned and Actual Project Period

	Plan (at the time of appraisal)	Actual (as of March 2018)
Loan Agreement Signing Date	November 2009	November 2009
Consulting Services	August 2010-November 2013 (40 months)	May 2011-December 2015 (56 months)
Tendering / Contracts	November 2009-October 2010 (12 months)	September 2009-December 2014 (88 months)
Construction	November 2010-October 2013 (36 months)	December 2009-Incomplete (100 months or more) Of those, additional subprojects: December 2012-December 2016
Total Period	November 2009-October 2013 (48 months)	November 2009-Incomplete (101 months or more)

Source: Documentation provided by JICA; documentation provided by the executing agency

3.2.3 Results of Calculations for Internal Rates of Return (Reference Only)

At the time of appraisal, an internal rate of return of each subproject was not calculated for the project, which consisted of numerous, small-scale subprojects, because it was judged that the amount of effort it would take to make such calculations with high reliability for all subprojects

¹⁴ This was determined by simply comparing the plan and the actual results, as those incomplete subprojects were part of the original outputs. It should be noted that the number of incomplete subprojects at the time of final disbursement (February 2016) was 13 for the original subprojects and five for the additional subprojects.

would not justify the utility of the results. Therefore, internal rates of return were not calculated in the ex-post evaluation.

In light of the above, the project cost exceeded the plan, and the project period significantly exceeded the plan. Therefore, the efficiency of this project is low.

3.3 Effectiveness and Impacts¹⁵ (Rating: ③)

A number of indicators for quantitative effects (operation and effect indicators) and qualitative effects were established for this project at the time of appraisal. By sorting them into the immediate outcomes of the project (i.e., facilitation of transportation of goods to markets, the improvement in accessibility to public services, and the growth in agricultural productivity) (effectiveness) and the impacts (i.e., [contribution to] poverty reduction), this ex-post evaluation assessed those indicators in the following method:

- The target for indicators was marked as "to be reviewed in the detailed design" at the time of appraisal; the baseline and target were both revised during the detailed design. Therefore, the degree of achievement was evaluated by comparing between the revised target and actual results.
- Even though the indicators were established separately for the total values of all subprojects in each sector and for individual values of those subprojects that comprised pilot projects, this evaluation gave greater weight to the results of the former by considering the fact that pilot projects constituted only a part of the entire project.
- Since the number of indicators agreed on between JICA and the executing agency at the time of appraisal was numerous, the evaluation was conducted by giving greater weight to those indicators that were specifically mentioned in the ex-ante evaluation sheet under an assumption that they represented the key indicators.

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)¹⁶

Although the operation indicators for pilot projects have been only partially achieved, the quantitative effects are considered to have mostly materialized in this project, as the operation indicators when assessed for all subprojects as well as the effect indicators for all subprojects and pilot projects have been mostly achieved.

¹⁵ Sub-rating for Effectiveness is to be made with consideration of Impact.

¹⁶ About resetting the target year: The ex-ante evaluation sheet set the planned project completion date to October 2013 and the target year for the operation and effect indicators to 2016, two years from project completion. As mentioned in "Efficiency," the actual includes one incomplete subproject. By taking into consideration that 88 percent of subprojects had been completed by December 2015, this ex-post evaluation sets the target year to December 2017, two years from that date.

(1) All Subprojects

In terms of the five-item operation indicators (a total of 11 sub-items), this project, based on the calculation for those subprojects whose data were obtained, has attained 80 percent or more of the revised target, except for one road sub-item (annual average daily traffic volume for newly constructed provincial roads) and one electricity item (annual interruption duration) (neither of which was part of weighted indicators). Although the precise reasons are unclear for those two items that missed the target, it might be the case, for the road item, that the mean value was influenced by outliers.¹⁷ All seven-item effect indicators (a total of 10 sub-items) achieved above 80 percent of the revised target (Table 4).

In most individual subprojects, the achievement rate of the revised target for key operation and effect indicators was over 80 percent. There were four road subprojects, three water supply subprojects, and two irrigation subprojects that did not reach an achievement rate of 80 percent; among these, a water supply subproject and an irrigation subproject had an achievement rate lower than 50 percent. Known reasons for partial attainment or nonattainment included road traffic restrictions due to natural disasters (road), sluggish or declining demand (water supply), social traditions among farmers (irrigation), among other things (Figure 1).¹⁸

Despite the presence of some clerical errors and ambiguity, the revised baseline and target that were established during project implementation appear to be mostly appropriate, as the executing agencies of the subprojects confirmed in the ex-post evaluation interviews that those values were appropriate, and this assessment was mostly consistent with other obtained information and observations.

¹⁷ The reasons why these items did not reach the target are unknown, and information that would help judge whether the values will improve before the end of 2018 also could not be obtained. Regarding the annual average daily traffic volume of newly constructed provincial roads, it should be noted that responses were obtained from two subprojects among five relevant subprojects, and one of these two cases (Quang Tri Province) had an revised target of 2,500 PCU (Passenger Car Unit) and the actual of 1,500 PCU, both representing highest values across this project, and has likely influenced the mean value.

¹⁸ Responses to the subproject questionnaire and interviews identified the following reasons for missing the target.

Water Supply: The actual water supply population of a water supply subproject that covered multiple districts including Pho Yen District in Thai Nguyen Province was 5,600 in 2017, significantly smaller than the revised target of 43,350. According to the provincial water supply company that carries out operation and maintenance, the reasons are: 1. Sluggish demand (residents continue to use well water, which is free, except for drinking water); 2. A large factory of a foreign electronics manufacturer that was built in the area after this project engages in water source development and water supply in the nearby areas; 3. A shortfall in the expenditures for the water supply network development (external to this project).

Irrigation: The two subprojects that missed the target were both subprojects in the mountainous ethnic minority area in Dien Bien Province. Of these two, the revised target for the size of benefited area in Muong Nhe District was 180 ha, but the actual was only 80 ha. It was consistently pointed out in the interviews with the District People's Committee and the commune officials that the residents who had settled in the area as a result of government policy were not using the irrigation facilities developed in this project because they had an aversion, based on their social traditions, to increasing production through long hours on the field or the use of chemical fertilizers, and continued engaging in the traditional single cropping of rice using meteoric water. The government has not carried out part of rice paddy development due to the absence of demand. It has been reported that some residents who are members of another tribe are engaging in double cropping by using the facilities of this project. For the other irrigation subproject (Tuan Giao District) in this province, refer to "(2) Pilot Projects," as it is part of a pilot project.

Table 4: Operation and Effect Indicators (All Subprojects)

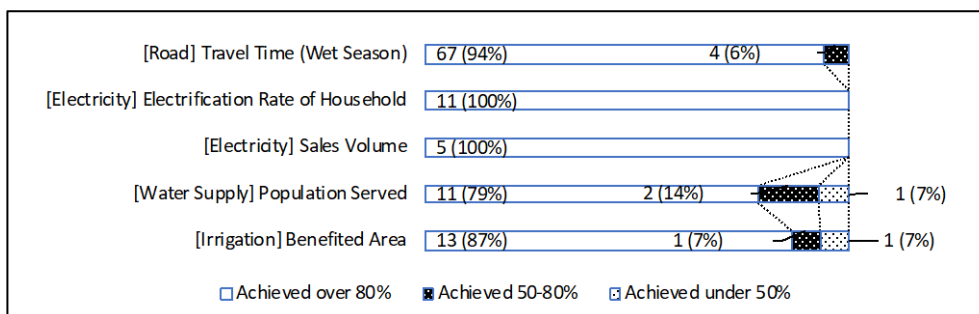
[Sector] Indicator Name (Unit) ⁽¹⁾		Baseline	Target	Revised Baseline	Revised Target ⁽²⁾	Actual
		2008	2016	2009	2017	2017
		Year Planned	2 Years after Completion	Year Detailed Design was Conducted	2 Years after Completion	2 Years after Completion
Operation Indicator						
[Road] Annual Average Daily Traffic Volume (PCU/Day) (Mean) ⁽³⁾	New Construction	0	206	0	Provincial Road 1,425 District Road 380	Provincial Road 900 District Road 556
	Improvement	256	601	Provincial Road 221 District Road 132	Provincial Road 394 District Road 340	Provincial Road 357 District Road 357
[Electricity] System Average Interruption Duration (Minute/Household/Year) (Mean)		2,359	700	888	334	460
[Water Supply] Population Served (Person) (Total) ○		16,437	289,343	31,556	337,932 (319,508)	324,743
[Irrigation] Benefited Area (ha) (Total) ○	New Construction	0	350	0	1,017 (867)	748
	Improvement	28,370	30,738	32,299	33,842 (32,962)	32,962
[Irrigation] Planted Area by Crop (ha) (Total)	Rice	31,046	39,220	51,005	60,361 (58,001)	56,816
	Maize	723	682	5,248	5,615 (5,465)	5,379
Effect Indicator						
[Road] Travel Time (Wet Season) (Index) (Mean) ○		100	55	100	23	22
[Road] Travel Time (Dry Season) (Index) (Mean)		100	45	100	33	32
[Electricity] Electrification Rate of Household (%) (Mean) ○		54.7	97.9	31	100	100
[Electricity] Sales Volume (MWh) (Total) ○		5,142	12,550	978	5,316 (2,274)	8,703
[Water Supply] Turbidity (NTU)	Tuan Giao	To be established for each subproject		50	50	50
	Others			2-200	2 or lower	0.03-2 (Mean 1.59)
[Irrigation] Major Crop Yield (t) (total)	Rice	To be established before the Loan Agreement becomes effective		238,075	333,056	320,819
	Maize			24,479	27,730	26,361
[Irrigation] Major Crop Unit Yield (t/ha) (Mean)	Rice	To be established before the Loan Agreement becomes effective		4.68	5.42	4.89
	Maize			3.84	4.54	4.17

Source: Ex-ante evaluation sheet; documentation provided by JICA; documentation provided by the executing agencies; subproject questionnaire responses (The number of valid responses was 75 cases out of 89 for road, 11 cases out of 14 for electricity, 16 cases out of 17 for water supply, and 15 cases out of 18 for irrigation)

Note: (1) Those indicators listed in the ex-ante evaluation sheet are designated as key indicators, and are indicated with the symbol "○".

(2) Since the values in parentheses under revised target do not include the target values for those subprojects that did not respond to the questionnaire in ex-post evaluation, those values can properly be compared to actual values. It should be noted that some numbers with discrepancies were found in different parts of the documentation provided by the executing agency. For such cases, in principle, the values re-calculated by the ex-post evaluator using individual subproject values were used. In addition, corrections were made for obvious clerical errors.

(3) The baseline and target at the time of appraisal appear to be the average for provincial and district roads.



Source: Same as Table 4

Note: The number of cases was counted based on the achievement level of the operation or effect indicators listed in the ex-ante evaluation sheet. Due to rounding, the total may not be 100%.

Figure 1: Number of Subprojects by Achievement Level for Key Operation and Effect Indicators (Breakdown of Valid Responses)

(2) Pilot Projects

As for the operation indicators, a road indicator and a water supply indicator among the six indicators made the target by exceeding the revised target, while the achievement rates of two irrigation indicators were about 70 percent and under 50 percent, respectively. As for the effect indicators, the two indicators related to the Center made the target in Tuan Giao District but not in Hoang Hoa District. Of the five effect indicators, while three indicators for road and water supply achieved 80 percent or more of the target, an irrigation indicator and a Center indicator resulted in partial attainment and nonattainment, respectively (Table 5).

In both operation and effect indicators, the reasons for nonattainment were similar within each sector. First, according to the district executing agency and consultants, the irrigation sector (Tuan Giao District) was affected by such reasons as the splitting of the original target commune into two communes that left only one of them as the target commune, and the delays in rice paddy development (which was planned to be implemented by the district government upon the completion of the subproject). However, as single cropping of maize is currently (at the time of ex-post evaluation) practiced, the pilot projects are considered to have had an effect of increasing the unit yield through the use of irrigation water. In addition, the target commune reported that the development of rice paddy was underway in 2017 and double cropping of rice has been planned to begin in 2018.

Second, as for the Center, Tuan Giao District and Hoang Hoa District presented contrasting pictures. In Tuan Giao District, while the number of training courses was lower than the target, the number of participants exceeded the target, potentially suggesting different ways in which the number of courses was counted.¹⁹ Moreover, in addition to holding training courses and workshops, the Center is actively used as the area's community center, as indicated by the

¹⁹ Themes of the training: regional development, strengthening of community capabilities, strengthening of *Program 135* implementation, forest protection, animal husbandry, protection of children, maternal and child health, etc. The count includes the training by World Vision (an international NGO) that has an office in the Center.

7,300 individuals (2017) who used its food and beverage facilities, swimming pool, etc. that had been built by the company (using its private funding), to which the District People's Committee outsourced the operation of the Center. In contrast, even though it was anticipated for the Center in Hoang Hoa District to be occupied by private-sector tenants, there are no tenants except for an agricultural company²⁰ that operates in an adjacent land and three-quarters of its space is unused. Although the ownership was transferred from the district to the Department of Agriculture and Rural Development (hereafter, "DARD") in 2014, the Center remains underutilized at the time of ex-post evaluation. However, revitalization in the future is anticipated considering that an operation plan including the recruitment of the private sector that had been submitted by DARD to the Provincial People's Committee was approved in November 2017. The use of the Center at the provincial level has a high potential because the Center is located not in the district's center but rather along a national road, which can be easily accessed from other districts.

Table 5: Operation and Effect Indicators (Pilot Projects)

[Sector] Indicator Name (Unit) ⁽¹⁾		Baseline	Target	Revised Baseline	Revised Target	Actual
		2008	2016	2009	2017	2017
		Year Planned	2 Years after Completion	Year Detailed Design was Conducted	2 Years after Completion	2 Years after Completion
Operation Indicator						
[Road] Annual Average Daily Traffic Volume (PCU/Day)	Tuan Giao	400	800	30	250	350
	Hoang Hoa	800	1,040	175	300	300
[Water Supply] Population Served (Person) ○ ⁽²⁾	Tuan Giao	0	2,920 households	0	620 persons	758 persons
[Irrigation] Benefited Area (ha) ○	Tuan Giao	3	80	0	68	49
[Irrigation] Planted Area (ha)	Tuan Giao	83	160	76	136	49
[Center] Training Courses (Times/Year)	Tuan Giao	13	45	n/a	n/a	20
	Hoang Hoa	4	48	n/a	n/a	0
[Center] Trainees (Person)	Tuan Giao	640	1,350	n/a	n/a	1,620
	Hoang Hoa	370	1,440	n/a	n/a	0

²⁰ The executing agency explained that although it attempted to recruit tenants by displaying and selling local products, there were no companies that expressed interest. However, an agricultural company who is a tenant and the provincial government jointly conduct demonstrations of piped irrigation at the demonstration farm built next to the Center's building, and it is reported that it receives some visitors although the number is unknown.

(Table 5 continued)

[Sector] Indicator Name (Unit) ⁽¹⁾		Baseline	Target	Revised Baseline	Revised Target	Actual
		2008	2016	2009	2017	2017
		Year Planned	2 Years after Completion	Year Detailed Design was Conducted	2 Years after Completion	2 Years after Completion
Effect Indicator						
[Road] Travel Time (Wet Season) (Index) (Hour) ○ ⁽³⁾	Tuan Giao	100	51	3.5	0.25	0.17
	Hoang Hoa	100	52	2.0	0.30	0.40
[Road] Travel Time (Dry Season) (Index) (Hour) ⁽³⁾	Tuan Giao	100	76	100	8	6
	Hoang Hoa	100	79	100	15	20
[Water Supply] Water Supply Coverage (%) ⁽⁴⁾	Tuan Giao	0	80	n/a	n/a	100
[Irrigation] Unit Yield by Crop (t/ha)	Tuan Giao	Spring Lowland Rice 0	Spring Lowland Rice 5.4	Rice 3.0 Maize 2.6	Rice 4.5 Maize 3.5	Rice 0.0 Maize 4.0
[Center] Sales at the Shop (Annual Average; million VND)	Hoang Hoa	5,200	7,800	n/a	n/a	32

Source: Ex-ante evaluation sheet; documentation provided by JICA; documentation provided by the executing agency; subproject questionnaire responses

Note: (1) Those indicators listed in the ex-ante evaluation sheet are designated as key indicators, and are indicated with the symbol "○".

(2) Although 2,920 households were designated as the target at the time of appraisal, this project constructed water supply facilities that were designed to serve the central area of a single village, and a study preceding the project (documentation provided by JICA) listed 87 households/638 people as the beneficiaries. For these reasons, it appeared—and the subproject's executing agency acknowledged—that the 2,920 households represented the total population of the village including the target areas.

(3) The baseline and target of the travel time at the time of appraisal are represented by index numbers (the rationale for the calculation is unknown). The revised baseline and target are represented by hours (they appear to be the hours it takes to travel between the start and end of the target road).

(4) As it is unlikely that the target at the time of appraisal referred to 80 percent of the district population given the circumstances mentioned in Note (2), this figure is presumed to be the coverage rate in the water supply area of this project. For this reason, the latter coverage rate was used for the actual value.

3.3.1.2 Qualitative Effects (Other Effects)²¹

Although not representative of the results of all subprojects, the evaluation verified among almost all subprojects that were included in the qualitative study²² that the use of target infrastructure had facilitated transportation of goods to markets, improved access to public services, and improved agricultural productivity. The followings are the most significant changes after the project as identified by the residents who participated in the study.

²¹ At the time of appraisal, "to raise and stabilize incomes" and "to bring improvements to living environments" were listed as qualitative effects of this project, but this ex-post evaluation classified them as part of the impact "contribution to poverty reduction."

²² Qualitative survey was conducted in Dien Bien Province, Thanh Hoa Province, Kon Tum Province, and Soc Trang Province among the provinces visited in the ex-post evaluation. In addition to conducting key-informant interviews with organizations related to subprojects, focus group discussion and semi-structured interviews were administered to examine the residents in the target areas of different subprojects. A request was made to the People's Committee of each target commune to select resident-participants (respondents) in a manner to minimize biases in terms of sex, occupation, income, etc. This resulted in a total of 90 participants (32 women and 58 men). Most of them were farmers, and some were teachers and local government employees. Although age information of the residents could not be comprehensively collected, most of them seemed to be in their 20s to 50s except for a few who were under 20 or over 60.

- Road: That it became more convenient to use (easier; shorter amount of time). That it became easier to transport produce to the market.
- Electricity: Stable supply of electricity. That it became possible to use electronic appliances such as the television, rice cooker, and washing machine at home.
- Water Supply: That it became possible to get safe water easily.
- Irrigation: That it became possible to get agricultural water easily year around. That agricultural productivity has improved. That flood damages were reduced by the development of drainage channels.

3.3.2 Impacts

3.3.2.1 Intended Impacts

Intended impacts—contribution to poverty reduction (raising and stabilizing incomes and bringing improvements to living environments)—were observed.

(1) Quantitative Impacts

Agricultural income and district-level poverty rate data were collected to be used as impact indicators for the operation and effect indicators that were established at the time of appraisal. As shown in Table 6, although the indicators have generally improved despite some fluctuations, the obtained data were limited and do not clearly show associations with this project. However, in light of the qualitative impacts as will be discussed below, and also considering that improvement projects—in addition to the subprojects of this project—for national and provincial roads by the Vietnamese government, public-private partnerships, other development partners (the World Bank, the Asian Development Bank, etc.), and so forth were being implemented concurrently in the target districts of this project, this project is presumed to have contributed to the improvement in agricultural production and reduction in poverty rate even though the effects may not be showing up in macro data.

Table 6: Operation and Effect Indicators for the Level of Impacts

Indicator Name (Unit) ⁽¹⁾	Baseline 2008	Target 2016	Actual 2010	Actual 2011	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	
Average for all target districts										
Agricultural Income per Agricultural Household (million VND)	Established before the Loan Agreement becomes effective		25.5	27.8	31.7	34.0	37.1	39.2	42.6	
District Poverty Rate (%) ○	Established for Each Subproject		29.6	30.6	25.2	22.5	18.2	23.1	22.8 (Tentative)	
Pilot Project										
District Poverty Rate (%) ○ ⁽³⁾⁽⁴⁾	Tuan Giao	43.6	16.4	n/a	n/a	45.9	42.3	39.1	33.6	53.6
	Hoang Hoa	24.0	13.3	17.5	15.9	13.1	10.2	7.9	10.7	7.9
Users of District's Health Facilities (Person)	Tuan Giao	118,468	138,648	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Hoang Hoa	167,820	217,820	n/a	n/a	n/a	n/a	n/a	n/a	n/a
District Child Mortality (%)	Tuan Giao	4.1	2.0	n/a	n/a	3.4	2.5	2.6	2.6	3.6
	Hoang Hoa	1.9	1.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Source: Ex-ante evaluation sheet; documentation provided by JICA; computed from the District People's Committee questionnaire responses (valid responses from 62 of 118 districts)

Note: (1) Those indicators listed in the ex-ante evaluation sheet are designated as key indicators, and are indicated with the symbol "○".

(2) Revised baseline and revised target were not established in the detailed design.

(3) The baseline for district poverty rate was that of 2006.

(4) Due to the unavailability of actual data for the poverty rate in Tuan Giao District, Dien Bien Province's rural poverty rate was used as a substitute. In addition, Tuan Giao District appears to have relatively favorable economic conditions among the province's rural areas, as it has 14.5% of the provincial population and is responsible for 15% of the total provincial agricultural output, both ranking second after Dien Bien District in the province (the numbers are from 2016; based on data from the General Statistics Office of Viet Nam).

(2) Qualitative Impacts

A number of impacts were identified in the qualitative study (Table 7), and some of them were observed during the site visits. This project appears to be contributing to the reduction of the district's poverty rate through an improvement in agricultural income and a reduction in agricultural cost.

Table 7: Examples of Qualitative Impacts by Sector

Road	<ul style="list-style-type: none"> • We used to be just subsistence farmers before the project, but access became much easier after a road was constructed next to our farm, so we began selling produce at the market. • The cost of transporting produce has gone down. • Transportation became easier so we began producing new products (acacia plantation, etc.). • New stores opened along the road. • We now make additional income from a store we opened in front of our house that faces the road. • Our income increased after becoming capable of transporting produce and forest products in large quantities, so we built a concrete house. • The truck we purchased using part of everyone's profit in the village has made large-scale shipping possible. • It's now easier for children to go to the school. • It has become easier to take a sick person to the hospital. • We began visiting the commune's health station more regularly. • People now give birth at the clinic in town. (mountainous ethnic minority region) • It has become safe without having to go through the forest (mountainous areas) and water (Mekong River Delta area).
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(Table 7 continued)

Electricity	<ul style="list-style-type: none"> • Home appliances such as the rice cooker have made the life easier. Housekeeping has become less burdensome. • We began to get information about the outside world on the television. • Agricultural cost has gone down.²³ • The electricity bill is higher than the fuel cost for lamps or a generator but not prohibitively so. Benefits we get from electricity such as convenience and access to information are greater than the cost increase.
Water Supply	<ul style="list-style-type: none"> • Diseases caused by water (digestive system diseases, eye diseases) have gone down. • The school's restrooms that had been shut down for lack of water have become available. • Water has become available again at the school, so we can make aquaculture ponds and vegetable gardens. • We were able to save on the maintenance cost for the well pump and filters.
Irrigation	<ul style="list-style-type: none"> • Agricultural income has increased. • The expansion of irrigated areas and improved income allowed us to diversify products. We started production of new cash crops (rubber, coffee, etc.) • Production and sales of the produce in the irrigated area increased our income, allowing us to spend more money on education and healthcare. • The water in the canal has become available for everyday use at home. • Because we got enough water, the trouble among residents over water has disappeared.

Source: Qualitative study



An additional income of 4 million VND (approximately 20,000 yen) is being generated by start selling meat after the road improvement (Thanh Hoa Province)



With the construction of a bridge directly connected to the school, it has become possible to go to the school by bicycle rather than small boat (Soc Trang Province)

Clear synergistic effects within each pilot project were not observed. For Tuan Giao District, comments such as "Yields might have increased due to irrigation and training at the Rural Promotion Center (with increased productivity), and agricultural income might have increased as access to the market was improved through road improvement" were made by the executing agency. However, because any tangible situations could not be confirmed, and, as mentioned above, irrigation facilities have not been adequately utilized yet, it is doubtful whether there were synergies or not. In both cases, no situations were observed that would show that the executing agency had arranged some sort of coordination among subprojects within pilot

²³ In Kon Tum Province, for example, it was reported that the monthly fuel (gas) cost of running irrigation pumps for coffee farming, 1 million VND (approximately 5,000 yen), had dropped to an electricity bill of 300,000 VND (approximately 1,500 yen).

projects. It would be more appropriate to say that each one of the multiple subprojects that had been implemented in a given district generated impacts independently.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

At the time of appraisal, this project was categorized as not having significant adverse impact on the environment (Category B) under the *Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations* (2002). According to the executing agency, preparation of an Environmental Impact Assessment (EIA) report was required for 10 original subprojects (two road and eight irrigation subprojects) and one additional road subproject, and each one of them had received approval before construction began.

Regarding environmental mitigation measures and monitoring, although proper evaluation is difficult as specific implementation records could not be obtained, no serious problems have been reported. In addition, residents and communes did not point out problems in the qualitative study.

(2) Resettlement and Land Acquisition

Land acquisitions took place in 79 out of 89 road subprojects and all subprojects of other sectors. Although no details are available about the extent of those acquisitions, the reports from the executing agencies and the results of on-site interviews as a whole seem to indicate that acquisitions were mostly minor (e.g., road widening of less than one meter, lands for pumps, etc.) except for the following single irrigation case. In one irrigation subproject, compensation had to be given to approximately 300 households due to the construction of a reservoir. The shortage of funds for compensation had delayed the construction by 31 months. Although the delay in the execution of compensation had increased the compensation cost in this and several other subproject, the executing agencies reported that an amount stipulated by domestic law had been paid out and the matter had been settled by the time of project completion.

Among those subprojects above, resettlement of residents (a total of 11 households) took place in two cases. Due to the shortage of funds for compensation, construction was cancelled for a portion shorter than 1 kilometer. The status of restoring livelihood is not described in existing documentation or questionnaire responses.

Whether there were complaints among residents over land acquisition and how subprojects handled them are not reported or recorded comprehensively in existing documentation or questionnaire responses. However, there were no significant issues according to the 23 districts in six provinces targeted for the on-site interviews and a province (a district) that provided some information in the questionnaire response. The District People's Committee in Muong

Cha District (Dien Bien Province) and Ma Thi Ho Commune People's Committee in the same district reported, for example, that although acquisitions of part of their fields initially drew oppositions from the residents, the subproject earned their understanding by directly explaining the subproject's detail and its benefits such as easier transportation of produce. It was reported that complaints have not been expressed since then.

(3) Impacts Related to Gender

The following changes pointed out by residents in the qualitative study are considered impacts related to gender.

- Road: Women in the village used to give birth in the village, but more women are giving birth at the hospital in town because road improvement made access better. Before the project, we had to walk through the forest for a whole day to get to town, but I can now go by myself because it has become possible to cover the distance in a short amount of time during the daytime. Because the field now faces the road, it has become safe for a woman even when she is alone. It has become possible for women with small children to come to see the events at the commune (at the time of a site visit, many women and children were enjoying watching a traditional game that was being played).
- Electricity: Home appliances have made housekeeping less burdensome. Women and children now get information about the outside world on the television.

In light of the above, operation and effect indicators have mostly achieved the target except for a few instances, and the contribution of this project toward the improvement of indicators was confirmed by the qualitative data. Although some subprojects had issues, such as the underuse of irrigation facilities and the underuse of the Center in the pilot project, this project as a whole has mostly achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The institutional aspect of operation and maintenance of each subproject is summarized in Table 8. Although there have been some changes from the plan that was created at the time of appraisal such as the advancement of privatization in all sectors except for the road sector, responsibilities concerning the organizational structure and operation/maintenance were clearly defined and no understaffing issues were observed.

Table 8: Institutional Aspect of Operation and Maintenance in Subprojects

Sector	At the time of appraisal	At the time of ex-post evaluation
Road	To be undertaken by the Department of Transport of the Provincial or District People's Committee.	Undertaken as planned in 75 of the 89 cases for which survey responses were available (the Provincial Department of Transport for provincial roads; the district Department of Transport for district roads). The forms of conducting operation and maintenance included direct operation or outsourcing (to communes and local residents for routine maintenance and minor repairs, and private companies for further repair works). The number of personnel who were assigned to operation and maintenance was around six in the district's Department of Transport (approximately 45 including laborers in the case of direct operation) in the four cases for which data were obtained among the subprojects that were visited in the field research. Comments that no staff shortage problems.
Electricity	To be undertaken by the electricity distribution division of the Vietnam Electricity (hereafter, "EVN") Group or the electricity division of the Provincial People's Committee.	Among the 10 out of the 14 cases for which survey responses are available, operation and maintenance are undertaken by power companies (electricity distribution companies) under regional power companies, which are self-supporting corporations within the EVN Group, in nine cases (six cases are provincial level, and three cases are district level), and by the District Public Services entity in one case (Kon Ray District, Kon Tum Province). Among the subprojects visited in the field research, the number of personnel assigned to operation and maintenance was approximately 50 in those subprojects served by the district power company (Soc Trang Province), and 12 across the district in those subprojects served by the District Public Services entity (Kon Tum Province). Operation of facilities and inspection of target areas are being carried out in all cases.
Water Supply	To be undertaken by the Water Supply Company (hereafter, "WSC").	Among the 14 out of the 17 cases for which survey responses are available, operation and maintenance is undertaken by the WSC (province-level Joint Stock Company [hereafter, "JSC"]) in eight cases, by the district-level JSC in two cases, by the District Public Services entity in three cases, and by a private corporation (sold by the district in 2017) in one case. Privatization is progressing. In the two sites visited, the number of personnel assigned to operation and maintenance were five and 10, respectively, which are judged to be appropriate for the facility size.
Irrigation	To be undertaken by the Irrigation Management Company (hereafter, "IMC") at main facilities, and by the irrigation association for on-farm canals.	Among 15 cases of the 18 cases for which survey responses are available, operation and maintenance are undertaken by the provincial IMC in five cases, by DARD in two cases, by the province-level One Member Limited Liability Company in three cases, by the district IMC in one case, by a district-level One Member Limited Liability Company in one case, and by the commune's People's Committee in three cases. Among the subprojects that were visited, the number of personnel assigned to operation and maintenance was around 3-5 in the two cases for which data were obtained (around 30 for an entire province). These numbers are judged to be appropriate for the facility size (approximately 70 ha and 50 ha).
Center	To be undertaken by the Provincial or District People's Committee according to the operation plan that will be developed before the completion of construction.	The District People's Committee outsourced the operation to the private sector in Tuan Giao District. In Hoang Hoa District, efforts have been made to improve the utilization by transferring the rights of ownership and operation from the District People's Committee to Thanh Hoa Province's DARD in 2014 and assigning eight employees (however, those efforts have not been successful yet; the situation is such that the Center does not yet require many employees as there is little activity). The Center's demonstration farm is jointly managed by an agricultural company (a tenant) and DARD.

Source: Ex-ante evaluation sheet; documentation provided by JICA; documentation provided by the executing agency; subproject questionnaire responses

Therefore, it is judged that the institutional aspect of operation and maintenance of subprojects is mostly free of problems.²⁴

²⁴ "Mostly" is added to the evaluation because information about operation and maintenance could not be reviewed for every subproject. Likewise for other aspects on the sustainability discussed below.

3.4.2 Technical Aspect of Operation and Maintenance

As all subprojects were typical, small-scale rural infrastructure, all organizations that are responsible for operation and maintenance have experience working with similar infrastructure. The on-site interviews yielded responses acknowledging that operation and maintenance techniques required for regular inspections (all sectors), operation of pumps (water supply, irrigation), and water quality inspection (water supply) had been acquired as well as information about the implementation status of training/technical guidance including hands-on training. Although concerns had been expressed about the operation and maintenance technology in water supply subprojects at the time of appraisal, training was offered as part of consulting services and no problematic situations have been observed. Site visits confirmed that all subprojects were operated smoothly.

In an electricity subproject, which is not operated and maintained by an EVN power company, there are some concerns over the technical capabilities required in the future, though it has not experienced problems so far.²⁵ In view of the generally satisfactory level of technical capabilities of this project as a whole, however, the rating will not be lowered.

Therefore, it is judged that the technical aspect of operation and maintenance of subprojects is mostly free of problems.

3.4.3 Financial Aspect of Operation and Maintenance

The sustainability of the financial aspect was evaluated mainly by the information gathered through the on-site interviews (Table 9) as it was difficult to obtain financial information only through the survey questionnaire. Concerning district roads in particular, although comprehensive budget data could not be obtained, because the target districts have high poverty rates, it would be a challenge to use the ordinary budget to pay such an amount calculated by (maintenance costs per kilometer x road extension). However, this is mostly not problematic for the sustainability of the project effects (achieving smooth passage) considering that there is a mechanism in place to receive appropriations from higher administrative organizations for high-priority roads, and that road passage is ensured by inspection of the road and reporting of problem areas by residents organizations, mobilization of residents' labor for routine maintenance, and repairs using a provisional budget for cases such as when recovering from disasters. Other sectors also are operating and maintaining the facilities of this project by taking great efforts within the limitation of the budget.

²⁵ Because the subprojects operated and maintained by EVN power companies are part of the target of the EVN Group's internal training system, all employees receive some kind of training every year. A subproject in Soc Trang Province that was visited reported that it follows EVN's training system. The evaluation observed that the employees of a subproject in Kon Tum Province managed by the District Public Services entity were conducting regular inspections according to the EVN standards. Even though no issues requiring repairs have occurred by the time of ex-post evaluation, it was reported that a request for training was being made by the district to EVN to address possible breakdowns and damages to the distribution lines in the future.

Table 9: Financial Conditions for Operation and Maintenance in Subprojects Visited

Road	<ul style="list-style-type: none"> • Maintenance expenses are paid from the provincial or district ordinary budget (routine maintenance, minor repairs) or the provisional budget (further repairs) in all subprojects. • The annual expenditure from the district budget for a single district road subproject (which constitutes the bulk of the road sector of this project) ranges between 0 (when the residents provide labor) and 100 million VND (approximately 500,000 yen). For repairs whose extent is beyond the financial capabilities of the district, repairs are conducted by receiving funds by applying to the province, and to the MPI when the province, too, is not capable (e.g., there was a case of repairing district roads using 40 billion VND [approximately 200 million yen] from Dien Bien Province's budget). In general, maintenance is conducted by prioritizing items within the budget. There were no subprojects that were impassable due to the inability to conduct repairs for the lack of budget.
Electricity	<ul style="list-style-type: none"> • Although the financial conditions of individual power companies could not be obtained, all aspects of the operation and maintenance of the subprojects under EVN are financially supported by the power company. For example, the annual expenditure on a subproject in Soc Trang Province includes 180 million VND (approximately 900,000 yen) for routine maintenance and 4 billion VND on average (approximately 20 million yen) for overhaul (conducted as needed). • The maintenance expenditure for the subproject in Kon Tum Province in which the district carries out O&M is 200 million VND (approximately 1 million yen) annually for routine maintenance.
Water Supply	<ul style="list-style-type: none"> • As a general rule, the waterworks is to be operated by the water charge revenue. • Among the three subprojects visited for which data were obtained, even though the water charges are kept low at around 7,000 VND per 1 m³ (approximately 33 yen), two subprojects are managing to carry out routine maintenance within the revenue from this project's facilities (For example, the Dien Bien Province WSC has been able to carry out operation and maintenance using the monthly income of approximately 65 million VND (approximately 320,000 yen) it collects from the subproject of this project. Gravity flow is used where feasible to save the electric bills for water pumps. Moreover, installation of additional tanks at this project's facilities using the WSC's budget has been planned). • If we only look at the facilities of this project, they are in the red at the Thai Nguyen Province WSC, in which the population served is significantly smaller than the plan. However, the income and expenditure of the WSC as a whole including the maintenance of this project's facilities are balanced.
Irrigation	<ul style="list-style-type: none"> • All irrigation fees are paid by the central government, rather than by the members of the association. The facilities of this project, too, are operated and maintained using the provincial budget (subsidies from the central government). • The amount paid for operation and maintenance ranged between those cases in which the expenses were covered entirely by the residents' labor (no electricity charges are needed because of the use of turbine pumps that do not require electricity) and those cases in which IMC paid some 700 million VND (approximately 3.5 million yen) annually (of which, 400 million VND was personnel cost). In addition, expenditures have been made on an as-needed basis (For example, 3.3 billion VND [approximately 17 million yen] was spent to clean a canal for 4 kilometers in 2016).
Center	<ul style="list-style-type: none"> • At the Center in Tuan Giao District, the operating company has been stably paying for the operation and maintenance cost using its own revenues (an expenditure of 2.75 billion VND [approximately 13.75 million yen] was made in 2017). • At the Center in Hoang Hoa District, its owner Thanh Hoa Province pays 600 to 800 million VND annually (approximately 3 to 4 million yen) as personnel and utilities expenses.

Source: Documentation provided by the executing agency; interviews at subprojects

Therefore, it is judged that the financial aspect of operation and maintenance of subprojects is mostly free of problems.

3.4.4 Status of Operation and Maintenance

With many of the visited subprojects operating and maintaining the facilities of this project according to and within the operation and maintenance plan and budget, it was confirmed that their status was generally sound. In the road sector, although there have been damages on some roads due to an increase in large vehicle traffic and natural disasters, repair works have

continuously been carried out and the passage has been secured. Sections that were being repaired or had received repairs were confirmed during site visits. Therefore, it is judged that the status of operation and maintenance is mostly free of problems.

In light of the above, no major problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objectives of this project were to facilitate the transportation of goods to markets, to improve access to public services (electricity and water supply), and to increase agricultural productivity by conducting small-scale infrastructure improvement (subprojects) in road, electricity, water supply, and irrigation in rural areas in 36 provinces in Viet Nam, thereby contributing to poverty reduction. The relevance of these objectives is high, as they are consistent with Viet Nam's development policy and development needs as well as with Japanese aid policy that all aim to reduce poverty in rural areas through small-scale infrastructure development. The effectiveness and impact are high, as a total of 141 subprojects, with some exceptions, have mostly achieved the targets concerning their utilization and effects and produced such impacts as the improvement in agricultural income, the reduction in agricultural cost, and the betterment of quality of life. However, the degree to which the project cost exceeded the plan was disproportionate to the implementation of additional subprojects, and the project period significantly exceeded the plan. Therefore, the efficiency of the project is low. On the other hand, the sustainability is high, as no major problems were observed in the institutional aspects, technical aspects, and financial aspects of operation and maintenance.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- (1) Phu Tho Province DPI and Thanh Son District People's Committee are recommended to swiftly complete the unfinished construction of road subprojects. It is necessary not only for the province and district but also for the MPI to be involved to supplement the shortfall of the construction budget.
- (2) It is recommended that Thanh Hoa Province DARD soundly implement a revitalization plan for the Center.

4.2.2 Recommendations to JICA

It is recommended that JICA consider utilizing the Center's facilities itself when undertaking some kind of activities in Thanh Hoa Province in the future.

4.3 Lessons Learned

(1) Outsourcing of Center's Operation to the Private Sector

One of the two Rural Promotion Centers constructed in this project has not been adequately used for the lack of capabilities of the local government. In contrast, the other Center, by having its operation outsourced from the local government to a private company, has expanded the facilities through this company and recruited office tenants, and has been actively used for local events and training. When constructing a Center as a general-purpose center for a region, like in this project, rather than for a specific institution, it is recommended to consider outsourcing its operation to a private company with high management capabilities.

(2) Monitoring a Project with a Number of Dispersed Sites from Final Loan Disbursement to Project Completion

In this project, the loan disbursement had completed (consulting services had also terminated) when there still were incomplete subprojects, which were caused by such factors as the shortage of funds on the Vietnamese side. Coupled with subsequent delays, the project period significantly exceeded the plan. Although consultants had created an action plan for each of the delayed subprojects and suggested to institute a reporting structure, from the executing agency of each subproject to the Provincial DPI, then to the MPI/JICA, those suggested actions were not carried out because MPI and JICA were unaware that those were incomplete subprojects. When planning a financial cooperation project with a number of dispersed sites in which the weight of the recipient country's funds is high, it is recommended to foresee a situation in which loan disbursement completes before the completion of the construction and to explore post-ODA Loan disbursement monitoring systems. Furthermore, in case the ODA Loan portion terminates when there are incomplete subprojects, JICA is recommended to prompt the executing agency for proper administration of monitoring and keep track of the project until the project completion.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Road	52 subprojects Concrete pavement, bridge construction, etc. (Total length of approximately 890 km)	89 subprojects (Total length of 1,064.725 km and 2,506 m of bridges including 2 km of an unfinished road.)
Electricity	14 subprojects Installation, reinforcement, and restoration of medium- and low-voltage power lines, installation of distribution transformers, etc.	14 subprojects A total of 202.33 km of medium-voltage power lines, a total of 555.24 km of low-voltage power lines
Water Supply	16 subprojects Construction of water intake facilities, pump facilities, treatment and filtration facilities, water distribution networks, etc.	17 subprojects (one cancellation; two additions) Same specifications as the plan
Irrigation	18 subprojects Improvement of canals and drainage channels, development of reservoirs, etc.	18 subprojects Same specifications as the plan
Rural Promotion Center and other items	4 subprojects 2 training facilities, 1 production and marketing unit facilities, 1 demonstration farm.	3 subprojects (Cancellation of production/marketing unit facilities)
Consulting Services	62 man-months for foreign consultants, 80 man-months for Vietnamese consultants, and 230 man-months for assistants	93 man-months for foreign consultants, 114 man-months for Vietnamese consultants, and 303 man-months for assistants
2. Project Period	November 2009 - October 2013 (48 months)	November 2009 - incomplete as of March 2018 (101 months or more)
3. Project Cost		
Amount Paid in Foreign Currency	825 million yen	914 million yen
Amount Paid in Local Currency	20,780 million yen (3,522,034 million VND)	30,364 million yen (6,365,618 million VND)
Total	21,605 million yen	31,278 million yen
ODA Loan Portion	17,952 million yen	17,280 million yen
Exchange Rate	1 VND = 0.00590 yen (As of April 2009)	1 VND = 0.00477 yen (Average between 2009 and 2016)
4. Final Disbursement	February 2016	