Ex-Post Project Evaluation 2020:
Package IV-2 (Philippines)

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JAPAN INTERNATIONAL COOPERATION AGENCY

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Republic of the Philippines

FY 2020 Ex-Post Evaluation of Grant Aid Project

"Mini-Hydropower Development Project in the Province of Ifugao"

External Evaluator: Takako Haraguchi, i2i Communication, Ltd.

0. Summary

This project aimed to promote the use of domestically produced renewable energy by developing a mini-hydro electric power plant in Ifugao Province in northern Luzon Island, thereby contributing to the conservation of rice terraces as a regional tourism resource and to the reduction of greenhouse gas emissions. The relevance of the project is high because these objectives are consistent with the development plans and development needs in the Philippines and with Japan's aid policy. The power generation capacity of the Likud Mini-Hydro Power Plant (hereinafter referred to as "LMHPP") constructed under the project has been mostly maintained at the planned level. However, the plant has not been sufficiently operational due to the unapproved power supply agreement (hereinafter referred to as "PSA") and damage to civil engineering facilities such as the headrace. It is still out of commission at the time of the ex-post evaluation. Thus, no rice terrace conservation activities have been started using the income from electricity sales. Therefore, although there were some secondary effects, including the effects on agricultural aspects, the effectiveness and impact are judged to be low. The project outputs were mostly generated as planned, but the project cost and period exceeded the plan. Therefore, the efficiency is fair. The sustainability of the project effects is fair because the operation and maintenance of the project faced some problems due to the condition of some of the facilities.

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

1. Project Description

Project Location

Constructed Likud Mini-Hydro Power Plant

1.1 Background

Since the enactment of *the Renewable Energy Act of 2008*, the shift to renewable energy was actively pursued in the Philippines from the perspective of energy security and greenhouse gas emissions reduction. Although its impact on the overall energy balance would be small, the country hoped to actively develop small-scale hydropower generation because this type of power generation would be less challenging in terms of financing and environmental and social considerations than large-scale hydropower development. Ifugao Province, located in northern Luzon Island, has one of the highest potentials for small-scale hydropower generation in the country due to its abundant water resources and steep terrain. However, more than 90% of its annual electricity demand in 2011 relied on electricity supply from outside the province. The development of new power generation projects using small-scale hydropower was one of the important agendas.

In addition, there was a need to conserve the Ifugao Rice Terraces, which were registered as a World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Before this project, an initiative was underway to allocate part of the proceeds from the sale of electricity from the Ambangal Mini-Hydro Power Plant (hereinafter referred to as "AMHPP") (200 kW) installed in the province in 2010 with support from the Global Sustainable Electricity Partnership (hereinafter referred to as "GSEP," formerly known as e8; a framework for international support established by major power companies of the G8 countries, including Japan), for the conservation of rice terraces through the Rice Terraces Conservation Fund (hereinafter referred to as "RTCF"), which was established at the same time as the AMHPP. This project was also expected to expand this initiative.

1.2 Project Outline

The objective of this project is to promote the use of domestically produced renewable energy by developing a mini-hydro electric power plant (820 kW) in Ifugao Province in northern Luzon Island, thereby contributing to the conservation of rice terraces as a regional tourism resource and to the reduction of greenhouse gas emissions.

Grant Limit / Actual Grant Amount	893 million yen (original), 922 million yen (amended)[1] / 921 million yen
Exchange of Notes Date /Grant Agreement Date	March 2013 (original), March 2015 (amended) / April 2013 (original), May 2015 (amended)

[1] In this project, an amended Exchange of Notes and Grant Agreement were signed to increase the grant limit in order to accommodate the increase in project cost due to a change in scope after the start of the project (see "3.2 Efficiency").

Executing Agency	The Department of Energy (DOE)[2]
Project Completion	July 2015
Target Area	Barangay Haliap in Asipulo Municipality, Ifugao Province
Main Contractor	Iwata Chizaki Inc.
Main Consultant	Tokyo Electric Power Services Co., Ltd.
Basic Design/Preparatory Survey	July 2012 – March 2013
Related Projects	Development of the AMHPP by GSEP and Establishment of the RTCF (2010)

2. Outline of the Evaluation Study

2.1 External Evaluator

Takako Haraguchi, i2i Communication, Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2020 – January 2022

Duration of the Field Study: March 2021 (Remotely conducted from Japan due to the spread of the coronavirus[3])

3. Results of the Evaluation (Overall Rating: D[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of the Philippines

The development of renewable energy, including small-scale hydropower, has been promoted in the national and provincial development plans both at the time of the ex-ante and ex-post evaluations. Conservation of rice terraces has also been consistently pursued in the provincial development plans. Therefore, the consistency between this project and the development plan of the Philippines is high.

[2] In the ex-ante evaluation paper, the Provincial Government of Ifugao (hereinafter referred to as "PGI") was designated as the executing agency, and the DOE was designated as the supervising agency. This ex-post evaluation report aligns designations to the ones described in the grant agreement and official documents prepared during the project implementation.

[3] Under the direction of the ex-post evaluator, a local assistant residing in the suburbs of Manila conducted interviews with the executing agency and related organizations and made site visits. Some interviews were conducted online by the ex-post evaluator.

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

[5] ③: High, ②: Fair, ①: Low

At the time of the ex-ante evaluation, the promotion of the development and use of renewable energy, including hydropower, based on *the Renewable Energy Act of 2008,* is stated in *the Philippine Development Plan 2011–2016*, the national development plan, and *the National Renewable Energy Plan (2011–2030)*. In particular, these plans emphasize small-scale hydropower from the perspective of financing and environmental and social considerations. At the provincial level, Ifugao Province enacted *the Mini-Hydro Electric Power Development Program Ordinance No.2007-045* in 2007 to "increase the provincial development budget," "reduce electricity tariffs in the province," and "secure funds for rice terraces conservation," and encourages the development of small-scale hydropower in the province.

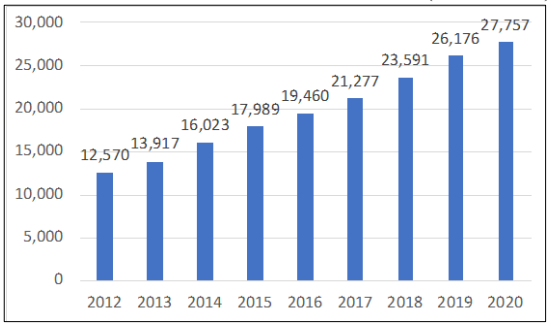
At the time of the ex-post evaluation, further promotion of renewable energy development and the promotion of the Electric Cooperative-owned Distributed Generation Facility Program are stated in the national development plan, *the Philippine Development Plan 2017–2022* (updated in February 2021). At the provincial level, *the Provincial Development and Physical Framework Plan 2017–2022* includes small-scale hydropower development as one of the infrastructure development goals. *The Mini-Hydro Electric Power Development Program Ordinance No.2007-045* stated above also remains effective.

3.1.2 Consistency with the Development Needs of the Philippines

Electricity demand and the need for small-scale hydropower development in Ifugao Province, as well as the need for rice terrace conservation through the sale of electricity, have been consistently high from the time of the ex-ante evaluation to the time of the ex-post evaluation.

As shown in Figure 1, electricity demand in Ifugao Province consistently increased from the time of the ex-ante evaluation to 2020. This is due to the progress in household electrification. The average annual growth rate of demand increased from 6.7% in 2001–2010 to 10.4% in 2012–2020. The peak demand shifted from 2.97 MW in 2013 to 6.97 MW in 2019, an increase of 135%. At the time of the ex-ante evaluation, the power was supplied by purchase from independent power producers (IPPs), with the exception of the AMHPP (200 kW) owned by the province. At the time of the ex-post evaluation, the LMHPP (820 kW) constructed under the project was added to this source. However, this did not change the situation that the province relied on purchases from IPPs for more than 90% of its electricity demand (see also "3.3.2 Impacts").

(Unit: MWh)



Source: Documents provided by the PGI

Figure 1: Electricity demand in Ifugao Province

According to the DOE, the executing agency of the project, and the Provincial Government of Ifugao (hereinafter referred to as "PGI"), which owns and operates the AMHPP and LMHPP, this project, namely the LMHPP, is critical in providing additional power to the regional grid and stabilizing voltage fluctuations. It was also pointed out that the plant is also an important facility as it would bring permanent and long-term jobs to the area and generate income, some of which the province can allocate to the conservation of the rice terraces.

Regarding the needs for rice terrace conservation, according to the PGI, as of the time of the ex-post evaluation, the support from the national and provincial governments for rice terrace conservation is on a one-time basis and limited in scale, and thus, considering the number of rice terraces that need to be rehabilitated (data not available), it is important to utilize the income from electricity sales from the provincial power plants.

3.1.3 Consistency with Japan's ODA Policy

For the reasons cited below, the consistency with Japan's ODA policy at the time of the ex-ante evaluation was high. *The Country Assistance Policy for the Republic of the Philippines (April 2012)* and *JICA Country Analysis Paper (March 2012)* state that Japan would support the diversification of power sources and improved energy self-sufficiency by promoting the development and use of renewable energy as part of "achieving sustainable economic growth through further promotion of investment" and "support for climate change countermeasures."

3.1.4 Appropriateness of the Project Plan and Approach

As explained below, the effectiveness and impact of the project were evaluated to be low, mainly due to the fact that the LMHPP constructed under the project was not in operation at the time of the ex-post evaluation. It was analyzed whether there were any problems in the project plan and approach (or whether they could have been avoided) based on existing documents and interviews with stakeholders concerning the major problems of the power plant: (1) damage to the facilities, such as cracks in the headrace and scouring of the settling basin, and (2) the fact that the power plant had to be shut down because the PSA has not been approved.

First, (1) regarding the damage to the facility, field investigations pointed out that they may have been caused by landslides due to the rise of groundwater level caused by heavy rains in 2016 and 2018. Moreover, after the heavy rains in 2020, the headrace was damaged again, including the repaired parts (see "3.3.1.1 Quantitative Effects" and "3.4.4 Status of Operation and Maintenance" for details on the condition of the facility). On the other hand, as a result of the investigation of the landslide topography at the time of the outline design (preparatory survey), it was concluded that the debris body was stable and debris slides would not recur. If the headrace crossed the topography in areas where surface land sliding had occurred in recent years, the headrace was designed with aqueduct bridge structures and retaining walls so that it

would accommodate such conditions, and no problems occurred. At that time, while the AMHPP in the adjacent municipality with similar topography had its headrace on a steeper slope, it did not experience similar problems. At the time of the ex-post evaluation, follow-up cooperation is provided by JICA, and it is planned to investigate and clarify whether the cracks in the headrace were caused by landslides or not. Thus, it cannot be concluded at the time of the ex-post evaluation that the outline design and detailed design underestimated the possibility of landslides.

Second, (2) regarding the pending approval for the PSA, it would have been difficult to foresee this issue, as similar problems had not occurred at the AMHPP, a similar power plant, at the time of the outline design of this project (see "3.2.1 Project Outputs" for details of the problem of the unapproved PSA).

Thus, the project plan and approach were considered to be generally appropriate given that it was beyond the project's control to foresee the problems that occurred after project completion.

In light of the above, 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: ②)

3.2.1 Project Outputs

The outputs of this project consisted of (1) construction of an 820-kW mini-hydro electric power plant (LMHPP), (2) consulting services (including a soft component), and (3) rehabilitation of existing irrigation facilities, which was not related to power generation but was added at the request of local residents. These outputs were mostly completed as planned, although there were some changes, as shown in the table below. All of the changes were made in response to situations that occurred after the start of the project, and no particular problems were identified. JICA also judged that the changes were appropriate. On the other hand, some of the approval procedures for the operation of the power plant, which were to be performed by the Philippine side, were not yet completed. While this did not affect the completion of the outputs, it caused the shutdown of the power plant and uncollected revenues from sales of electricity.

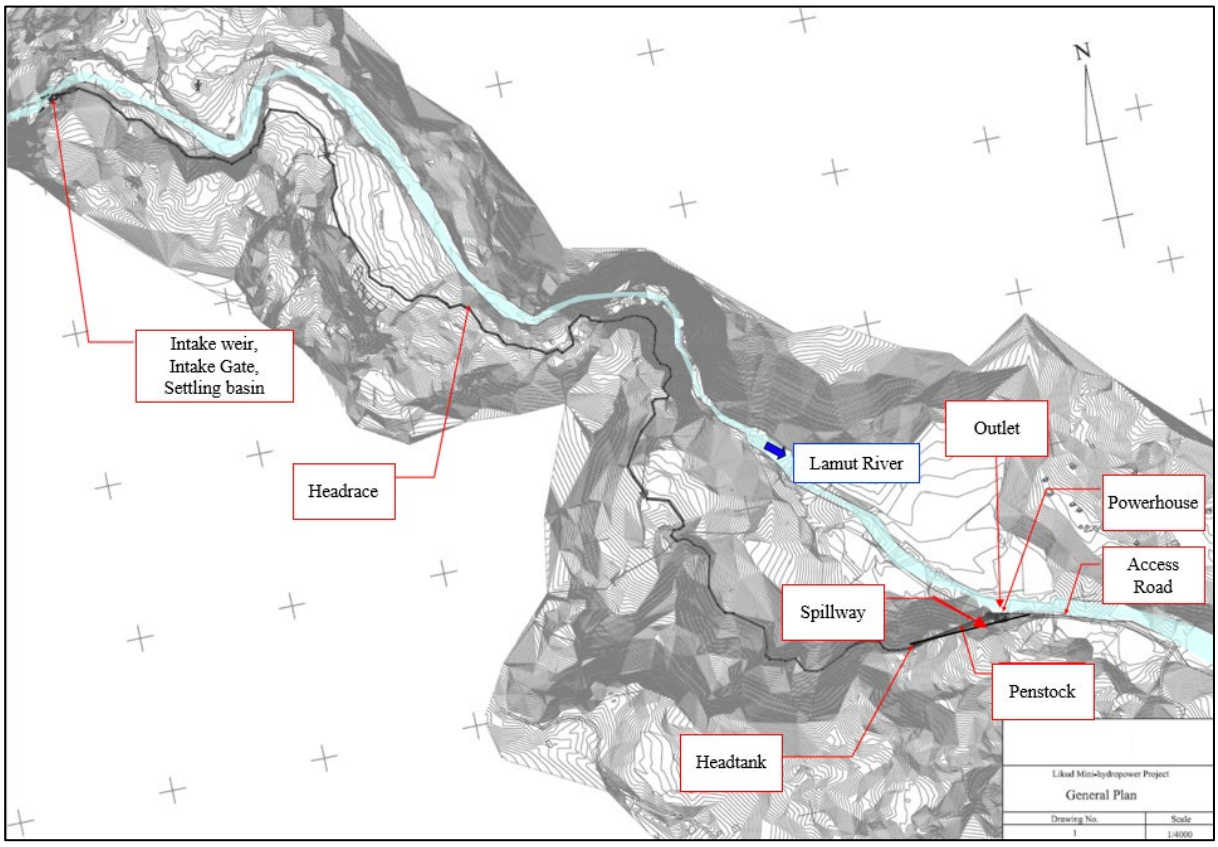
Table 1: Planned and actual outputs

Project Outputs	Plan at the Time of Ex-Ante Evaluation	Actual
(1) Construction of an 820-kW mini-hydro electric power plant	1) Equipment/Installation: Water turbine, generators, control device, switchgear, outdoor transformers, power distribution equipment 2) Civil structure: Intake weir, intake facilities, settling basin, headrace, penstock, head tank/spillway, powerhouse, access road	Mostly as planned with some scope changes. Major scope changes: • Changes in the shape of the headrace, changes in the shape and scope of the concrete retaining wall, and expansion of the scope of the masonry retaining wall construction for slope stability due to topographical changes caused by natural slope failures that seem to have occurred after the detailed design. • After excavation works began, cracks developed in the limestone more than expected, and it was found that the limestone was prone to collapse during excavation, which led to a change in the shape of the headrace from the slope of the steep cliff to a line crossing the ridge, and a partial change to a tunnel channel.
(2) Consulting services	1) Detailed design and construction supervision 2) Soft component: Developing the organization and human resources for the power plant, ensuring the proper operation of the RTCF	As planned. Specific contents of the soft component: • Developing the organization and human resources for the power plant (training for operator candidates (local residents) and a plant supervisor (provincial government worker)). • Ensuring the proper operation of the RTCF (revision of the existing RTCF guideline, assistance for revision of the Provincial Ordinance No. 2010-019 on the operation and maintenance of power plants and the RTCF, and revision of the operation manual of mini-hydro electric power plants. All approved at the Ifugao Provincial Assembly in July 2015.)
(3) Rehabilitation of existing irrigation facilities	Irrigation channel length: 700 m, irrigated area: 2.43 ha In conjunction with the construction of the power plant, repair of existing irrigation channels that were no longer functioning in the project area was added to the project components because local residents strongly requested it, its impact on the hydropower generation project was negligible, and the repair was relatively easy.	Irrigation channel length: 650 m. The irrigated area was mostly as planned according to the stakeholders, although the area was not surveyed accurately.

Source: Documents provided by JICA, documents provided by/interviews with the PGI, interviews with the consultants for construction supervision, site survey

Water Turbine and Generator

Headrace. The narrow canal on the valley side is the rehabilitated irrigation channel.



Source: Documents provided by the consultants for construction supervision

Figure 2: Project Layout

The Philippine side's obligations include (1) conclusion of a memorandum of agreement (MOA) between the DOE and the PGI regarding the division of responsibilities; (2) obtaining various approvals for the operation of the power plant by the PGI;[6] (3) establishment of an operation and maintenance setup by the PGI; (4) budgeting of operation and maintenance costs by the PGI; (5) operation of the RTCF by the PGI; and (6) tariff and tax exemption procedures by the DOE. As of September 2021, some aspects of (2) and (6) are uncompleted.

The following are the three incomplete items in (2) (various approvals for the operation of the power plant) above (the alphabetical symbols correspond to those in footnote 6).

[6] At the of the ex-ante evaluation, it was planned to (a) obtain Local Government Units (LGU) Endorsement (approval from provincial, municipal, and barangay assemblies) for the small-scale hydropower development, (b) acquire land for the project, (c) obtain the "Free and Prior Informed Consent (FPIC)" certificate from the National Commission on Indigenous Peoples (NCIP), (d) obtain an environment compliance certificate from the Department of Environment and Natural Resources (DENR), (e) obtain a water rights permit from the National Water Resources Board (NWRB), (f) obtain power plant operating permission (Renewable Energy Service/Operating Contract (RESC) and Certificate of Endorsement (COE) from the DOE, g) conclude a PSA between the PGI and Ifugao Electric Cooperative, Inc. (IFELCO), and (h) obtain the Certificate of Compliance (COC; certification of power plant operational capacity and the approval of power plant operation) from the Energy Regulatory Commission (ERC). The issue at the time of the ex-post evaluation is (i) the process of obtaining the approval of the PSA (item (g)) by the ERC. However, in the preparatory survey report, the PSA approval was not specifically mentioned separately from the conclusion of the PSA itself.

- (c) Obtaining the "Free and Prior Informed Consent" (hereinafter referred to as "FPIC") certificate from the National Commission on Indigenous People (hereinafter referred to as "NCIP"): Since the project site is located in an area inhabited by the Ifugao People, an indigenous people under Philippine domestic law, the development project had to disclose the project contents and information to the indigenous community in advance to obtain the FPIC in accordance with *The Indigenous Peoples' Rights Act of 1997*. The PGI had obtained the FPIC from the three directly affected barangays in 2014 during the construction stage. However, the NCIP headquarters additionally instructed that the FPIC from all relevant municipalities needs to be obtained. The PGI and the local NCIP are currently working on this request. According to the PGI, it is taking a long time for the NCIP provincial office to prepare necessary documents. Based on the "Revised Guidelines on Free and Prior Informed Consent (FPIC) and Related Processes of 2012," a project implementer is required to obtain a certificate from the NCIP indicating that the FPIC has been granted. However, the certificate for this project has not been issued yet due to the above-mentioned situation. Moreover, according to the PGI, the failure to obtain the certificate may affect the water rights (e) and the approval of the PSA (i) as explained below. The PGI is proceeding with the PSA approval process with the submission of a notification document indicating that the FPIC certification process is underway.

- (e) Obtaining a water rights permit from the National Water Resources Board (hereinafter referred to as "NWRB"): During the project implementation, the PGI responded to the NWRB's requests for additional documents after the submission of the application. However, the permit has not been obtained yet at the time of the ex-post evaluation. According to the PGI, it has requested the cost for expert service fees in the FY2021 supplementary budget to prepare an additional document, the "Ecological Sustainability Plan." Moreover, according to the PGI, although a water rights permit is one of the requirements for applying for approval of the PSA (i), the PSA approval process is proceeding with the submission of a notification document explaining that the process of obtaining a water rights permit is underway, and even if it is not obtained, the power plant can be operated based on the notification document.

- (i) Approval of the PSA by the Energy Regulatory Commission (hereinafter referred to as "ERC"): The PSA was executed in October 2014 between the PGI and the Ifugao Electric Cooperative, Inc. (hereinafter referred to as "IFELCO," the power distributor in the province), and the PGI and IFELCO submitted application documents for approval to the ERC in March 2015. However, incomplete application documents and

subsequent changes in requirements[7] have caused delays and interruptions in the process, resulting in uncollected revenues from sales of electricity and the shutdown of the power plant. In April 2021, the PGI and IFELCO submitted application documents again, which were accepted by the ERC. As of September 2021, the ERC, the PGI, and IFELCO are in the process of conducting hearings and other activities. The DOE and JICA (the Philippine Office and the follow-up cooperation mentioned above (being implemented at the time of the ex-post evaluation) are also supporting the process. It should be noted that during the delay in this procedure, the certification of power plant operational capacity and the approval of power plant operation called the Certificate of Compliance (hereinafter referred to as "COC") has expired. The COC, listed as item (h) in footnote 6, is a requirement for the PSA approval and was valid from August 18, 2016, to August 17, 2021. The PGI is in the process of applying to the ERC for renewal of the COC, but the fact that the FPIC certificate (item (c), not yet obtained as mentioned above) is a requirement for COC renewal is affecting the process. The PGI lodged a petition to the court claiming that the progress being made concerning FPIC should justify its COC renewal procedure. The court accepted the petition, and the PGI is awaiting the ERC's reply regarding the COC renewal.

Regarding (6) tariff and tax exemption procedures by the DOE, the Value Added Tax (VAT) had not been refunded as of July 2021, and the contractor was in the process of requesting the refund with the support of JICA and the Japanese Embassy. According to the DOE, the process is taking a long time due to the strict compliance with the Philippine government's auditing and accounting procedures.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned amount for the total project cost was 966 million yen (the Japanese side: grant limit 922 million yen based on the amended Exchange of Notes; the Philippine side: 44 million yen). The actual cost was 972 million yen (the Japanese side: 921 million yen; the Philippine side: 51 million yen), which exceeded the plan (101% against the plan).[8] While the project

[7] The application documents were not accepted because the format used was the one used at the time of the application for the AMHPP (2010) and the documents did not include information for items that have been required since then. In addition, the ERC has mandated a Competitive Selection Process (hereinafter referred to as "CSP") for PSAs since April 30, 2016, and it took time to consider how to ensure that the LMHPP would not be subject to this requirement (On September 5, 2018, the DOE informed IFELCO that the project is not subject to CSP). Although the preparation of the application was subsequently resumed, the ERC pointed out that the date of the attached documents was old, and some documents were missing, which necessitated further documentation.

[8] Figures are rounded down to the nearest million yen. The project cost on the Japanese side exceeded the planned amount mainly due to exchange rate fluctuations. The actual project cost on the Philippine side is 17,962,270 pesos for the DOE and 2,985,198 pesos for the PGI. The actual amount of the DOE does not include the unrefunded VAT (10,276,000 pesos). The exchange rate used for the yen conversion is (Plan) 1 peso = 2.03 yen (used in the preparatory survey) and (Actual) 1 peso = 2.45 yen (average during the project implementation).

cost on the Philippine side does not include the amount of the unrefunded VAT mentioned in the previous section, if the VAT refund is completed, the actual project cost on the Philippine side would be 61 million yen, making the total project cost 982 million yen (102% against the plan).

3.2.2.2 Project Period

The planned period between the signing of the grant agreement for this project and the start of operation of the power plant was 23 months, starting in April 2013 and ending in February 2015, according to the ex-ante evaluation. The actual project period was 28 months, starting in April 2013 and ending in July 2015, exceeding the plan (122% against the plan).[9] The reason for the extra time was the scope change mentioned above, as well as delays in some construction work due to delays in pre-construction procedures and the contractor's inability to secure some labor (planned construction period: 16 months, actual construction period: 21 months).

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

3.3 Effectiveness and Impacts[10] (Rating: ①)

3.3.1 Effectiveness

While the power generation capacity of the LMHPP constructed under the project has been mostly maintained, the plant has not been sufficiently operational, and thus the amount of generated electrical energy at the generating end, which indicates the quantitative effects, has been far below the target value during the period from the target year to the year in which this ex-post evaluation is conducted. While the effect of the soft component was confirmed as a qualitative effect, the achievement of the project objective, "the use of domestically produced renewable energy," was judged to be limited based on the results of the quantitative effects and the fact that the power plant was not in operation at the time of the ex-post evaluation.

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In this project, two indicators were set for quantitative effects: "generated electrical energy at the generating end" and "contribution to CO_2 emissions reduction." Since the project objective of the effectiveness level is "the use of domestically produced renewable energy," the indicator

[9] In line with the principle of JICA ex-post evaluation, the starting point of the project period was the signing of the grant agreement, and the end point was the start of operation. When comparing the planned and actual project periods, we used the date of signing of the initial grant agreement as the starting point of the project period, because the amended exchange of notes and grant agreement were signed after the start of the project.

[10] Sub-rating for Effectiveness is to be put with consideration of Impacts.

"generated electrical energy at the generating end" is verified in this section because this indicator, due to its nature, can be used as both an operation indicator and an effect indicator for the effectiveness level. On the other hand, "contribution to CO_2 emissions reduction" will be verified later in "3.3.2.1 Intended Impacts" as an impact level indicator because it measures the project objective of the impact level "the reduction of greenhouse gas emissions."

As shown in Table 2, the actual value of generated electrical energy at the generating end in the target year (2018) was 1,315 MWh/year, which was far below the target value of 4,451 MWh/year (30% achievement). In 2017, when the power plant operated stably, the performance was above the target. However, the average of power generation from 2016 to 2020, for which the annual average can be calculated, was 1,856 MWh/year, equaling to 42% of the target.

Table 2: Generated electrical energy at the generating end in the LMHPP

(Operation and Effect Indicator)

(Unit: MWh/year)

	Baseline	Target	Actual					
	2012	2018	2015	2016	2017	2018	2019	2020
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion	4 Years After Completion	5 Years After Completion
Generated electrical energy at the generating end	0	4,451[a]	545	2,095	4,447	1,315	961	462
(Reference) Generated electrical energy at the transmission end	0	-	532	2,042	4,360	1,303	961	462

Source: Documents provided by JICA, documents provided by the PGI

[a] The planned amount of generated electrical energy at the generating end differed depending on where it was reported; 3,657 MWh in the ex-ante evaluation paper, and 5,585.5 MWh or 4,451 MWh in the preparatory survey report. Since JICA stated that 4,451 MWh was the correct amount, this figure was adopted in this report.

The reason why the amount of electricity generated fell below the target was the shutdown of the power plant due to various problems. The details are summarized in Table 3. The facility problems included damage to the headrace and water leakage from the water turbines. While the PGI has been repairing the headrace every time it is damaged, the damage caused by the typhoon in November 2020 is scheduled to be repaired pending the results of the investigation in the follow-up cooperation conducted during the ex-post evaluation. As for the water leakage from the water turbines, investigation of the cause (worn labyrinth seals supporting the shaft) and emergency measures such as replacing the drainage hose have been carried out. However, the biggest impediment is the fact that the PSA has not been approved as mentioned above,

causing the power plant to stop operating and most of the past electricity sales revenue to remain uncollected as accounts receivable. The operation of the power plant and the sale of electricity in the past were done as a temporary measure by the PGI to perform the PSA between the PGI and IFELCO. However, the ERC recommended IFELCO and the PGI, and IFELCO and the PGI accepted, to stop the operation of the power plant while the agreement remained unapproved by the ERC. The operation of the power plant was suspended in August 2020.

Given the good performance in 2017, when the facility was trouble-free, and the fact that the maximum output of the power plant has generally remained at the planned level (Table 4), it is likely that the project effects will materialize as expected once the PSA is approved and the damaged headrace is repaired.

Table 3: Periods when power generation was lower than planned and its reasons (Excerpts)

Period	Reasons
July–November 2015	The operation was 12 hours a day to build a shed next to the head tank.
September–October 2015	The operation was stopped for 40 days due to a blown fuse (overcurrent in the power plant switchboard).
January–April 2016	The operation was stopped for 4 months due to transformer troubles.
October–November 2016	The operation was stopped for 23 days due to damage to the headrace caused by a typhoon (repaired).
October 2016–August 2017	The plant was operated intermittently for 10 months due to damage to the settling basin caused by a typhoon (repaired).
February–July 2018	Only one generator was operated until IFELCO completed reconfiguration due to a current imbalance caused by an error in the power distribution setting on the IFELCO side.
August–October 2018	The operation was stopped for 3 months due to cracks in the headrace caused by heavy rains (repaired).
March 2019	The operation was stopped for one month due to a dry season drought.
November 2019–May 2020	The operation was stopped for 7 months due to water leakage from the water turbines (emergency measures (replacement of drainage hose, etc.) have been taken, but the labyrinth seals supporting the shaft need to be replaced).
August 2020–present (as of September 2021)	The operation was stopped due to the unapproved PSA by the ERC. One part of the headrace was damaged by the typhoon in November 2020, and the repaired cracks nearby were damaged again. The PGI will repair it pending the results of the investigation in the follow-up cooperation.

Source: Documents provided by the PGI

Table 4: Other data of the LMHPP and reference data of the AMHPP

	2015	2016	2017	2018	2019	2020
Maximum output (kW)	815	820	820	812	802	764
Plant load factor (%)[a]	7.69	29.53	62.68	18.53	13.54	6.51
Number of months in operation (month)	6	8	12	9	9	3
Unplanned outage hours (hour) [b]	2,557	1,425	867	1,117	1,659	65
Amount of electricity sold (MWh) [c]	532	2,042	4,360	1,303	961	462
Gross electricity sales (thousand pesos) [d]	1,926	7,394	15,784	4,716	3,478	1,673
Net electricity sales (thousand pesos) [e]	1,830	7,327	15,701	4,601	3,889	1,640
Of which collected	1,830	480	0	0	3,389	801
Reference: AMHPP						
Amount of electricity sold (MWh)	910	0	220	424	442	630
Electricity sales (thousand pesos)	3,294	0	796	1,535	1,600	2,281

Source: Documents provided by the PGI
[a] The planned plant load factor is 62.73% (from 2016 onward).
[b] Figures are only for months when the power plant was in operation.
[c] Figures include sales revenue not yet collected.
[d] Since the approval of the PSA has not been obtained from the ERC, the PGI used the unit price of the AMHPP (3.62 pesos/kWh) to calculate the amount.
[e] The amount after deducting the amount for electricity purchased from IFELCO (for internal consumption) when power generation is suspended.

3.3.1.2 Qualitative Effects (Other Effects)

As qualitative effects[11] for the effectiveness, the effects of the soft component, namely the development of the organization and human resources at the power plant and the optimization of RTCF operations, were realized as planned. According to the PGI, all the personnel of the power plant trained under the project[12] engage in the operation and maintenance of the plant, with no issues with their basic skills. As for the RTCF operation, all the trained personnel have left the jobs at the time of ex-post evaluation because they were job orders (temporary) employees. However, new personnel is also operating the RTCF using the guidelines developed by the soft component (see also "3.4.2 Technical Aspect of Operation and Maintenance").

3.3.2 Impacts

3.3.2.1 Intended Impacts

This study considers that the manifestation of one of the intended impacts of this project, which was anticipated in the ex-ante evaluation paper, "the conservation of rice terraces as a regional tourism resource," has been limited. However, the other impact, "the reduction of greenhouse gas emissions," has been partially attained, although this is only theoretically so.

[11] While in the ex-ante evaluation paper, "conservation of tourism resources (conservation of rice terraces) through electricity sales revenue" was stated as a qualitative effect, this was regarded as an impact-level effect due to its nature. As for the qualitative effect at the Effectiveness level, the effect of the soft component was confirmed.
[12] Excluding one person who passed away.

In addition, while not specified in the ex-ante evaluation paper, this evaluation also examined potential impacts of the project, such as "contribution to the stable supply of electricity to Ifugao Province" and "increased interest in renewable energy and increased use of small-scale hydropower," and found that they have materialized to some extent.

(1) Conservation of rice terraces as a regional tourism resource

There is no impact yet on the conservation of rice terraces from the electricity sales of this project. The RTCF is mainly used for repairs of small-scale irrigation systems in rice terraces, and three to eight projects are implemented every year, all of which have so far been funded by the AMHPP. The contribution from the LMHPP is limited. This is because the LMHPP has not collected a large portion of the revenue from electricity sales because the PSA has not been approved. As of March 2021, the amount transferred to the RTCF from the LMHPP was 450,000 pesos, which was transferred in FY2020 to cover the cost of three small-scale irrigation repair projects in the rice terraces. However, there has been no actual expenditure yet. According to the budget document of the PGI, these projects will be implemented in FY2021.

Table 5: The RTCF data of Ifugao Province (as of March 2021)

Unit: pesos

		FY2016–FY2020
Transfer from electricity sales revenue	LMHPP	450,000
	AMHPP	4,200,000
	Total	4,650,000
Expenditure for rice terrace conservation	LMHPPa	0
	AMHPP	1,757,756
	Total	1,757,756
Balance	LMHPP	450,000
	AMHPP	2,442,244
	Total	2,892,244

Source: Documents provided by the PGI

[a.] Expenditures are planned for FY2021.

(2) Reduction of greenhouse gas emissions

The impact of the project on the reduction of greenhouse gas emissions was estimated by calculating the CO_2 emission reduction as a theoretical value based on the amount of electricity generated (as shown in the table below). Although Ifugao Province had been using hydropower as its power source before the project, if we look at the Philippines as a whole, CO_2 emissions have been reduced to the extent that the LMHPP has been put into operation.

Table 6: Contribution to the CO_2 emission reduction by the LMHPP (theoretical value)

(Effect Indicator)

Unit: tCO_2/year

	Baseline	Target	Actual					
	2012	2018	2015	2016	2017	2018	2019	2020
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion	4 Years After Completion	5 Years After Completion
Contribution to the CO_2 emission reduction (at the generating end) [a]	0	2,167[a]	266	1,020	2,166	640	468	225

Source: Documents provided by JICA, documents provided by the PGI

[a.] While the target reads 1,780 tCO_2/year in the ex-ante evaluation paper, 2,167 tCO_2/year as stated in the preparatory survey report was used according to the instruction of JICA. Both target and actual values are calculated as Annual Power Generation x Emission Factor (0.487 tCO_2/MWh).

(3) Contribution to the stable supply of electricity to Ifugao Province

In Ifugao Province, electricity from the LMHPP and AMHPP is regarded as the baseload power source for the province, and the province expected to receive a stable power supply from these sources. The share of purchases from IPPs to electricity demand was 91% on average between 2015 and 2020, remaining unchanged from the time of the ex-ante evaluation. This was due to increased electricity demand and frequent shutdowns of the LMHPP. In 2017, when the plant operated relatively smoothly, the amount purchased from IPPs dropped to 79%, but due to subsequent problems, the percentage, which had once decreased, has increased again. Thus, we can say that this impact occurred during the period when the power plant was in operation. According to the PGI's Rate Impact Analysis (2021), if the LMHPP operates as planned and purchases from IPPs decrease, the generation cost would increase slightly, but the transmission cost would decrease, resulting in an overall cost reduction.[13] The AMHPP has been operating mostly stably except in 2016.

(4) Increased interest in renewable energy and increased use of small-scale hydropower

The impact of the project on the increased interest in renewable energy and increased use of small-scale hydropower can be seen in the fact that the project, together with the AMHPP, has become an example of small-scale hydropower in the region and has contributed to subsequent small-scale hydropower development. In other words, the two power plants have raised awareness and demand for small-scale hydropower in regions, and the DOE has issued 11 Hydropower Service Contracts in Ifugao Province with a total capacity of 450 MW. As of

[13] This analysis is based on IPP prices as of 2020, but since these prices fluctuate, the impact on power generation costs may also change.

March 2021, one of them was under construction, and ten were under feasibility study or detailed design.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment[14]

No negative impacts on the natural environments were observed.

Under the Philippine environmental laws, this project is exempted from the application of the Environmental Impact Assessment (EIA) due to its small output. The project was required to obtain the Certificate of Non-Coverage (hereinafter referred to as "CNC") certifying the exemption from the Department of Environment and Natural Resources (hereinafter referred to as "DENR"), and the PGI obtained the CNC in April 2013 and October 2014 (for the design change).

The construction works under this project were to minimize the impact of air pollution and noise caused by operating construction machinery and transporting materials and equipment, as most of the work was done by hand, and simple cableways (non-powered) were used to transport materials and equipment. Regarding the operation stage, the project selected oil-less equipment so that water pollution (caused by oil spills, etc.) would be prevented in the event of an accident caused by abnormal floods, etc. Although there were no houses in the vicinity of the power plant, and the plant was unlikely to generate noise and other problems, it was decided to prevent noise from leaking outside by making the powerhouse a reinforced concrete structure. In this way, the impact of the project on the natural environment was minor. Even so, in order to mitigate any negative impacts of the project, the DOE and the PGI decided to implement an environmental management plan. This plan included water quality conservation measures (drainage through settling basins in both construction and operation stages) and ecosystem conservation measures (keeping a flow rate of 0.136 m^3/s in a water reduction section of 1.8 km in the operation stage). These measures were implemented as designed and did not encounter any problems.

After the project completion, the PGI has been submitting an environmental monitoring report to the DENR once every six months. The report contains the results of monitoring in accordance with the environmental management plan.

(2) Resettlement and Land Acquisition

In addition to the planned acquisition of approximately 1.5 hectares of land, the project required the acquisition of the land above the tunnel (a 5-meter-wide area directly above the tunnel) due to design changes. The DOE and the PGI reported that the land was acquired in

[14] The environmental and social consideration guidelines applied to this project is the "JICA Guidelines for Environmental and Social Considerations" (2010). The environmental category was "B".

accordance with Philippine domestic procedures and JICA guidelines, and the acquisition and payment of compensation were completed without any problems. No resettlement occurred.

(3) Consideration for indigenous people

The area around the project site is inhabited by the Ifugao People with a unique culture in the Philippines. The area also has rice terraces designated as a World Heritage Site. For this reason, it was pointed out during the ex-ante evaluation that construction management would need to take into account the local conditions and customs. According to the DOE, the PGI, and the consultants for construction supervision, discussions were held regularly and on an as-needed basis to address the impact on local customs and traditions, and no problems were reported.[15]

(4) Others

The following positive secondary effects were observed among the target population.

- Agricultural production: The rehabilitation of the irrigation facilities (concrete lining) enabled two cropping seasons for rice, which was not possible before the project due to damage to the facilities.[16] In addition, additional water intake was made possible by installing pipes and holes in the spillway, and water intake from the headrace to vegetable fields was made possible by using small diameter hoses when there is surplus water or when the power plant is not in operation. All of these use surplus water and have no negative impact on hydropower generation. It was also observed that the concrete cover of the headrace was used for drying rice paddy.
- Aquaculture: Several areas adjacent to the headrace where water was stagnant have been developed by the PGI as small-scale tilapia (edible freshwater fish) aquaculture ponds for local consumption.
- Employment of local residents: In addition to the large number of residents employed as construction workers, ten people were hired to operate the completed power plant.
- Road: The access road was paved with concrete for the construction works under this project, which made it easier for local residents to transport their agricultural products to the market. Concrete roads are also used for drying rice.

[15] As explained above, the FPIC from the NCIP was obtained from the directly-affected barangays in 2014, and the fact that the certificate for the FPIC has not been obtained (see "3.2 Efficiency") does not mean that there is a negative impact on the social environment.

[16] Yield data was not available.

In addition, as part of the utilization of products and technologies developed by Japanese small and medium-sized enterprises (SME), water turbines and generators from SMEs in Fukushima Prefecture were used, which were highly evaluated by the DOE. However, the impact on the Japanese side could not be confirmed.

No negative impact of this project was observed.

In light of the above, while some positive impacts were observed, this project has achieved its objectives at a limited level. Therefore, effectiveness and impacts of the project are low.

Beneficiary areas for the rehabilitation of the irrigation facilities along the headrace

Drying rice paddy in the concrete area above the headrace

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

The operation and maintenance system of this project is mostly as it was expected at the time of the ex-ante evaluation. The PGI is responsible for operation and maintenance of the project facilities, under which the head of the Provincial Planning and Development Office (hereinafter referred to as "PPDO") serves as the plant manager and oversees the LMHPP (this project), the AMHPP, and the Ifugao Cultural Heritage Office (hereinafter referred to as "ICHO") that manages the RTCF. The Steering Committee consisting of relevant agencies from across the province oversees the plant manager. The personnel of the LMHPP includes one plant manager (the head of the PPDO), one electrical engineer, six plant operators, and three water guards.

At the time of the defect inspection (August 2016), the consultant recommended that the maintenance of the distribution lines be outsourced to IFELCO, which is licensed by the PGI for distribution line maintenance. This recommendation, based on the necessity of periodic maintenance such as clearing of vegetation under the distribution lines, was carried out by the time of the ex-post evaluation. On the other hand, the project has not carried out the recommendations made by the soft component consultant, namely (1) to make the temporary organization, ICHO, a permanent office of the province to accumulate know-how on rice terrace conservation activities and (2) to assign a full-time staff member to supervise both the mini-

hydropower plants and RTCF operations. Regarding (1), according to the PGI, the head of the ICHO (contract staff) and ten job orders staff are assigned, and the PGI plans to establish the ICHO as a permanent office in its organizational reform plan. Regarding (2), while there is no concrete prospect, the PGI recognizes that the assignment of a full-time supervisor is desirable. At the time of the ex-post evaluation, the current operation and maintenance system has not encountered any problems regarding either of (1) and (2), as there are a small number of conservation activities by the RTCF.

Thus, the system and structure for operation and maintenance are generally established.

3.4.2 Technical Aspect of Operation and Maintenance

Although there are no professional hydropower engineers in the PGI for the operation and maintenance of the LMHPP, the plant manager of the PPDO has been supervising the LMHPP and AMHPP since the project completion and has sufficient basic knowledge. Based on the interviews with the PGI and the site visit during the ex-post evaluation, it seems that the personnel at the LMHPP have the necessary skills of power plant operation, the basic skills of power plant maintenance, and the knowledge on flood risks and countermeasures. The "Likud Mini-hydropower Plant Operation & Maintenance Manual" prepared during the soft component of the project has also been used. However, the PGI demands the assignment of experts and further training in troubleshooting techniques for mechanical and electrical equipment. While no new training is planned by the PGI, the current status of the technical level and future requirements will be identified in the follow-up cooperation conducted during the ex-post evaluation.

As for RTCF management, according to the PGI, the ICHO staff have the capacity to manage fund allocations. The "RTCF Guideline" prepared during the soft component of the project has also been used.

Thus, although room for further improvement has been pointed out, the operation and maintenance techniques are generally established.

3.4.3 Financial Aspect of Operation and Maintenance

The operation and maintenance expenditure of the power plant is secured by the revenue from electricity sales and supplementary funds from the PGI. According to the PGI, there is no shortage in the budget for operation and maintenance costs, and the PGI plans to pay the cost of measures (repairs, etc.) in response to the recommendations to be made in the follow-up cooperation.

As explained above, while the contribution from the LMHPP to the RTCF is still limited, the contribution mechanism has been established, and thus it is expected that the contribution will be made as planned once the PGI is able to recover the uncollected revenue from electricity sales.

Table 7: Budget allocation from the PGI to the LMHPP

Unit: pesos

	FY2019	FY2020	FY2021
Operation and maintenance cost	808,979	2,148,147	1,657,572
Of which, remuneration for power plant staff	600,000	1,201,626	500,000
Remuneration for external electrician	0	179,388	239,184
Repair and maintenance	129,979	570,633	532,888
Others	79,000	196,500	385,500
Honorarium	0	60,000	60,000
Capital investment	0	140,000	100,000
RTCF contribution	0	450,000	0
Total	1,617,958	4,946,295	3,475,144

Source: Documents provided by the PGI

Thus, it can be said that the finances for operation and maintenance have been secured.

3.4.4 Status of Operation and Maintenance

It is commendable that the operation and maintenance of the LMHPP are carried out in accordance with the "Likud Mini-hydropower Plant Operation & Maintenance Manual," and that problems have been handled every time. The condition of the power generation facility is as described in "3.3.1.1 Quantitative Effects," and the problems that need to be solved at the time of the ex-post evaluation are water leakage from the water turbines (worn labyrinth seals need to be replaced)[17] and the damage to the headrace. Regarding the first issue, according to the PGI, while a quotation for new labyrinth seals has already been obtained from the Japanese manufacturer, it plans to place the order after collecting the accounts receivable from IFELCO (subject to the approval of the PSA).

A damaged part of the headrace.
A part that was repaired in the past was damaged again.

Regarding the second issue, while damage to the headrace has been repaired every time, the repair of the damage caused in November 2020 is pending the survey results of the follow-up cooperation. During the site visit in March 2021, it was observed that there was a lot of sediment inflow into the settling basin and the headrace. According to the PGI, this is because during floods, the stop log[18] of the intake either did not work due to floating or the water was not

[17] There was a possibility that the wear of the labyrinth seals was caused by sediment and dust being drawn into the water turbine, but at the time of the site visit in March 2021, there was no sediment in the head tank and no damage to the dust prevention screen in the penstock. According to the operator, the turbine runner and guide vanes were also undamaged, and the labyrinth seals were considered to be worn out due to friction.

[18] A square piece that is dropped into vertical grooves on both sides of the sluice gate to stop water flow.

stopped when the water level exceeded the upper limit, and slope failure occurred in the open-type headrace section (where slope failure was not expected). Moreover, the areas where slope failures had occurred were covered with wood, but the wood corroded and fell into the headrace in some places (the PGI is considering replacing the wood cover with concrete material). The accumulated sediment is removed by hand, and the power plant operation is sometimes suspended for this purpose. On the other hand, the head tank was in good condition.

Thus, some issues were present in the status of operation and maintenance.

In light of the above, some minor problems have been observed in terms of the current status. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to promote the use of domestically produced renewable energy by developing a mini-hydro electric power plant in Ifugao Province in northern Luzon Island, thereby contributing to the conservation of rice terraces as a regional tourism resource and to the reduction of greenhouse gas emissions. The relevance of the project is high because these objectives are consistent with the development plans and development needs in the Philippines and with Japan's aid policy. The power generation capacity of the Likud Mini-Hydro Power Plant (LMHPP) constructed under the project has been mostly maintained at the planned level. However, the plant has not been sufficiently operational due to the unapproved power supply agreement (PSA) and damage to civil engineering facilities such as the headrace. It is still out of commission at the time of the ex-post evaluation. Thus, no rice terrace conservation activities have been started using the income from electricity sales. Therefore, although there were some secondary effects, including the effects on agricultural aspects, the effectiveness and impact are judged to be low. The project outputs were mostly generated as planned, but the project cost and period exceeded the plan. Therefore, the efficiency is fair. The sustainability of the project effects is fair because the operation and maintenance of the project faced some problems due to the condition of some of the facilities.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) The power plant operation has been suspended because the PSA has not been approved. The PGI is recommended to take full advantage of the JICA follow-up cooperation conducted at the time of the ex-post evaluation to obtain necessary approvals as soon as

possible, including the approval of the PSA, so that the power plant can be restarted promptly. The DOE is also recommended to continue to cooperate fully with the PGI.

(2) While it is necessary to purchase labyrinth seals to stop water leakage from the water turbines, the procurement is planned using the accounts receivable (revenues from the sale of electricity so far) that will be collected from IFELCO after the approval of the PSA. If it is expected that the approval of the PSA will take more time, the PGI is recommended to use the provincial budget to procure the labyrinth seals without waiting for the collection of accounts receivable so that the water leakage from the turbines can be fixed as soon as possible and the plant will not be shut down again due to this problem after it is restarted.

(3) The PGI is recommended to promptly repair the damaged headrace and restart the power plant as soon as possible, based on the findings of the follow-up cooperation.

(4) The PGI is recommended to take measures against the inflow of sediment into the settling basins and headrace during heavy rains, including measures to prevent the floating of the stop log (a proposal based on the site observation is to replace the worn stop logs with high-density and durable ones, but it has to be confirmed that this is technically valid) and covering the headrace sections where sediment has flowed in due to slope failure. It is also desirable to proceed with the plan to replace the corroded wood that is currently used as a cover. It is necessary to ensure safety by restricting people's passage and stay in those places. In addition, preparations against floods should be made beforehand so that when the water level in the river starts to rise above the design discharge level of the facility, steps can be taken to shut down the power plant to prevent sediment from entering the head tank.

(5) The DOE is recommended to look for training opportunities for plant personnel to improve their mechanical and electrical troubleshooting skills and refer the PGI to training institutions. Even when outsourcing mechanical and electrical maintenance to specialized companies, the PGI requires that the staff have knowledge of the functions of each facility and component and skills to perform simple repairs.

4.2.2 Recommendations to JICA

JICA is recommended to continue to monitor the outstanding issues at the time of the ex-post evaluation and provide indirect support through the follow-up cooperation to the PGI's efforts to obtain the approval of the PSA and to improve the skills of the plant personnel.

4.3 Lessons Learned

Sufficient consideration for obtaining approvals for a mini-hydro electric power plant

In this project, the ERC approval of the PSA has not yet been obtained, causing uncollected revenues from sales of electricity (the portion operated temporarily without approval) and

shutdowns of the power plant. Although the preparatory survey report (outline design) listed the necessary permits and approvals and described the required time frame, there was no analysis of the risks in case of delays in different procedures. In particular, regarding the PSA, the report mainly covers the period up to the execution of the agreement between the PGI and IFELCO, and there is no clear assumption about the subsequent approval by the ERC, which is the main problem this project encountered.

Although the delay in obtaining the approval was due in part to external factors such as changes in the process during the application process, it was also affected by the fact that the PGI was not able to prepare the required documents promptly at the beginning of the application process. This, in turn, resulted in an increase in the number of required procedures over time, causing further delays. This suggests that the PGI was asked to take actions beyond its capacity. In addition, in the Philippines, each agency has strong authority. The efforts of the DOE (headquarters) and JICA in providing monitoring and advice did not lead to approval.

Local governments are expected to be the main actors in obtaining approvals for mini-hydro electric power plants. Thus, it is important, at the planning stage, to adequately estimate the realistic amount of time required for each procedure and risks in light of the capacity of the implementing entities. At the implementation stage, the relevant national government and JICA need to provide timely monitoring and advice by taking into account risk factors. Realistic planning is particularly important in cases where each agency has strong authority, as in the Philippines, because we can expect that attempting to intervene with the implementing entity would be difficult. It may be possible to consider incorporating support for obtaining permits and approvals into the work of consultants.

Republic of the Philippines

FY2020 Ex-Post Evaluation of Grant Aid Project

"The Project for Improvement of Equipment for Disaster Risk Management"

External Evaluator: Mitsue Mishima, OPMAC Corporation

0. Summary

This project aimed to improve the monitoring capacity for earthquakes and tsunamis and drainage measures by installing monitoring equipment for earthquakes and tsunamis and mobile drainage pumps throughout the Republic of the Philippines (hereinafter referred to as "the Philippines"), therefore reducing the human and economic damage caused by such disasters. The implementation of this project was well in line with the development plan and development needs of the Philippines and with Japan's ODA policy, and is highly relevant. The efficiency is fair because both the project cost and the project period exceeded the plan. Of the equipment maintained through this project, problems with the Philippine Institute of Volcanology and Seismology (PHIVOLCS) data transmission of the earthquake intensity meter and tsunami wave detector had not been resolved at the time of the ex-post evaluation. As for other equipment, due to the spread of the new coronavirus infection (COVID-19), travel restrictions in various locations made it difficult to replace batteries and parts and to deal with equipment malfunctions, and therefore some of the equipment seems not to be operating. However, the equipment has contributed to speedy observations and improved information on earthquakes and tsunamis in the past. As for the mobile drainage pumps of the Department of Public Works and Highways (DPWH), they have helped prevent flood damage or recovery after flood disasters through drainage, contributing to a reduction in human and economic damage. For these reasons, the effectiveness and impact are considered fair as a certain effect of the implementation of the project has been observed. Although sustainability was observed to a certain degree in terms of the institutional/organizational, technical, and financial aspects of the operation and maintenance system, at the time of the ex-post evaluation, there were some problems with equipment operation due to defects or failures. Therefore, the sustainability of the project effects is fair.

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

1. Project Description

Project Site

Equipment maintained by this project
(PHIVOLCS headquarters monitors, IPSTAR satellite communication equipment)

1.1 Background

The Philippines is one of the countries with the highest number of natural disasters in Southeast Asia. The economic and human damage caused by these disasters that occur almost every year is extensive, and the repeated damage to the social infrastructure has had a long-term impact on economic activities. The countries seriously affected by the Sumatra Earthquake and the Asian Tsunami in 2004 are improving their disaster prevention capabilities, measuring earthquakes, and disseminating earthquake information. However, monitoring networks, accurate data analysis systems, and warning systems for earthquakes and tsunamis are still under development in those countries.

Meanwhile, the Great East Japan Earthquake that occurred on March 11, 2011, resulted in tremendous damage to Japan and reminded the international community of the importance of disaster prevention. It is still a fresh memory that drainage in the tsunami-damaged area was a significant issue in the process of socio-economic recovery after the Great East Japan Earthquake, and at that time, the usefulness of mobile drainage pumps was reacknowledged.

In the Philippines, PHIVOLCS, a science and technological service institute of the Department of Science and Technology (DOST), develops and operates prediction technology for volcanic eruptions, earthquakes, tsunamis, and other related phenomena and is building a monitoring network. PHIVOLCS has been required to update seismic measurement equipment, enhance the monitoring network, and improve monitoring capabilities. In addition, for all disasters, including earthquakes, tsunamis, and floods, DPWH is responsible for "developing a disaster-resistant infrastructure" as a disaster prevention measure and "recovering and reconstructing infrastructure" after disasters. The deployment of mobile drainage pumps was decided upon to satisfy this need.

1.2 Project Outline

This project aimed to improve monitoring and drainage capacity for earthquakes and tsunamis by installing monitoring equipment and mobile drainage pumps throughout the Philippines, thus contributing to a reduction in the human and economic damage due to disasters such as earthquakes and tsunamis.

Grant Limit/Actual Grant Amount		1 billion yen / 1 billion yen
Exchange of Notes Date/Grant Agreement Date		March 2012 /June 2012
Executing Agencies		Philippine Institute of Volcanology and Seismology (PHIVOLCS) Department of Public Works and Highways (DPWH)
Project Completion		July 2014
Target Area		The Philippines
Contractors	Main Consultants	Oriental Consultants Co., Ltd.* Pacific Consultants Co., Ltd.
	Procurement Agent	Japan International Cooperation System (JICS)
	Equipment Procurement	Toyota Tsusho Corporation, NEC Corporation
Basic Design/Preparatory Survey		April 2012-March 2013
Related Projects		<JICA Technical Cooperation> Science and Technology Research Partnership for Sustainable Development (SATREPS) “Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines” (2010-2015) <Other Donors> United Nations Development Programme (UNDP), Agency for International Development (AusAID) “READY Project” (2006-2013)

*At the time of ex-post evaluation, Oriental Consultants Global Co., Ltd.

2. Outline of the Evaluation Study

2.1 External Evaluator

Mitsue Mishima, OPMAC Corporation

2.2 Duration of Evaluation Study

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

Duration of the Study: December 2020 – January 2022

Field Study: A field survey by an external evaluator was not conducted because of travel restrictions due to the rapid spread of COVID-19 in the Philippines.

2.3 Constraints during the Evaluation Study

As it was impossible for the external evaluator to conduct a field survey in the Philippines due to the rapid spread of COVID-19, executing agencies were interviewed online, and field survey assistants visited the project site. After analyzing the results of these activities and the materials related to the project submitted by the executing agencies, the external evaluator conducted a desk evaluation.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of the Philippines

This project was highly consistent with the development policy of the Philippines from the time of the ex-ante evaluation to the ex-post evaluation. Due to its geographical location and its characteristics as an island country, the Philippines is susceptible to typhoons and earthquakes. Thus, disaster prevention and preparedness has been prioritized in the development policy.

In The *Philippine Development Plan (2011-2016)* at the time of this project's ex-ante evaluation, a major policy to strengthen disaster risk reduction at both national and local levels was set. In the field of disaster risk management, *The National Disaster Risk Reduction and Management Framework (NDRRMF)*" and *The National Disaster Risk Reduction and Management Plan (NDRRMP) 2011-2028* were established in June 2011 and February 2012, respectively, based on the *Disaster Risk Reduction and Management Law (Republic Act No. 10121)* enacted in 2010 to reduce disaster risk. NDRRMP covers four thematic areas, namely "Disaster Prevention & Mitigation," "Disaster Preparedness," "Disaster Response," and "Disaster Rehabilitation and Recovery." The long-term goals, sector-wise outputs, action plans, etc. in each priority area are also included. This project addresses "Disaster Prevention & Mitigation," which is one of the priority areas of NDRRMP as a national high-level plan, to contribute to the promotion of the achievement targets "Enhance Monitoring, Forecasting and Hazard Warning," "Develop Disaster-Resistant Infrastructure," and "Recover and Reconstruct Infrastructure."

In the *Philippine Development Plan (2017-2022)*, at the time of the ex-post evaluation, the implementation of disaster vulnerability and risk assessments throughout the Philippines was to be carried out in one of the three pillar policies, "Reform to reduce inequality." Regarding flood control, the plan stated that flood control and dredging master plans would be updated, and that coordination with related agencies and management capabilities would be strengthened.

Regarding earthquake monitoring, PHIVOLCS has been continuously working to strengthen the network of earthquake intensity meters under the "Development and Management of

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

Philippine Earthquake Intensity Meter Network" project of the *National Earthquake Monitoring and Information Program*, and to improve the management of seismic stations under The *Management of Operations of Seismic Stations Project*. Regarding tsunami monitoring, PHIVOLCS has been promoting the development of tsunami monitoring and warning systems under the *National Tsunami Monitoring and Early Warning System Program 2021*.

3.1.2 Consistency with the Development Needs of the Philippines

This project was consistent with the development needs from the time of the ex-ante evaluation to the ex-post evaluation. In the Philippines, where there are many disasters such as earthquakes and tsunamis, there is a high need to improve the monitoring equipment for those disasters in order that the situation may be grasped accurately and that water can be drained after tsunamis and floods.

In the Philippines, which has many fault lines and about 300 volcanoes, and is one of the most earthquake-prone countries in the world, more than 60 seismic stations have been established. However, some earthquake monitoring equipment requires renewal, and the development of a telemetry network of strong motion seismographs has been delayed in comparison to other Asian countries. This has made it difficult to grasp the magnitude of seismic motion at epicenters and to issue early tsunami warnings. Furthermore, nationwide monitoring networks and simulation databases were not developed for tsunamis, and accurate and prompt warnings were not being issued, so the strengthening of the monitoring capabilities for earthquakes and tsunamis was necessary.

In addition, the Philippines has a high risk of tsunamis due to its geographical position, and flood damage caused by typhoons occurs frequently every year. Some of the country's drainage pump station facilities constructed in the past have deteriorated, and there are areas where the existing drainage pump stations cannot manage floods. Thus, it has been necessary to strengthen drainage measures.

3.1.3 Consistency with Japan's ODA Policy

The Country Assistance Policy for the Republic of the Philippines (April 2012) stated that support for infrastructure development to respond to disasters, including soft aspects, would be provided as a support measure for "Disaster Risk Reduction and Management" under the priority theme of "Overcoming Vulnerability and Stabilizing Bases for Human Life and Production Activity." In addition, the JICA Country Analysis Paper (March 2012) positioned the disaster prevention sector under "Overcoming Vulnerability" to improve hard and soft infrastructure and provide support for maintenance, with the organizational structure based on the capacity of the Local Government Unit (LGU) in the target area. Therefore, this project, which aimed to

improve earthquake and tsunami monitoring capabilities and drainage capacity, aligns with these policies.

Based on the above, this project has been highly relevant to the Philippines's development plan and development needs and as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

As shown in the table below, the sets of real-time earthquake and tsunami monitoring systems for PHIVOLCS and the eight DPWH mobile drainage pumps were prepared in the quantities as initially planned (refer to Attached Map 1 -3). Each piece of equipment was installed in various places by the Philippine side. However, the earthquake intensity meter could not be installed at the time of planned installation due to a transmission problem, and had not been installed at the time of the ex-post evaluation (further details are given in "3.3.1 Effectiveness", "3.3.1.1 Quantitative Effects (Operation and Effect Indicators), (1) Operational Status" below).

Table 1: Planned and Actual Project Outputs

Equipment	Quantity (Planned/actual were same) (At time of completion: 2015)
● **Real-time Earthquake Monitoring System**	
Broadband Strong Motion Seismometer (Real-time)	10 stations
Strong Motion Seismometer (Real-time)	36 stations
Earthquake Intensity Meter (Real-time)	240 sets
Earthquake Monitoring Software	2 sets
Earthquake Monitoring System	1 set
Headquarters Satellite Communication Equipment	1 set
● **Real-time Tsunami Monitoring System**	
Tsunami Wave Detector	19 stations
Tsunami Data Transmission Station	19 stations
Tsunami Monitoring System	1 set
Tsunami Simulation Database Development Hardware	1 set
● **Mobile Drainage Pumps**	
Mobile Drainage Pumps	8 units

Source: "FY2011 Preparatory Survey Report on The Project for Improvement of Equipment for Disaster Risk Management in the Republic of the Philippines" (February 2017) pp. 3-4 for the quantity. Regarding the installation status, questionnaire answers from PHIVOLCS (May 2021).

It was confirmed with PHIVOLCS at the time of the ex-post evaluation that the set of real-time earthquake monitoring systems and real-time tsunami monitoring systems had been installed at the locations generally as planned. After confirmation with DPWH, the actual placement of the mobile drainage pumps was partially changed from the planned locations. Considering the flood

damage in Manila city at the time of project implementation and that the area is an economic priority zone, the location of two mobile drainage pumps for Region V (Bicol), Legazpi City, Albay State and Region VI (Wester Visaya), Iloilo City, Iloilo were changed. To increase placement in Metro Manila, these were relocated to Los Baños, Laguna, in Region IV-A Calabarzon, an economic zone near Manila. This placement change was to respond to economies where there is a greater need for faster recovery.

Photo 1: Strong Motion Seismometer (Region VIII Leyte, Palo earthquake monitoring station)

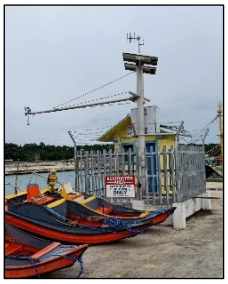


Photo 2: Tsunami Wave Detector (Region X Mindanao, Mati)

Photo 3: Mobile Drainage Pump (Region III Pampanga, San Fernando)

3.2.2 Project Inputs

3.2.2.1 Project Cost

As shown in the table below, the project cost was higher than planned due to the increased costs borne by the recipient side, and the total project cost exceeded the plan (100.6% of the plan). The cost of the installation of the earthquake intensity meter will be further incurred in the future. However, the sub-rating will be evaluated as fair even after it is added, as the total will not reach 150% of the planned total project cost.

Table 2: Planned and Actual Project Costs

Item	Plan (May 2012)	Actual[2] (August 2021)
Total Project Cost	1.005 billion yen	1.011 billion yen
Grant Aid	1 billion yen	1 billion yen
Recipient side[1]	5.71 million yen (2.87 million Philippine Peso)	11.38 million yen (4.97 million Philippine Peso[3])

Source: JICA documents, Questionnaire answers from executing agencies
Note 1: Exchange rates: 1PHP=1.99 yen (May 2012) for Plan, 1PHP=2.29 yen (Average between 2012-2017) for Actual
Note 2: Earthquake intensity meters have not been installed in various areas, and therefore the actual installation costs to be borne by the recipient side are not included.
Note 3: Sum of 4,834,337 Philippine Peso (PHIVOLCS) + 137,000 Philippine Peso (DPWH)

3.2.2.2 Project Period

The project period is from the conclusion of the E/N to the delivery of all equipment. The plan was from March 2012 to February 2015 (36 months), but the actual project period was from March 2012 to October 2015 (44 months), exceeding the plan by 8 months (122% of the plan). Therefore, the evaluation of the sub-rating is fair.

Looking at each planned and actual project period in Table 3, it can be seen that the main delays in the project period were due to PHIVOLCS equipment. According to PHIVOLCS, the port of Tacloban on Leyte Island, where equipment was to be installed, was damaged by the large-scale Yolanda typhoon in November 2013. As it was decided that there would be recovery and further expansion of the area, the equipment installation site needed to be changed from the initial location. According to the PHIVOLCS report, the Port Authority claimed that the equipment installation location as planned would affect port operation, and therefore a new site needed to be re-examined and negotiated, which was also a factor in the delay.

Table 3: Planned and Actual Project Period

Item	Plan	Actual	Difference
E/N Sign to End of Preparatory Survey	March 2012-March 2013 (13 months)	March 2012-March 2013 (13 months)	—
(PHIVOLCS) Bidding/Procurement to delivery of real-time earthquake and tsunami monitoring system	September 2013-February 2015 (18 months)	September 2013-October 2015 (26 months)	+8 months
(DPWH) Bidding/Procurement to delivery of mobile drainage pumps	June 2013-June 2014 (13 months)	June 2013-July 2014 (14 months)	+1 month

Source: JICA Documents, Questionnaire answers from executing agencies
Note: The definition of project completion is the time of delivery of the equipment according to plan

From the above, it can be seen that both project cost and project period exceeded the plan. Therefore, the efficiency of the project is fair.

3.3 Effectiveness and Impact[3] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

(1) Operational Status

[Real-time Earthquake and Tsunami Monitoring System Sets]

Table 4 shows the operational status of each piece of equipment at the time of the ex-post evaluation (as of August 2021). In addition to the earthquake intensity meters that had not been installed at the time of the ex-post evaluation, some of the equipment was out of operation.

[3] Sub-rating for Effectiveness is to be put with Consideration of Impacts.

Prior to this project, Japanese technical cooperation had been implemented so that PHIVOLCS could promptly convey highly reliable information to disaster prevention-related organizations through observing and analyzing earthquakes, tsunamis, and volcanoes with the support of the Science and Technology Research Partnership for Sustainable Development (SATREPS) "Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information" (2010-2015). As for the earthquake intensity meters, this project used the same equipment as procured in the SATREPS project and their operation was verified at test installations at two monitoring stations in the Philippines before shipment. However, when the equipment was installed in various places after delivery, it was found that it could not transmit data from most locations, and PHIVOLCS returned the installed equipment to headquarters. The response to the data transmission problem has been delayed, and at the time of the ex-post evaluation, it was still to be installed. Delivery of the project equipment to the recipient government has been completed, and although it was planned that most of the equipment installation and confirmation of the operating system was to be handled by the government who were to assure installation and the system operation being in place, operational support post installation has also been necessary.

A problem with the data transmission of the earthquake intensity meter was also found in the SATREPS project, however, this was resolved after adjustments were made to the data transfer speed. The Philippine side requested that JICA conduct a follow-up cooperation survey in 2017 to look into the problem with the earthquake intensity meter. At the time of this ex-post evaluation (FY2021), it was planned that the follow-up project would take the same measures as the SATREPS project to adjust the earthquake intensity meter.

Table 4: Operational Status of Equipment

Equipment	Number of installed pieces of equipment (Completed in 2015)	Number of pieces of equipment in operation (August 2021)	Operational Status (August 2021)
Broadband Strong Motion Seismometers (Real-time)	10	3 sets in operation	➢ 6 sets need replacement of batteries or spare parts, or onsite inspection and repairs, but operation has been suspended because of difficulties in sending staff under travel restrictions due to the spread of COVID-19. ➢ 1 set is out of order and will be repaired in Japan without the need for outside funds.
Strong Motion Seismometers (Real-time)	36	34 sets in operation	➢ 2 sets are out of operation. The Intensity Meter Module is out of order in one set, and a solution is being confirmed with the manufacturer. The building housing one set was damaged by a typhoon and the Intensity Meter Display Monitor broke at the end of last year. The response has been delayed with staff unable to access the site under travel restrictions due to the spread of COVID-19.

Equipment	Number of installed pieces of equipment (Completed in 2015)	Number of pieces of equipment in operation (August 2021)	Operational Status (August 2021)
Earthquake Intensity Meters (Real-time)	Uninstalled	—	➢ 200 locations were planned for installation, but installation has not yet taken place due to data transmission issues (40 units were spare units)
Tsunami Wave Detectors and Data Transmission Stations (Real-time)	19	6 locations in operation 6 locations recording data	➢ Only 6 locations can record and transfer data. Data cannot be transferred to the headquarters at 6 locations, but the tsunami wave detector is in operation and data is being recorded. ➢ The remaining 7 detectors are not operating nor is data being recorded due to problems with equipment and batteries, such as damage caused by a ship collision and the need for replacement parts. Response has been delayed with staff unable to access the site due to the spread of COVID-19.
Mobile Drainage Pumps (Owned by DPWH)	8	6 units in operation 2 units under repair	➢ The 2 units under repair were in Davao and Laguna. ➢ Of 6 mobile drainage pumps in operation, one is a broken submerge pump out of two pumps.

Source: JICA Documents, Questionnaire answers from executing agencies

According to project members, the time required for the implementation of the follow-up cooperation requested in 2017 was due to the significant time needed by JICA to communicate with equipment manufacturers and project members regarding countermeasures for the earthquake intensity meter problems. The follow-up cooperation scheduled for FY2020 was delayed by another year due to the spread of COVID-19.

When confirmation of the operational status of the earthquake and tsunami monitoring equipment (excluding the earthquake intensity meter) was made, it was found that some of the equipment that had been running at the start of operation was out of service as of August 2021. Reasons for this included unreplaced batteries, defective parts in need of replacement, and data transmission issues. At the time of the ex-post evaluation, the equipment operation rate was low, so it is assumed that data collection and analysis within the scope that was initially intended is currently limited. However, for broadband strong-motion seismometers, tsunami wave detectors, and data transmission stations, if staff can go onsite to replace batteries and parts, or if the data transmission issues can be resolved, those components can restart operation. As of August 2021, it was unclear when COVID-19 restrictions would be lifted and when staff would be able to go onsite. It was planned that the ongoing follow-up cooperation at the time of the ex-post evaluation would confirm the situation of these defects to the extent possible and propose countermeasures.

[Mobile Drainage Pumps]

According to DPWH, one mobile drainage pump was out of order at the time of the ex-post evaluation and two were under repair.

(2) Effect Indicators

[Real-time Earthquake and Tsunami Monitoring System Sets]

Table 5 shows the target achievements of the project effect indicators set at the time of ex-ante evaluation, according to PHIVOLCS and DPWH.

"1) Percentage of issuing moment magnitude[4] and epicenter information within 15 minutes after earthquakes of M4.5 and above" has not reached the target value of 60%, and according to PHIVOLCS, there is still a problem with the accuracy of the calculation. However, although there are still issues, compared to before project implementation, the project equipment has enabled the measuring and recording of large ground tremors, grasping of the magnitude epicenter, and more precise information of massive earthquakes, which are effects of this project.

Regarding "2) Time required for magnitude calculation of very large earthquakes useful for tsunami information and potential earthquake damage evaluation," there is no actual value as no massive earthquake has occurred since project completion. With the installation of the broadband strong-motion seismometer, the tsunami waveform of a huge earthquake can now be promptly transmitted to the headquarters. According to PHIVOLCS, the system allows for calculation within 15 minutes.

Regarding "3) Time required for confirmation of local tsunami after detection or observation of first tsunami wave," although the target value of less than 1 minute was not achieved, considering that the time taken before the project was 30 minutes to several hours, the project has clearly had the effect of speeding up tsunami wave detection. Prior to the implementation of this project, PHIVOLCS used the tide gauge of the National Mapping and Resource Information Agency (NAMRIA) to detect tsunamis, but this was for map creation and did not allow tsunami information to be grasped in real-time.

Regarding indicators 1) to 3), as mentioned in (1) Operational Status, there were 7 locations where the broadband strong-motion seismometers installed in this project were not operating and 7 locations where the tsunami wave detectors were also out of service at the time of the ex-post evaluation. Given that the equipment was expected to be in full operation and that the target value has not been achieved, the effect has also not been achieved. However, the indicators had improved compared to before project implementation. In hearings from the implementing agency of the SATREPS project and PHIVOLCS, guidance had been given in advance to improve monitoring and analysis capabilities using the earthquake and tsunami monitoring equipment of the SATREPS project also employed in this project. Improvement in

[4] An earthquake occurs when the underground rock is displaced, and the magnitude of the earthquake is calculated based on the scale of the displacement (area of the fault surface x displacement of the fault x hardness of the rock). This is called the moment magnitude. In general, the magnitude is calculated from the amplitudes of seismic waves recorded by seismographs, while the moment magnitude is effective for measuring large earthquakes. However, complex calculations using high-performance seismograph data are required to obtain the value. (https://www.jma.go.jp/jma/kishou/know/faq/faq27.html#8 Japan Meteorological Agency website / August 2021)

the earthquake and tsunami monitoring capabilities of PHIVOLCS staff, which is the purpose of this project, has been observed compared to the situation before the project.

Regarding "4) Number of tsunami simulation cases that can be processed per 6 hours," although the consultants of this project, PHIVOLCS, and those involved in the SATREPS project were questioned about the basis for setting the target value of 400 cases, the reason could neither be confirmed nor evaluated. According to those concerned, the number of cases was most likely based on the calculation capacity of the simulation software and the high-performance PC cluster (10 PCs) installed with the tsunami simulation database development hardware set. PHIVOLCS did not perform such simulation calculations, and the software introduced by this project does not use multiple PCs simultaneously but simulates on a single PC. According to PHIVOLCS, the SATREPS project has already accumulated a considerable number of tsunami simulation cases, but since there has never been a tsunami caused by a large-scale earthquake, there is no record or number of simulation cases. So far, it has not been used for training purposes either. At the time of the ex-post evaluation, some of the PCs procured in this project had already been updated by PHIVOLCS.

Table 5: Project Effect Indicators

Indicators	Baseline (2012)	Target (2018) (3 years after completion)	Actual (July 2021)
1) Percentage of issuing moment magnitude and epicenter information within 15 minutes after earthquakes of M4.5 and above	2%	60%	43% Percentage of issuing earthquake information (usual magnitude) of M4.5 and above within 15 minutes is 90% and more to total number of earthquakes every year from 2018 to 2020. Moment magnitude of M4.5 and above are calculated daily, however they are not always disclosed due to problems with calculation accuracy. Also, moment magnitude is calculated when sufficient stations can transmit waveform data to the center and then the usual magnitude information is later replaced with moment magnitude. PHIVOLCS has commissioned and incorporated other broadband stations to the system to improve the calculation. .
2) Time required for magnitude calculation of very large earthquakes useful for tsunami information and potential earthquake damage evaluation	N/A	Less than 15 minutes	Within 15 minutes The maintenance of the equipment is said to have made it possible to achieve the target value, but as there has been no huge earthquake that would cause a tsunami since equipment installation, the actual results have not been confirmed.
3) Time required for confirmation of local tsunami after detection or observation of first tsunami wave	30 minutes to several hours	Less than 1 minute	Less than 1 minute Only cases of small waves (less than 1m) had occurred up until the time of the ex-post evaluation.

Indicators	Baseline (2012)	Target (2018) (3 years after completion)	Actual (July 2021)
4) Number of tsunami simulation cases that can be processed per 6 hours	1 case	400 cases	According to PHIVOLCS, the SATREPS project calculated and accumulated a considerable number of tsunami simulation cases. It would be possible to perform simulations using the PC cluster of this project, or to install analysis software on each PC and run multiple PCs at the same time to calculate many cases, but there is no record of such simulations being performed.
5) Time required for pumping out inland flood in urban areas	Approx. 3 days	Approx. 1 day	Within 1-8 hours depending on the location

Source: JICA documents, Questionnaire answers from executing agencies

[Mobile Drainage Pumps]

The time required for mobile drainage pumps to drain varies from 1 to 8 hours, depending on the flood damage in each region. However, the actual results up to the time of the ex-post evaluation show that the targeted drainage within one day had been achieved in pumping out inland water in urban areas.

3.3.1.2 Qualitative Effects (Other Effects)

According to PHIVOLCS, the following points were pointed out as qualitative effects. Earthquake and tsunami information is provided to domestic and overseas disaster prevention related organizations (Office of Civil Defense of the Department of National Defense, National Disaster Risk Reduction and Management Council, and South China Sea Tsunami Advisory Center (SCSTAC)).

[Strengthening Earthquake Monitoring Capacity]

The earthquake monitoring network has been strengthened to disseminate monitoring information when an earthquake is detected. For earthquakes of M4.5 and above, details of moment magnitude and occurrence status are now summarized in the earthquake status report, providing vital information on whether aftershocks should be expected during rescue operations in the affected area.

Data from operating tsunami wave detectors is also provided to other governmental organizations to help monitor volcanic activity and typhoon tracks. For example, a water level survey by the Nasugbu, Bauan, and Batangas Maritime Bureaus in the first half of 2020 revealed that changes in water levels could be associated with Taal volcanic activity at that time. Sea level data was also provided to NAMRIA in regard to the course of typhoons in the Philippines.

[Strengthening Tsunami Monitoring Capacity]

Although there have been no major earthquakes that have generated tsunamis up until now, PHIVOLCS evaluates the threat of tsunamis and issues tsunami information when small tsunamis occur due to maritime earthquakes. For tsunami monitoring, tsunami simulation software is now used to perform real-time tidal current analysis in cooperation with NAMRIA. In addition, this project has allowed earlier detection of tsunamis and more accurate calculations of tsunami conditions, and, as a result, it has become possible to give more precise instructions through the early warning system on the occurrence of a tsunami.

3.3.2 Impacts

3.3.2.1 Intended Impacts

Regarding the impact of "contributing to reducing human and economic damage caused by disasters such as earthquakes and tsunamis," according to DPWH, mobile drainage pumps are removing excess water from drainage channels during floods to minimize flood areas.

At DPWH's San Fernando office, the project's mobile drainage pumps are the only ones in the area and are used during major floods on Manila North Road in Pampanga. The site is near a commercial complex, and without a mobile drainage pump, significant damage could be caused by floods. When a big disaster occurs in Metro Manila, the mobile drainage pump of the San Fernando regional office will be used. The mobile drainage pumps located in Metro Manila have helped to pump out water at drainage pump stations. At the DPWH Davao branch, mobile drainage pumps are also used to clear gutters and help prevent floods.

Mobile drainage pumps have also been used as an emergency power source in a disaster, which is an example of other usages. DPWH's regional office on Leyte Island used them as a power source for offices when a magnitude 6.5 earthquake occurred in July 2017 and as a power source for the Maintenance Division in the Ursula typhoon in December 2019. In March 2021, they were used as a standby power source for the hotel where the country's president was staying.

3.3.2.2 Other Positive and Negative Impacts

The mobile drainage pumps conducted quick drainage, which aided the smooth flow of road traffic. No other major positive and negative impacts have been confirmed.

Among the equipment of this project, the data transmission problem of PHIVOLCS's earthquake intensity meter and tsunami wave detector, which was discovered after project completion, remained unresolved at the time of the ex-post evaluation. With travel restrictions in various places due to the spread of COVID-19, some of the other equipment is also out of service because batteries and parts cannot be replaced, or the equipment malfunction needs to be handled onsite.

However, much of the equipment, other than the uninstalled earthquake intensity meters, has been operating, which has helped provide information to each disaster response organization. Some DPWH mobile drainage pumps were under repair at the time of the ex-post evaluation. Still, they are helping with the recovery of flooded sites or preventing floods, therefore contributing to reducing human and economic damage. This project has achieved its objectives to some extent. Thus, the effectiveness and impacts of the project are fair.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

It is considered that the organizational structure required for the operation and maintenance of the project's equipment is sustainable to a certain point.

At PHIVOLCS, the Seismological Observation and Earthquake Prediction Division (SOEPD) manages the operation and maintenance of the equipment procured by the project, as in the ex-ante evaluation, and the number of staff is 71. According to SOEPD, the organizational structure is partially sufficient. New technical staff are needed for more effective maintenance, and PHIVOLCS technical staff directly supervise and employ personnel to carry out the designated technical work, although only for a specific period. In addition, automated data processing is being promoted to review daily monitoring tasks, to reduce workload and minimize human error.

According to those in charge of the operation and maintenance of the DPWH mobile drainage pumps, the equipment management unit of each regional office equipped with a mobile drainage pump has about six staff members, and DPWH's self-evaluation shows that this number is sufficient. DPWH has assigned the necessary staff for mobile drainage pumps, and no problems have been observed.

3.4.2 Technical Aspects of Operation and Maintenance

No problems have been observed in the technical aspects of this project's equipment operation and maintenance on a daily level.

According to PHIVOLCS's self-evaluation, there was an operation and maintenance orientation given by the supplier and technology transfer from the contractor to specific staff members. Still, as those staff members have gradually been promoted or have retired, technology transfer has been inadequate for the troubleshooting skills of new staff members. Regarding this, each unit has begun to identify the necessary technology and replenish personnel by outsourcing.

DPWH self-evaluates that the technical capabilities of the mobile drainage pump engineers and mechanics are sufficient. Preventive maintenance is carried out based on the annual maintenance schedule and budget, and since the staff have good knowledge of maintenance and training, there seem to be no technical issues.

3.4.3 Financial Aspects of Operation and Maintenance

The budget required for the daily operation and maintenance of the project equipment is generally provided.

According to PHIVOLCS SOEPD, the annual operation and maintenance budgets after 2017 were between 6-8 million Philippine pesos. The budget covers the daily operation and maintenance costs, such as the procurement of spare parts and repairs. According to answers to the questionnaire provided by the DPWH headquarters and each regional office, the annual budget required for the maintenance of the mobile drainage pumps is allocated to the maintenance unit of each regional office.

3.4.4 Status of Operation and Maintenance

The operational status of each piece of equipment at the time of the ex-post evaluation was as shown in Table 4. Regarding the equipment of PHIVOLCS, when the equipment under the jurisdiction of PHIVOLCS Headquarters, Region VIII Regional Office (Leyte Island), and Region X Regional Office (Mindanao Island) was inspected onsite, all were operating without problems.

DPWH's mobile drainage pumps were directly inspected at two locations in Metro Manila, the Pampanga Regional Office, the Leyte Island Regional Office, and the Davao Regional Office. The mobile drainage pump located in Davao was out of order, as reported in the response to the questionnaire, but the others were in operation. The mobile drainage pump located in Bicutan in Metro Manila had one faulty submersible pump, but the other one was in operation.

The operation and maintenance status of the equipment confirmed at the time of the ex-post evaluation is as follows.

- According to PHIVOLCS, the budget for daily maintenance is covered but it is difficult to obtain spare parts from the supplier when needed.
- Some of the replacement batteries and parts have already been procured, but due to the spread of COVID-19, access to the site is restricted, and at the time of the ex-post evaluation (August 2021), replacements had not yet been completed. As the delivery procedure has already been initiated, the amount of equipment reoperating should increase once the replacement of batteries and parts takes place at the sites.
- Regarding the two mobile drainage pumps under repair, the pumps are being repaired in Laguna, and the inverters and drainage pumps are being repaired in Davao. Replacing the hose of the drainage pump requires time, as the hose cannot be procured in the Philippines.

As mentioned above, a certain degree of sustainability has been observed in the institutional aspects, technical aspects, and financial aspects of the operation and maintenance system. However, some equipment is not in operation due to defects or breakdowns, the JICA follow-up

cooperation was still underway at the time of the ex-post evaluation, and measures such as the procurement of spare parts are also still being implemented. Therefore, the status of improvement cannot yet be confirmed. As some minor problems have been observed in the institutional aspects, technical aspects, and financial aspects of the operation and maintenance system, the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to improve the monitoring capacity for earthquakes and tsunamis and drainage measures by installing monitoring equipment for earthquakes and tsunamis and mobile drainage pumps throughout the Philippines, therefore reducing the human and economic damage caused by such disasters. The implementation of the project was well in line with the development policy and development needs of the Philippines and Japan's ODA plan and is highly relevant. The efficiency is fair because both the project cost and the project period exceeded the plan. Of the equipment maintained through this project, problems with PHIVOLCS data transmission of the earthquake intensity meter and tsunami wave detector had not been resolved at the time of the ex-post evaluation. As for other equipment, due to the spread of COVID-19, travel restrictions in various locations made it difficult to replace batteries and parts and to deal with equipment malfunctions, and therefore some of the equipment seems not to be operating. However, the equipment has contributed to speedy observations and improved information on earthquakes and tsunamis in the past. As for the mobile drainage pumps of the DPWH have helped prevent flood damage or recovery after flood disasters through drainage, contributing to a reduction in human and economic damage. For these reasons, the effectiveness and impact are considered fair as a certain effect of the implementation of the project has been observed. Although sustainability was observed to a certain degree in terms of the institutional/organizational, technical, and financial aspects of the operation and maintenance system, at the time of the ex-post evaluation, there were some problems with equipment operation due to defects or failures. Therefore, the sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(DPWH)

As with PHIVOLCS, it takes time for regional offices to procure parts. For parts that can be replaced in advance, such as batteries, a spare parts management plan for each site should be reviewed to include early replacement at the timing of regular inspections.

4.2.2 Recommendations to JICA

For equipment that is not operating, such as PHIVOLCS earthquake intensity meters and tsunami wave detectors, JICA should support coordination with all Japanese parties (including follow-up cooperation implementers, equipment developers, manufacturers, etc.) through the follow-up cooperation underway in FY2021, in order to promote the implementation of countermeasures, and aim for early operation.

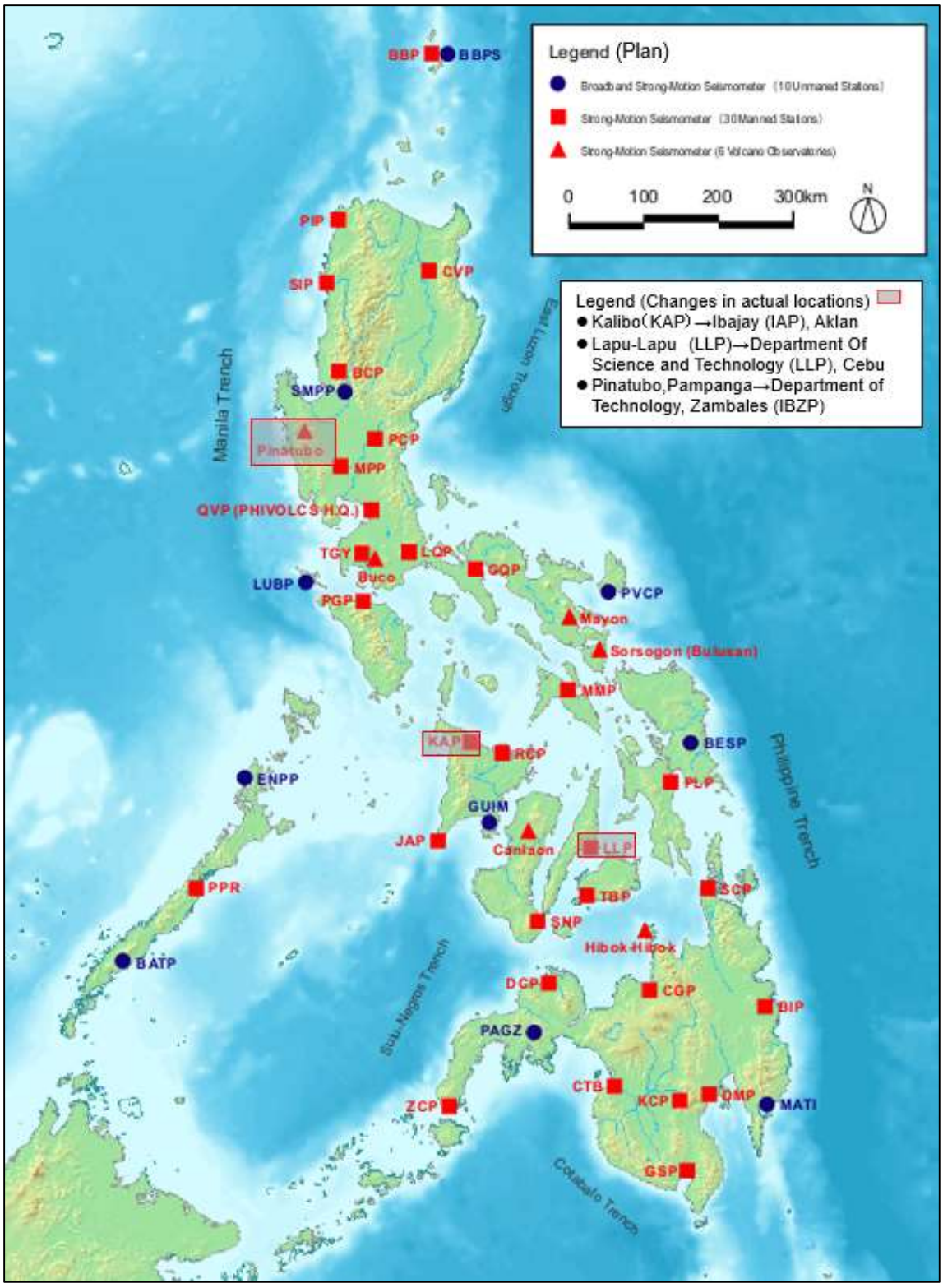
4.3 Lessons Learned

Early Identification and Consideration of Countermeasures for Communication Infrastructure Risks in Building Data Transmission Networks

For the operation of PHIVOLCS earthquake and tsunami monitoring equipment sets, the communications system is a prerequisite and is a requirement for proper functioning. There are various issues to be examined, such as forecasting the development of communication systems and the compatibility between evolving communication equipment and existing equipment. Adopting the right outlook for this is a challenge. In addition, when building a wide-ranging data transmission network in an island country such as the Philippines, that includes less-accessible areas, problems unique to each region can be expected, each requiring more careful consideration and a different implementation structure.

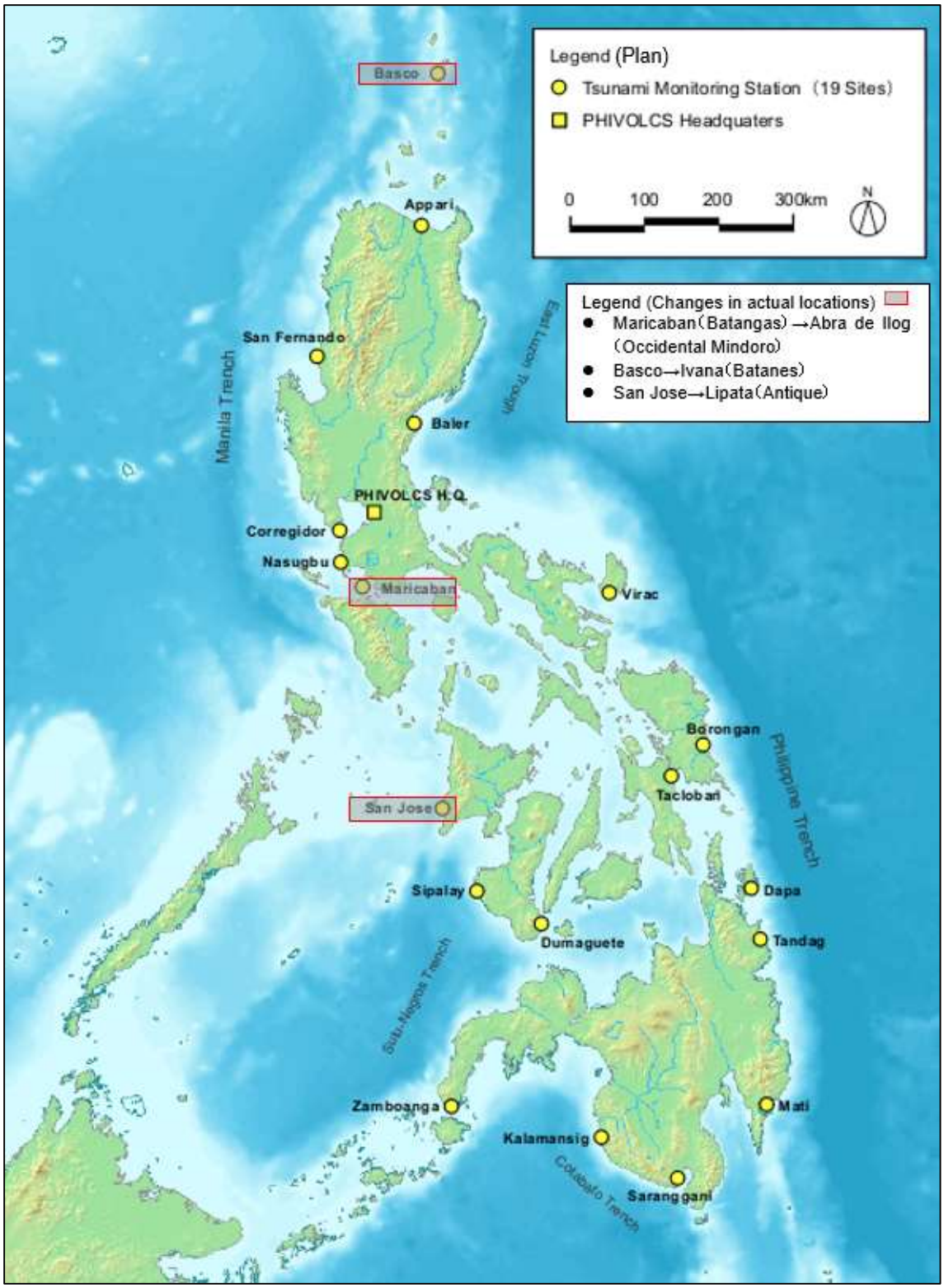
Detailed consideration of assumed risks and the presentation of countermeasures when risks occur should be included at the stage of the preparatory survey. The project plan during the project implementation period can include the soft component in terms of : (1) Including support for equipment installation and communication tests, (2) Identifying risks that may occur after equipment installation and proposing countermeasures, (3) For communication equipment such as that used in this project, a location for equipment suppliers to inspect the operation should be selected with consideration to the differences in communication environments and the supplier should conduct inspections more carefully with a longer inspection period.

End



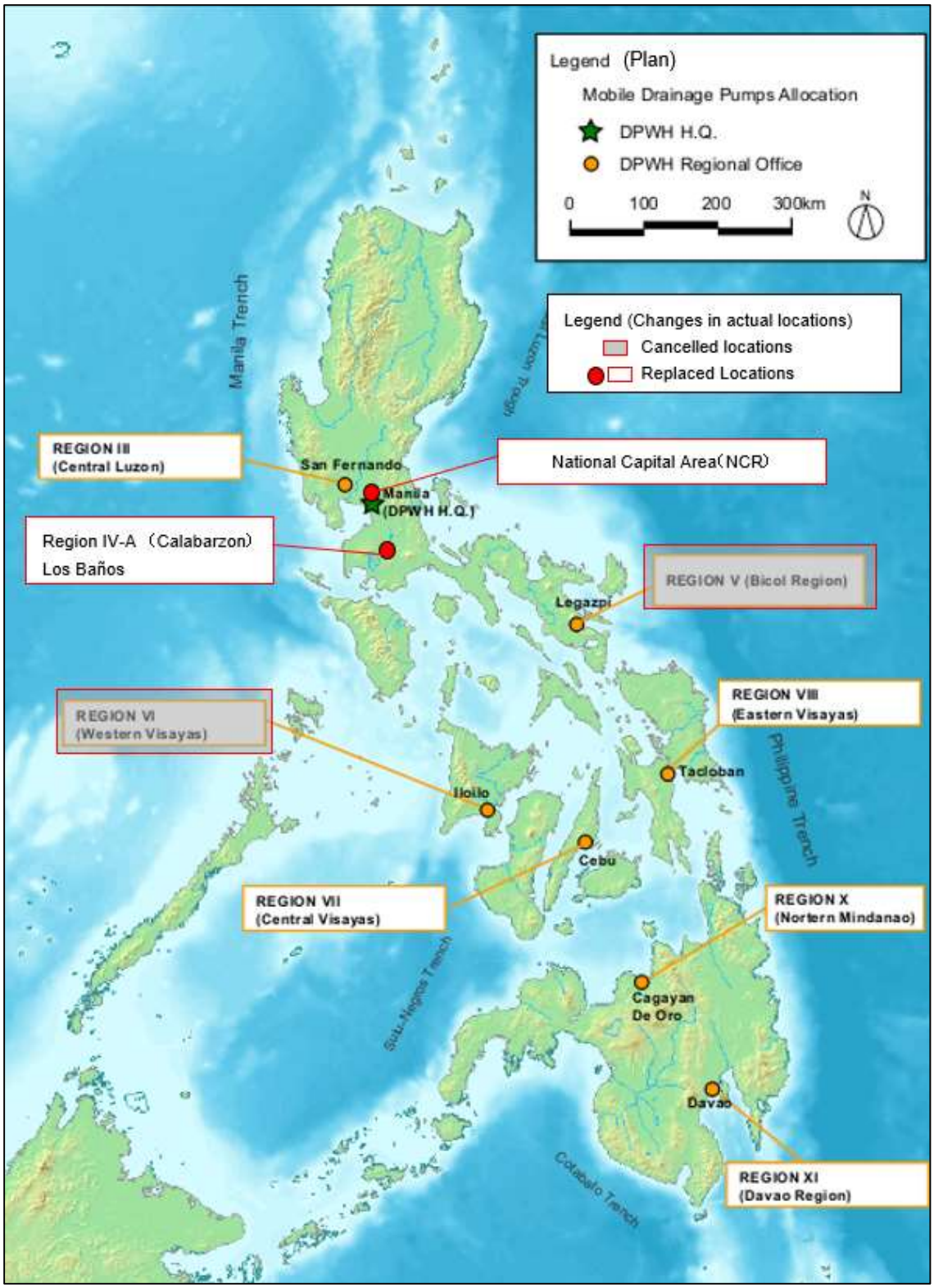
Source: JICA "Preparatory Survey Report on the Project for Improvement of Equipment for Disaster Risk Management in Republic of The Philippines" (2013). Actual locations were from other JICA documents.

Attached Map 1: Target Sites of PHIVOLCS Realtime Earthquake Monitoring System



Source: JICA "Preparatory Survey Report on the Project for Improvement of Equipment for Disaster Risk Management in Republic of The Philippines" (2013). Actual locations were from other JICA documents.

Attached Map 2: Target Sites of PHIVOLCS Realtime Tsunami Monitoring System



Source: JICA "Preparatory Survey Report on the Project for Improvement of Equipment for Disaster Risk Management in Republic of The Philippines" (2013). Actual locations were from other DPWH and JICA documents.

Attached Map 3: Target Sites of DPWH Mobile Drainage Pumps

The Republic of the Philippines

FY2020 Ex-Post Evaluation Report on Technical Cooperation Project

"Capacity Development in Public-Private Partnership (PPP) Project Formulation"

External Evaluator: Naomi Nakai, Keishi Miyazaki, OPMAC Corporation

0. Summary

The objectives of this project were to accelerate the infrastructure development necessary for the country's economic development by enhancing the capacity for Public-Private Partnership (PPP) project formulation between the Philippine government and implementing agencies. In the Philippines, under severe fiscal circumstances, foreign direct investment has tended to be low due to delays in infrastructure development, which have hindered economic growth. Therefore, the Philippine government has been working to accelerate infrastructure development by utilizing PPP to tap the private sector's efficiency, innovations and financial capital. The objectives of this project were consistent with the Philippines' development policy and development needs as well as with Japanese aid policy. However, the relevance is evaluated to be fair as there are issues in the setting of logical pathways and indicators leading from the project activities to the overall goal, as well as the project design in areas such as the implementation structure. At the time of project completion, it was considered that the acquisition of knowledge and the strengthening of implementing agencies' capacities through training had generally been made, except for some agencies, although they had not yet been institutionalized. In addition, although the indicators of the overall goal have been generally achieved, the degree of the contribution of this project is unclear. On the other hand, although there are some issues in capacity improvement of the implementing agencies and the PPP Center, it has been confirmed that the effect is manifested to some extent. Based on the above, the effectiveness and impact are considered to be fair. Although the project cost was mostly as planned, the project period exceeded the plan, therefore, the efficiency is fair. Regarding sustainability, new methods and institutional arrangements have been introduced after project completion in terms of systems and structure. None of these affect the sustainability of this project but instead are considered desirable from the perspective of the sustainability of the project effects. No major problems have been observed in the policy and political commitment and the institutional/organizational, technical, or financial aspects. Therefore, the sustainability of the project effects is high.

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

1. Project Description

Project Location

Operation training at Baguio Sewage Treatment Facility
(Photo provided by PPP Center)

1.1 Background

In the Philippines, foreign direct investment has tended to be lower than in other ASEAN countries due to delays in infrastructure development, which have hindered economic growth. The President Aquino administration, formed in 2010, declared in the Philippine Development Plan (2011-2016) that public investment in 2016 would be increased to 2.7%[1] of GDP, which was thereafter raised to 5.0% in a 2013 review. The administration announced a policy emphasizing PPP, which could develop large-scale infrastructure by utilizing private funds as an essential means of achieving the goal. Against this background, JICA collected and analyzed information on the current status and issues of PPP in the Philippines and made policy recommendations through two surveys. This project was implemented as a technical cooperation project related to the ODA loan of the Development Policy Support Program (Investment Climate) to respond to the issues.

[1] From 2000 to 2010, the average public investment as a percentage of GDP was 2.1%.

1.2 Project Outline

Overall Goal		An improved PPP project formulation process will contribute to infrastructure development necessary for sustainable economic development of the Philippines.
Project Purpose		Capacity of the GOP (Department of Public Works and Highways: DPWH), Department of Transportation (DOTr)[2], Department of Health (DOH) will be improved to formulate PPP projects.
Outputs	Output 1	The selection of PPP candidate projects will be enhanced with added consistency and strategic consideration.
	Output 2	PPP project formulation capacity of the following Implementing Agencies (DPWH, DOTr, DOH, Iloilo City LGU.) will be strengthened.
	Output 3	A policy discussion is facilitated relative to the GOP support mechanism for PPP financing.
Total Cost (Japanese Side)		504 million yen
Period of Cooperation		November 2014 – December 2017 (including extended period: January 2017 – December 2017)
Target Area		The Republic of the Philippines
Implementing Agency		Counterpart: PPP Center, DOH, DPWH, DOTr, Iloilo City LGU
Other Relevant Agencies / Organizations		Department of Finance (DOF) - Target agency of activities for Output 3.
Consultant in Japan		Joint Venture: Deloitte Tohmatsu Financial Advisory LLC (Japan) / Castalia Limited (New Zealand)
Related Projects		[ODA Loan] Development Policy Support Program (Investment Climate) (Signing of Laon Agreement: October 2012) * This project was a technical cooperation project related to the above ODA loan project. [Other Donors] Asian Development Bank (ADB), “Strengthening Evaluation and Fiscal Cost Management of Public-Private Partnerships” (2014 – 2017) (Technical Assistance)

2. Outline of Evaluation Study

2.1 External Evaluator

Naomi Nakai (OPMAC Corporation)

Keishi Miyazaki (OPMAC Corporation)

2.2 Duration of Evaluation Study

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

[2] DOTr was Department of Transportation and Communications (DOTC) at the start of the Project.

Duration of the Study: December 2020 – January 2022

Duration of Field Study: February 1, 2021 – March 26, 2021

2.3 Constraints during the Evaluation Study

With difficulties in conducting face-to-face interviews with the implementing agencies and project members due to the outbreak of the coronavirus disease (COVID-19), information was mainly gathered through online interviews. However, in some areas where communication systems were poor, there was the cancelation of online focus group interviews, and thus there were certain restrictions on the availability of information.

In addition, since no ex-ante evaluation was conducted for this project, project information, especially information on the project planning stage, was limited compared to the usual ex-post evaluations of technical cooperation projects. The lack of information was supplemented by interviews with JICA officials who were familiar with the project at the planning stage and other materials provided by JICA. However, access to some information remained limited[3].

3. Results of the Evaluation (Rating: C[4])

3.1 Relevance (Rating: ②[5])

3.1.1 Consistency with the Development Plan of the Philippines

The project was consistent with the development plan of the Philippine government both at the time of project planning and at the time of project completion. In the Philippine Development Plan (2011-2016) at the time of planning, accelerating infrastructure development was positioned as an important strategy and as one of the five key strategies. Under the President Aquino administration, the goal was to increase the ratio of public infrastructure investment to 2.7% of GDP in 2016. One of the means to achieve that goal was to develop large-scale infrastructure by actively introducing PPP which taps the private sector's efficiency, innovations and financial capital.

At the time of project completion, the Philippine Development Plan (2017-2022) listed 15 strategies, including the acceleration of infrastructure development. In addition, it was presented in the 10-point Socioeconomic Agenda announced by President Duterte when he took office in 2016 that PPP plays an essential role in public investment, and therefore the administration would accelerate annual public expenditures for infrastructure to account for 5.0% of GDP, with PPP playing a key role.

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[3] The data and information collection in this ex-post evaluation was made through (i) the questionnaire survey with 6 agencies (PPP Center, DPWH, DOTr, DOH, Iloilo City LGU, NEDA), (ii) the online interview survey with 8 agencies and persons concerned (PPP Center, DPWH, DOTr, DOH, Iloilo City LGU, Civil Aviation Authority, JICA, JICA experts of the project), and (iii) Focus Group Interview with 2 agencies (PPP center, DPWH) in addition to the review of existing project related documents.

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

[5] ③: High, ②: Fair, ①: Low

After President Duterte took office, expenditure for infrastructure reached an average of 6.3% of GDP in 2017-2018. This is more than double the average of 3.0% during the previous regime, indicating an acceleration in infrastructure development. Under the President Duterte administration, more priority to infrastructure spending has been given in the national budget, such as for the promotion of the Build Build Build (BBB) program[6]. In addition, under this administration, the Philippine government has raised the upper limit of the budget deficit to GDP ratio from the previous 2% to 3% in light with low-interest rates worldwide. As a result, government borrowing such as ODA is directed more toward infrastructure spending. Meanwhile, 30 of the government's 104 flagship projects will be implemented as PPP (as of August 2020), which remains as an important means for the government to achieve its goal of accelerating infrastructure development.

Table 1: Average Infrastructure Expenditure and Budget Deficit (as a percentage of GDP)

Unit: %

	Average Infrastructure Expenditure	Budget Deficit (as a percentage of GDP)
President Aquino administration (2011-2016)	3.0	1.6
President Duterte administration (2017-2018)	6.3	2.7

Source: Department of Budget Management, Philippines

The President Duterte administration has come to see the use of PPP as an effective tool to primarily reduce the overconcentration of population in the capital and realize inclusive growth through job creation and infrastructure development in various regions. The PPP Center, which is the counterpart of this project, is a government agency responsible for policy and institutional design, coordination with related organizations, project formation, advice on implementation and the monitoring, etc., of PPP projects in the Philippines, and is an attached agency of the National Economic and Development Authority (NEDA). In 2017, the PPP Center announced the “Local PPP Strategy” and has been strengthening the support of implementing agencies such as local governments.

3.1.2 Consistency with the Development Needs of the Philippines

Consistency with development needs was high both at the time of project planning and project completion. The development needs of this project at the time of planning were as described in “1.1 Background.” This ex-post evaluation sought to confirm whether the project purposes of (1) Infrastructure development through PPP (Overall Goal), (2) Enhancement of PPP project formulation capacity of the implementing agencies (Project Purpose, Output 1 and Output 2)

[6] The BBB Program is a development project that aims to accelerate spending on infrastructure, promote growth, create jobs, and develop industries to uplift the lives of Filipinos by targeting sectors such as railways, airports, industrial parks, energy, water sources, irrigation, flood management, and redevelopment.

and (3) Development of a system to promote the entry of the private sector into PPP projects (Output 3), met the needs of the Philippines at the times of project planning and project completion.

(1) Infrastructure Development through PPP

As mentioned above, infrastructure development through PPP was a key strategy under the President Aquino administration at the time of project planning. It was also being emphasized by the President Duterte administration when the project was completed.

(2) Enhancement of PPP Project Formulation Capacity of the Implementing Agencies

In the existing studies[7] before project implementation, issues with project formulation capacity and implementation capacity were pointed out, such as insufficient development of good project candidates and many delays in infrastructure development through PPP due to the limitation of the implementing agency's PPP project implementation capacity. In this project, the capacities of target implementing agencies were evaluated, and a program suitable for each, based on their capacity at that time, was provided. The programs did not solve all the issues pointed out in the above existing studies, however, they also responded to issues recognized at the time of project planning, as described later in terms of "Effectiveness."

(3) Development of a System to Promote the Entry of the Private Sector into PPP Projects

At the time of project planning, the existing surveys pointed out the need for a system that would allow the private sector to enter an appropriate competitive environment. In addition, during the implementation of the project, JICA experts examined the guarantee system necessary to promote the entry of the private sector. However, as described later in "Appropriateness of the Project Plan and Approach," it was not possible to approach improvement of this system in this project. Therefore, although it is considered that there was a need, there were issues in the project plan and approach as described later.

3.1.3 Consistency with Japan's ODA Policy

The purpose of this project was consistent with the Country Assistance Program for the Philippines (April 2012) which contained "Sustainable Economic Growth through Promotion of Investment." In addition, it was also in line with the goal of JICA's country analysis paper for the Philippines (March 2012), which stated that it would provide technical support to improve the PPP system and strengthen capacity and comprehensively support infrastructure development under "Sustainable Economic Growth through Promotion of Investment."

[7] The study on improvement of the PPP system (FY2011) and the study on supporting institutional development of PPP (FY2013).

3.1.4 Appropriateness of the Project Plan and Approach

Some issues were recognized in setting the logic and indicators of the Project Design Matrix (PDM), management of the PDM following scope changes, the position of the project as a technical cooperation project related to ODA loan, and collaboration with ADB.

3.1.4.1 Setting of the Logic and Indicators of the PDM

The outputs described in the PDM are: (1) Selection of PPP candidate projects will be enhanced with added consistency and strategic consideration, (2) PPP project formulation capacity of the following Implementing Agencies (DPWH, DOTr, DOH, Iloilo City LGU) will be strengthened, and (3) A policy discussion is facilitated relative to the GOP support mechanism for PPP financing. Through these three outputs, the project aimed to improve the capacity of the GOP (DPWH, DOTr, DOH, Iloilo City LGU) to formulate PPP (the Project Purpose).

Looking at each output to achieve the project purpose, Output 2 and the project purpose both point to the same content, given that the implementing agencies and the GOP assumingly indicate the same target agencies with difference terms. That is, the project purpose is a paraphrase of Output 2. Since the selection process of PPP projects in the implementing agencies is also part of the project formation, it can be said that Output 1 will contribute to the improvement of the PPP project formation capacity, which is the project purpose. On the other hand, the policy dialogue (policy discussions conducted between JICA and DOF) envisioned in Output 3 indirectly affects the overall goal of "An improved PPP project formulation process will contribute to the infrastructure development necessary for sustainable economic development of the Philippines". However, the direct impact on the achievement of the project purpose is considered to be limited.

In addition, generally, in a technical cooperation project, the Output is the result of the activities, and the project purpose is the direct outcome that is manifested during the period up to project completion. Therefore, the indicators of the outcome and project purpose represent the situation/status to be achieved when the project is completed. However, in the case of this project, considering that it would take about three years after project completion to establish a model for PPP project formation, and for the results to appear in the number of tenders for the PPP project, the indicator was set to three years after project completion for Output 2 and the project purpose. In other words, the original aim of this project was to build a model for PPP project formation, and Output 2 and the project purpose described in the PDM corresponded to the overall goals.

In light of the above, it is considered that there are issues in the PDM in terms of logic, from activities to the overall goal and their indicators.

3.1.4.2 Management of the PDM Following Scope Changes

When this project began in November 2014, it was expected that Output 1 would select specific PPP projects based on the master plan, which would be used as pilot projects in Output 2 to conduct the feasibility study and provide support for creating tender documents mainly by on-the-job-training (OJT). In other words, Output 1 and 2 aimed to improve the PPP project formation capacity of the target implementing agencies by supporting the restructuring of the process of "consistent and strategic selection of PPP projects based on the master plan." However, when the project began and the pilot projects were selected, it became clear that it was difficult to provide support in the way initially envisioned, mainly from the perspective of complying with the Environmental and Social Consideration Guidelines, and therefore the scope was revised in September 2015. In doing so, the terms of reference of the JICA experts of the project stipulated in the contract changed. However, the PDM was not modified accordingly. For this reason, the activities and outputs that were outside the project scope due to the scope change remained in the PDM. It can be argued that the PDM should have been thoroughly reviewed at the timing of the scope change.

In this ex-post evaluation, evaluation is fundamentally performed according to the PDM. However, as for effectiveness, it is necessary to confirm the outcomes up to project completion. Therefore, instead of confirmation of achievements of the indicators with the target years as three years after project completion, an examination was mainly made of the results of the activities, and the evaluation of the impact focus on the status of the manifestation of the project purpose and outputs at the time of the ex-post evaluation, in addition to the achievement status of the overall goal.

3.1.4.3 Position as a Technical Cooperation Project Related to ODA Loan

At the time of project planning, through linking the project to, and cooperation with, the ODA loan "Development Policy Support Program (Investment Climate)", the synergistic effect of increasing and speeding up the development effect of the ODA loan was expected. However, the mechanism for cooperation between the two projects was not incorporated into the project plan, and no substantial collaboration between the two projects was carried out during the project implementation period. It would be a challenge to expect synergistic effects to occur spontaneously in situations where the experts and related parties who support each project differ. Therefore, it is necessary to have a system for mutually utilizing the outputs of both projects, such as institutionalizing the periodic coordination meetings into the project implementation schemes.

3.1.4.4 Collaboration with ADB

As mentioned above, the same can be said for collaboration with ADB. In parallel with this project, ADB provided technical assistance related to PPP. As it mainly targeted NEDA, which is responsible for the approval process of PPP projects, and DOF, which is the competent authority for financial support system development, cooperation related to Output 3 of this project was expected. At the time of project planning, the necessity for collaboration with ADB was confirmed, but no agreement had been reached on establishing a structure or a scheme for specific collaboration. As a result, the collaboration between this project and ADB was not realized during project implementation.

In light of the above, this project was highly relevant to the development plan and development needs of the Philippines, as well as to Japan's ODA policy. However, there were issues in the appropriateness of project planning, and therefore, its relevance is fair.

3.2 Effectiveness and Impacts[8] (Rating:②)

3.2.1 Effectiveness

In technical cooperation projects, effectiveness is generally evaluated by the output of the activities achieved and the degree of achievement of the project purpose by the time of project completion. As mentioned above, since the indicators are set to be achieved three years after project completion for Output 2 and the project purpose, in this ex-post evaluation, the indicators set in the PDM for the project purpose and Output 2 were not used as an index of effectiveness, and analysis was performed based on the activity results. For Output 1 and Output 3, in addition to the activity results, the degree of achievement of the indicators and the degree of the contribution of this project were analyzed.

3.2.1.1 Achievement of Project Purpose

The project purpose was "capacity of the GOP (DPWH, DOTr, DOH, Iloilo City LGU) will be improved to formulate PPP projects." The project aimed to achieve the project purpose through these three outputs: "the selection of PPP candidate projects will be enhanced with added consistency and strategic consideration" (Output 1), "PPP project formulation capacity of the following Implementing Agencies (DPWH, DOTr, DOH, Iloilo City LGU) will be strengthened" (Output 2), and "a policy discussion is facilitated relative to the GOP support mechanism for PPP financing" (Output 3).

However, as stated in "3.1.4 Appropriateness of Project Plans and Approach", while Output 3 would improve the PPP system in the Philippines in a broad sense, it is difficult to say that it directly contributes to the achievement of the project purpose. As for Output 1 and Output 2,

[8] Sub-rating for Effectiveness is to be put with Consideration of Impacts.

both should have contributed to the accomplishment of the project purpose, as the selection process of PPP projects is also a part of PPP project formation. However, since it became unnecessary to select PPP projects due to the scope change of September 2015, the activities related to Output 1 in PDM were hardly implemented. As a result, there were no cases in which this project contributed to restructuring the process of "consistent and strategic selection of PPP projects based on the master plan" that was initially the aim of this project. Due to this, it is considered that Output 1 has not contributed to the improvement of PPP project formation capacity. As for Output 2, although it did not build a model for PPP project formation, it can be said that it contributed to the improvement of PPP project formation capacity such that it was able to handle the weak areas of each implementing agency.

The aim of Output 2 was to improve the PPP project formation capacity of the implementing agency by analyzing its PPP project implementation capacity, identifying issues, and formulating and implementing training to solve the problems. The original plan was to strengthen the capacity of implementing agencies through OJT using the pilot projects selected in Output 1. After the scope was changed, capacity assessments were conducted for each implementing agency, and capacity-building programs were set up according to the issues identified (Table 2). This capacity-building program is no longer in the form of OJT based on pilot projects, but the primary activities were not changed from the initial plan. In addition, the capacity assessment of each implementing agency conducted by the experts was evaluated as appropriate by the PPP Center and the implementing agency.

Table 2: Capacity Building Direction, Programs/Assistance and the Actual Situation of each Implementing Agency (at time of project completion)

DOH	**Direction**	**Actual**
	• Acquisition of basic knowledge of PPP • Understanding the PPP process • Acquisition of basic skills for implementing PPP	• PPP Unit was established. • Training programs were conducted 8 times and more than 20 people participated. • DOH-sponsored workshops: 3 times/ more than 100 participants each time. • A screening and scoping guidebook for PPP projects were implemented.
	Programs/Assistance	
	• Establishment of PPP Unit • Implementation of training programs • Implementation of DOH-sponsored workshops • Preparation of screening and scoping guidebook	
DPWH	**Direction**	**Actual**
	• Acquisition of basic knowledge and concept of PPP • Understanding the differences between the public and private roles of PPP in the sewage and road sector, and how to use PPP in practice • Development of skills needed to extract and prioritize PPP projects • Acquisition of management methods for PPPs proposed by the private sector	• Training programs were conducted 8 times for 12 people of implementing agencies in charge of PPP projects. • A Guideline for Adopting PPP to NSSMP projects was prepared.
	Programs/Assistance	
	• Implementation of training programs • Preparation of manuals and guidelines	

DOTr	**Direction**	**Actual**
	• Improvement of organizational structure (establishment of PPP Unit) • Preparation of manuals	• Establishment of a project model type PPP unit and the improvement of the organizational structure including assignment of a new position of Deputy Secretary in charge of PPP were proposed. • The project implementation manual was prepared. • A training program on contract management (one time) was organized.
	Programs/Assistance	
	• Proposal for improvement of organizational structure • Creation of manual	
Iloilo City LGU	**Direction**	**Actual**
	• Identification and prioritization of potential PPP projects that will realize the city of Iloilo's future vision through review of infrastructure projects and preparation of financial plans.	• A project prioritization tool was prepared and candidate PPP projects were selected by using the tools. • A workshop was organized once at the end and the above selection of candidate PPP projects was explained. • The Proof of Concept of the proposed Iloilo City Sewerage and Septage Project were prepared and presented by the LGU officials.
	Programs/Assistance	
	• Preparation of tools • Implementation of a training workshop (1 time) • The following are implemented through OJT • Preparation of a long list from the development plan • Prioritization (Identification of potential PPP projects)	

Source: Project completion report, response to the questionaries.

The evaluation of each implementing agency's capacity building program was divided according to the capacity level of each implementing agency before project implementation, and to whether the content of the capacity building program was centered on training or whether it focused on organizational reform. The target implementing agencies where training was the center of the capacity building program were generally well-received.

At DOH where knowledge about PPP was insufficient before project implementation, it was not possible to improve the organizational capacity of PPP through training alone. Still, there was feedback that the basic concepts learned in training helped promote PPP. In addition, DPWH, which already had abundant experience in PPP projects in the road sector, highly evaluated the capacity building program for the gaining of practical knowledge for utilizing PPP in the water sector through training. On the other hand, DOTr, which also has abundant PPP experience in the transportation sector, used a program that focused on organizational reform rather than training. However, according to their feedback, one seminar of about 30 minutes was not enough to strengthen capacity (organizational reform will be described later).

At the time of project completion, not all the implementing agencies had used the manuals and tools developed by this project. However, there were many opinions that the content was valuable and helpful.

Regarding organizational reform, only DOH had established a new PPP unit by the time of project completion. Although DOTr proposed the establishment of a PPP unit, establishment was not achieved. As it is considered essential that manuals, tools, and organizational reforms

are embedded and utilized after project completion, a further analysis based on the impact was conducted (details described later).

To summarize the above, in this project, the assessment of PPP project formation of the target implementing agencies was carried out, and capacity building programs were formulated and implemented according to the capacity of each implementing agency. As these activities led to the acquisition of knowledge and the strengthening of the organization based on the level of each implementing agency to some extent, it is considered that Output 2 was mostly achieved. On the other hand, the activities related to Output 1 and Output 3 have hardly been implemented, and the level of the model building of PPP project formation aimed at by this project has not been reached. Therefore, the achievement of effectiveness (project purpose) is evaluated as fair.

3.2.2 Impact

As mentioned in "3.1.4 Appropriateness of the Project Plan and Approach," there are issues with the PDM logical pathway, such as the achievement year for indicators of the project purpose and Output 2 being set three years after project completion. Therefore, the evaluation of impact focused on the project purpose, the achievement of the outputs, and the achievement status of the overall goal at the time of the ex-post evaluation.

3.2.2.1 Achievement of Project Purpose

The table below shows the achievement of each indicator at the time of the ex-post evaluation.

Table 3: Achievement of Project Purpose

<table>
<tr><th>Goal</th><th>Indicator</th><th>Actual</th></tr>
<tr><td rowspan="3">Project Purpose: Capacity of the GOP (DPWH, DOTr, DOH, Iloilo City LGU) will be improved to formulate PPP projects.</td><td>The following targets have been achieved for next three years after the project completion.</td><td></td></tr>
<tr><td>(1) More PPP projects are put to bid per year than the previous three years.</td><td>
<table>
<tr><td>Year</td><td>2012</td><td>2013</td><td>2014</td><td>2017</td><td>2018</td><td>2019</td><td>2020</td></tr>
<tr><td>No. of bids</td><td>2</td><td>2</td><td>6*</td><td>1</td><td>2</td><td>1</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>(2) The average number of bidders per a bid of a PPP project increase than the previous three years.</td><td>
<table>
<tr><td>Year</td><td>2012</td><td>2013</td><td>2014</td><td>2017</td><td>2018</td><td>2019</td><td>2020</td></tr>
<tr><td>No. of bidders **</td><td>6</td><td>1.5</td><td>2.7</td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
</table>
</td></tr>
</table>

Source: PPP Center
Note 1:* Of the six bids conducted in 2014, two were canceled in 2016.
Note 2: ** Annual average number of bidders per a bid.

Regarding the achievement of the project purpose, the number of bids has not significantly changed between before and after project implementation, and the average number of bidders

per project is almost the same except in exceptional circumstances. Both numbers increase or decrease depending on the year. Since these indicators rely on the difficulty of the project, the form of PPP, the scale, etc., it is not possible to make a general comparison based on the size of the numerical values[9]. On the other hand, since the content of support for each implementing agency differs from the initial plan due to the change in scope, the effects of project implementation do not necessarily lead to an increase in the number of bids and bidders. Therefore, to more accurately measure the impact of this project after completion, the status of the results (especially Output 2) at the time of the ex-post evaluation was confirmed and analyzed.

The organizational reform and institutionalization of guidelines seems to have been difficult during the three-year project period (two years after the full-scale capacity-building program began). However, in DOH, a PPP unit[10] has been established, and although it still has insufficient personnel, it exists as the Health Project Management Office, and manages six pipeline projects, providing support for improving the capacity of regional offices. In addition, the "Screening and Scoping Guidebook for PPP Projects" developed in this project was incorporated into the ministerial ordinance[11] in 2019 and is still used today. The two PPP projects selected based on this guidebook will be bid in 2021.

At DPWH, a PPP capacity building program (training) was conducted for existing departments such as the Environmental Social Safeguards Division (ESSD) and the PPP Service Division. Currently, in addition to ESSD and the PPP Service Division, DPWH also handles PPP projects at the United Project Management Office for Flood Control (UPMO). Most of the staff who have attended the training program still belong to the same department and utilize what they learned in training at work. The level of recognition of this project was high, and as mentioned in Effectiveness, all participants commented that the training was practical and beneficial. On the other hand, although the guidelines developed by this project have been acknowledged, they are not currently used because the ministry has not officially accepted them. In order to be used, in addition to updating the contents of the guidelines based on changes that have occurred after project completion, it is necessary to have procedures within the ministry officially accepted by DPWH. At the time of the ex-post evaluation, DPWH confirmed that no such plans were in place. However, some DPWH officials commented that the fact that these guidelines were not officially used does not impact their validity and that they were helpful as reference material for work.

[9] While the number of bids and the average number of bidders per project for the solicited proposal for PPP projects have not significantly changed, the openness to unsolicited proposals for PPP projects increased the number of private companies submitting proposals. This background is considered that changes in policy directions brought about by the new administration in the middle of the project.

[10] Later, the DOH PPP unit is named as DOH-PPP for Health.

[11] Administrative order on the revised PPP policy framework to support universal healthcare (Administrative Order 2019-0028).

At DOTr, JICA experts proposed the establishment of a PPP unit and improvements in the organizational structure. Although DOTr considered that the analysis by JICA experts was valid, they did not accept the proposal, and even at the time of ex-post evaluation, operation continues under the same organizational setting as in 1986. Compared to 1986, the scale and number of projects in DOTr are now very different, and they are fully aware of the need for organizational reform. On the other hand, reform requires an increase in staff and funds, and DOTr cannot do it alone. As for now, DOTr employs temporary staff and has established a Project Management Office (PMO) to implement each PPP project. However, when handled by temporary staff, the knowledge attained through PPP project management is not accumulated within DOTr as an institutional memory. Therefore, the assignment of staff with no fixed employment period (Plantilla Positions) and the execution of a rational organizational reform is under consideration. This project also created a project implementation manual for DOTr. Still, this is not officially used, although it is referred to in some projects[12], because it is premised on the above-mentioned organizational structure reform.

In Iloilo City, PPP candidate projects were selected through OJT using a project prioritization tool developed by JICA experts. The project that was given high priority using this tool was a Mass Rapid Transport System that included an elevated monorail. However, this PPP candidate project has not been implemented due to changes in the priority considerations of the city. This tool was not being used at the time of the ex-post evaluation. LGUs in the Philippines, including Iloilo City, will select projects using the Goal Achievement Matrix (GAM) based on "the Urban Land Use Planning Guidelines" established in 2008. The GAM has been used as a tool for project selection from 2009 to the time of ex-post evaluation. In July 2021, the City Government of Iloilo issued Executive Order No. 74-2021 creating the PPP Selection Committee (PPP-SC) of Iloilo City. The roles of the PPP-SC include the preparation of feasibility or project study and selection/tender documents for PPP projects. The City has 2 PPP projects in the pipeline at the time of ex-post evaluation. It is expected that the PPP formulation tools developed by the project may be used in the future to complement the existing framework of Iloilo City.

When organizational reform or a manual is developed in a project, it is necessary that it continues to be utilized even after the project is completed in order to sustain the effect. For that purpose, it needs to be institutionalized, at least within the target implementing agency. On the other hand, it is considered extremely difficult for each implementing agency to institutionalize the proposed organizational reforms, the tools developed, the guidelines and manuals within a limited project period of about two to three years. This project was only able to reach the proposal stage within the project period. Especially when there are existing

[12] Projects supported by Japan. For example, projects partially supported by ODA and partially (operation, etc.) by private companies.

institutionalized tools, as in the case of Iloilo City, or when achievement cannot be made without involving other ministries or changing the law, such as in the case of DOTr's organizational reform plan, it is not easy to institutionalize the outputs of the project. Nevertheless, at DOH, the PPP unit established through this project has continued operations, the guidebook was incorporated into the ministerial ordinance after project completion, and PPP projects are selected based on the guidebook and are undergoing bid preparations. This is one example in which the aim of this project, capacity improvement of the implementing agency, was realized.

3.2.2.2 Achievement of Overall Goal

The overall goal of this project was "an improved PPP project formulation process will contribute to the infrastructure development necessary for the sustainable economic development of the Philippines." To measure the achievement status, "the numbers of both PPP projects being put to bidding and contract" and "the share of investment in infrastructure against GDP" were set as indicators.

Looking at the number of PPP projects which were successfully awarded, the policy change is visible. The sum of national-level projects within the three years from 2014 compared to the three years from 2017 decreased by eight. On the other hand, the number of projects in rural areas increased by six during the same period. The total is a decrease of two cases, but considering that the latter includes the period immediately after the inauguration of the President Duterte administration, this is not considered to be a negative decrease[13].

Table 4: Number of PPP projects which were successfully awarded before and after Project Completion (preliminary figures)

	3 years before completion (2014-2016) (number of bids)	**3 years after completion (2017-2019) (number of bids)**	**Increase/decrease (number of bids)**
National level	12	4	-8
Local level	27	33	+6
Total	39	37	-2

Source: PPP Center

As mentioned in "Relevance," there was a change in administrations in the Philippines during the implementation of this project. The President Duterte administration emphasized the acceleration of infrastructure development more than the previous administration had, and therefore policies such as raising the upper limit of the budget deficit to GDP ratio from the

[13] Although the Duterte administration was inaugurated in July 2016, the procedures and decision-making of essential government projects may not progress, or there may be cases where they are postponed during the transition between administrations or the period until the new administration is established and fully starts-up.

previous 2% to 3% were taken to increase infrastructure spending. Prior to the outbreak of COVID-19, the Philippine economy was strong and tax revenues were steadily increasing. Against this backdrop, the ratio of infrastructure investment against GDP during the first two years of the President Duterte administration more than doubled from an average of 3.0% during the President Aquino administration to 6.3%.

Table 5: Achievement of Overall Goal

Goal	Indicator	Actual
Overall Goal: an improved PPP project formulation process will contribute to infrastructure development necessary for sustainable economic development of the Philippines.	The following goals have been achieved for the next three years after the project completion.	
	(1) The number of both PPP projects being put to bidding and contract of those with successfully awarded will increase in comparison to the previous three years.	2014-2016: 39 projects 2017-2019: 37 projects
	(2) The share of investment in infrastructure against GDP rises.	President Aquino administration (2011-2016) average: 3.0% President Duterte administration first half (2017-2018) average: 6.3%

Source: PPP Center, Department of Budget and Management, the Philippines.
Note: Regarding "(1) The number of both PPP projects being put to bidding and contract of those with successfully awarded", the actual number of projects which are awarded as successful bidders are provided.

Under the President Aquino administration, the fiscal situation was tight, and therefore PPP were actively selected to finance the acceleration of infrastructure investment under a limited budget. On the other hand, while the President Duterte administration positions the implementation of PPP projects as one of its priorities, it anticipates using PPP projects as a means to reduce the concentration of over-population in the capital and realize inclusive growth through job creation and infrastructure development in various regions (GOP's priority issues). The PPP Center has also formulated the Local PPP Strategy for LGUs and is strengthening its support of local implementing agencies.

In light of the above, it can be seen that the numeric indicators of the overall goal were mainly achieved. However, it is not clear whether this is due to the results of this project, as they largely depend on the policy priority changes[14] set by the two administrations. However, with the support of the Philippine government's policy, at the time of the ex-post evaluation, it is thought that the infrastructure development necessary for economic growth was accelerating.

[14] Worded as 'enhancement of priority' in policy documents.

3.2.2.3 Other Positive and Negative Impacts

A secondary effect of capacity building at the PPP Center was observed. In this project, the PPP Center was expected to play a role in overall management and was not the main target of capacity building. However, the PPP Center was provided with the opportunity to join training programs for each implementing agency as an observer and hold workshops with JICA experts. In addition, all deliverables created by JICA experts for each implementing agency were also provided to the PPP Center and, therefore, can be referred to at any time. In response, the PPP Center gave the positive feedback that this project provided opportunities to utilize tools that would improve PPP's capacity. For example, DOTr's contract management manual development was a good starting point for PPP Centers to devise similar tools for other agencies to use. The project also delivered new insights into capacity gaps between implementing agencies. When the PPP Center provided support to implementing agencies after project completion, there was feedback on how its implementation had taken place with attention to the capacity gap.

The number of advisory services carried out by the PPP Center reached 62 in 2020 alone. As for training programs utilizing the outcomes of this project, in 2020, for example, two training programs were conducted for DOH on the themes of PPP project identification, project development, etc.

From these facts, it is considered that this project had a secondary effect of capacity building even at the PPP Center, which was not the main capacity-building target.

To summarize the above, it is considered that at the time of project completion, Output 1 had not been implemented, but that Output 2 had generally been achieved due to knowledge acquisition through training, except for some implementing agencies, and organizational reform. However, it is considered that it did not reach the level of building a PPP project formation model in each implementing agency, and therefore the achievement of the project purpose is fair. Regarding the overall goal, although indicators such as the number of bids (contracts) and the GDP ratio of infrastructure investment have been generally achieved, the degree of the contribution of this project is unclear. However, capacity improvement at implementing agencies and the PPP Center have been confirmed to some extent, and the effects have been observed. In light of the above, the effectiveness and impacts of the project are fair.

3.3 Efficiency (Rating:②)

3.3.1 Inputs

The inputs of this project are as shown in the table below.

Table 6: Planned and Actual Inputs

Element of input	Planned	Actual (at project completion)
Dispatch of experts	Short-term: 15 persons (172.55 man-months)	Short-term: 36 persons (153.15 man-months)
Training participants	Not listed	63 people in total
Project cost of Japan side (total)	Total 499 million yen	Total 504 million yen
Inputs by partner country	Counterparts, office space, information materials, etc.	Counterparts, office space, information materials, etc.

Source: Provided by JICA

3.3.1.1 Elements of Inputs

In September 2015, approximately one year after project implementation, a feasibility study was conducted where the scope changed from support for preparation of tender documents to focus on capacity development. As a result, the composition of experts has changed, with an increase from 15 experts in the plan to 36 experts in actual results. However, on an input man-month basis, the actual result was 153.15 man-months, compared to the planned 172.55 man-months. These were appropriate changes due to the change in scope, and the procedure was adequately carried out.

As part of the capacity development program, training indicates the total number of participants in seminars, etc., held in the Philippines. In addition, three workshops have been held at DOH, etc., in which more than 100 people participated each time.

3.3.1.2 Project Cost

The project cost was almost as planned. Specifically, the actual amount was 504 million yen, 101% of the planned amount of 499 million yen. This was mainly due to the extension of the project period under the change of scope and the increased number of trips. However, due to the change of scope, the project employed younger experts instead of veteran experts. This reduced the total number of experts from the planned input man-month of 172.55 to the actual 153.15 man-months. Efficient travel planning also took place. Therefore, the project avoided a significant increase in cost.

3.3.1.3 Project Period

The project period exceeded the plan. Specifically, the actual period was 37 months (November 2014 to December 2017), 128% of the planned 29 months (August 2014 to December 2016). The project was extended twice. The first was an extension until July 2017, and the second was an extension until December 2017.

According to JICA experts, after changing the scope, the target agencies to conduct capacity development were reselected, the capacity of each agency was reassessed, and programs were developed before being provided. The first extension was made in consideration of the time

required for these steps. This procedure was carried out when the contract of the JICA experts changed (when the scope changed in September 2015). After that, when the specific content of support was decided and the period required for support was clarified (May 2017), the procedure for re-extension was carried out.

Although the project cost was almost as planned, the project period exceeded the plan. Therefore, the efficiency of this project is fair.

3.4 Sustainability (Rating:③)

3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

As mentioned in "3.1.1 Consistency with the Development Plan," in the Philippines, PPP policy has been emphasized under both the President Aquino and Duterte administrations. Although there were changes in how priorities were set under the President Duterte administration, the tools, manuals, training contents, etc., developed through this project withstood administration change, and the effects are considered sustainable. In addition, according to JICA experts, as the President Duterte administration emphasizes PPP in local areas, the tools, manuals, training contents, etc., developed through this project will offer further effectiveness. However, the shift in priorities due to administration change has meant an increasing need to strengthen capacity in areas not covered by this project. For example, the hybrid model[15] actively promoted and unsolicited proposals by private businesses under the President Duterte administration are the areas that require the review and improvement of existing policies and legal systems. In addition, following the COVID-19 pandemic from 2020, IT, health, logistics, etc., are now recognized as new priority areas at the local level. Under these circumstances, the role of PPP, which supplements government capabilities, is again drawing attention to the provision of infrastructure services.

3.4.2 Institutional/Organizational Aspect for the Sustainability of Project Effects

Since 2017, NEDA has acted as the secretariat for the approval process of PPP projects, and the PPP Center, as a member of the ICC Technical Board[16] under NEDA, has participated in PPP screening when needed. In addition, it also provides technical and financial advice[17] to implementing agencies for pre-approval projects. The ICC Technical Board comprehensively deliberates on projects from the perspective of all the financial resources of ODA, PPP, and the General Appropriations Act (GAA). The evaluation of candidate projects from various aspects

[15] A method in which infrastructure development is carried out with government budget and ODA, and management is entrusted to private businesses.
[16] The ICC Technical Board is the body that reviews various aspects (legal, institutional, technical, economic, financial aspects, bankability, risk allocation, etc.) of the proposed PPP project.
[17] From 2014 to 2016, the PPP Center acted as the secretariat for the approval process for PPP projects, and also conducted initial screenings.

such as the legal, institutional, technical, economic and financial aspects, bankability, risk allocation, etc., has been strengthened under the President Duterte administration. Therefore, the sustainability of the outputs of this project is considered to be improving in the desired way.

Of the PPP units of each implementing agency established or strengthened through this project, the PPP unit of DOH continues operations as the Health Project Management Office. At DOH, under the COVID-19 catastrophe, there has been an increasing call for projects in the health and medical fields, and its institutional strengthening is expected moving forward. The existing units in charge of DPWH's PPP operations (ESSD, PPP Service Division, the Unified Project Management Office for Flood Control) have also been sustained. However, as mentioned above, although the establishment of a PPP unit was proposed, it was never established within DOTr. With the deteriorating financial conditions of the Philippine government due to the COVID-19 pandemic, there is the possibility that some infrastructure development will be implemented as a PPP project, including the hybrid system, and DOTr will view organizational strengthening as a critical issue in the future. On the other hand, Iloilo City LGU has started to create the PPP Selection Committee (PPP-SC) in July 2021 in charge of preparation of feasibility or project study and selection/tender documents for PPP projects. There is expected that the PPP formulation tools will be used in the future to complement the existing framework in Iloilo City LGU.

3.4.3 Technical Aspect for the Sustainability of Project Effects

At DPWH, 11 of the 12 employees who participated in the capacity development program implemented by this project continue to work and are involved in the PPP project. In contrast, at DOTr and DOH, where a PPP unit has been established, most of the staff who participated in the capacity development program have already left their positions and are no longer in the organization. This is because the implementing agencies have a fixed number of permanent staff and increasing the number beyond that is challenging. Therefore, PPP project implementation is handled by hired temporary staff. As DOTr points out, when a project is over, temporary staff are dismissed and do not remain in the organization, so the knowledge and know-how related to PPP projects fail to be accumulated.

To solve this problem, it is desirable that each implementing agency officially accept the manuals and tools prepared by this project and utilize them systematically. However, as mentioned above, although they are used as a reference within DOTr and DPWH, they have not been officially utilized. In addition, the manuals and guidelines prepared by this project also need to be updated regularly in order to respond to subsequent changes. For this reason, at the time of the ex-post evaluation, each implementing agency was implementing PPP projects using the BOT Law and existing institutionalized tools and guidelines.

3.4.4 Financial Aspect for the Sustainability of Project Effects

Infrastructure spending by the Philippine government has increased significantly since the change in government. In addition to the steady increase in annual revenue, it is thought that the President Duterte administration's decision to raise the upper limit of the budget deficit from the previous 2% to 3% of GDP is another background factor. External debt is an increase in the upper limit of the budget deficit which is within the control of the government and therefore is not particularly an issue.

Table 7: Trends in the Philippine Government's Revenue and Infrastructure Spending (2014-2020)

Unit: 1 billion pesos

Year	2014	2015	2016	2017	2018	2019	2020
Revenue	1,909	2,109	2,196	2,473	2,850	3,150	3,536
Infrastructure Spending	246	576	650	991	991	862	973

Source: Department of Budget and Management, the Philippines
Note: 1 peso=0.4585 yen (Foreign exchange rates dated August 19, 2021, Central Bank of the Philippines)

Looking at the revenue and expenditure of the PPP Center, which was the counterpart of this project, revenue decreased significantly between 2014 and 2019. On the other hand, operating expenses have increased considerably. Shortfalls have increased, but there are no operational problems as the government provides subsidies based on the GAA. The primary source of revenue for the PPP Center other than government subsidies is the fees[18] for technical assistance provided by the PPP Center, which increase or decrease depending on the number of awarded bidders. The increase in operating costs may also be due to the implementation of the Salary Standardization Law, the increase in the number of permanent staff, the rise in the price of leased office space, the procurement of necessary items for ICT maintenance, and inflation.

Table 8: Revenue and Expenditure of the PPP Center (2014-2019)

Unit: million pesos

Year	2014	2015	2016	2017	2018	2019
Revenue	107	79	31	59	8	5
Operating Cost	100	126	133	146	178	199
Surplus/Insufficient funds	7	-47	-102	-88	-170	-194

Source: Department of Budget and Management, The Philippines

[18] The source of revenue for the PPP Center (other service revenue) refers to the 10% administrative costs included in the refund of technical assistance costs from the awarded bidder or implementing agency of the PPP project. This depends on how long the refund from the awarded bidder or implementing agency is collected and/or the number of projects granted during that period.

In light of the above, no major issues have been observed in the policy/political commitment, institutional/organizational, technical, or financial aspects. 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 accelerate the infrastructure development necessary for the country's economic development by enhancing the capacity for Public-Private Partnership (PPP) project formulation between the Philippine government and implementing agencies. In the Philippines, under severe fiscal circumstances, foreign direct investment has tended to be low due to delays in infrastructure development, which has hindered economic growth. Therefore, the Philippine government has been working to accelerate infrastructure development by utilizing PPP to tap the private sector's efficiency, innovations and financial capital. The objectives of this project were consistent with the development policy and development needs of the Philippines as well as with Japanese aid policy. However, the relevance is evaluated to be fair as there are issues in the setting of logical pathways and indicators leading from the project activities to the overall goal, as well as the project design in areas such as the implementation structure. At the time of project completion, it was considered that the acquisition of knowledge and the strengthening of implementing agencies' capacities through training had generally been made except for some agencies, although these had not yet been institutionalized. In addition, although the indicators of the overall goal have been generally achieved, the degree of the contribution of this project is unclear. On the other hand, although there are some issues in the capacity improvement of the implementing agencies and the PPP Center, it has been confirmed that the effect has been manifested to some extent. Based on the above, the effectiveness and impact are considered to be fair. Although the project cost was mostly as planned, the project period exceeded the plan, therefore, the efficiency is fair. Regarding sustainability, new methods and institutional arrangements have been introduced after project completion in terms of systems and structure. None of these affect the sustainability of this project but instead are considered desirable from the perspective of the sustainability of the project effects. No major problems have been observed in the policy and political commitment and the institutional/organizational, technical, or financial aspects. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

None

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) Setting the Project Purpose, Outputs and Indicators for Technical Cooperation Projects

Some issues were found in the PDM of this project, such as similarities in the project purpose and some outputs, or that even if some outputs were achieved, this did not lead to achievement of the project purpose, or that the goal was set too high for the results of activity carried out by the project to be evaluated appropriately. At the time of project planning, it is desirable that the focus is placed on development issues that can be solved within the project period and limited input, and to set indicators that can appropriately grasp the results of activities.

(2) Necessity of PDM Modification Due to Scope Change

After the project began, it was found that the original plan could not be implemented as expected, so there was a change in scope. During this, although the expert's contract was modified, the contents of the PDM were not amended as they could be widely interpreted, even after the scope was changed. However, in reality, due to the scope change, two of the three outputs were not implemented. If there is a change in scope which means that any of the activities will not be implemented, or if changes need to be made to the outputs, purpose, or indicators in order that the results can be evaluated appropriately, consultations should take place with project stakeholders and the PDM should be modified as necessary.

(3) Ideal Project Implementation Structure for Synergistic Effects/Collaborations

This project was a technical cooperation project related to the ODA loan. It was expected that the implementation of the project would increase the development effect of the ODA loan project and accelerate the manifestation of the impact (synergistic effect). In addition, collaboration with ADB, which provided technical assistance related to PPP during the same time, was also planned. However, no specific mechanism for collaboration was incorporated into the project implementation structure for either of these at the time of planning and, therefore, collaboration was not realized during project implementation. In projects where synergistic effects from collaboration are expected, collaboration is rarely realized spontaneously. Therefore, it is necessary at the time of project planning to arrange regular coordination meetings for collaboration, and to include specific plans for these such as the expected participants, frequency, and venue, into the project implementation structure.

(End)