Ex-Post Project Evaluation 2017 : Package III-3

(Solomon Islands, Vanuatu, Mongolia)

November 2018

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN ECONOMIC RESEARCH INSTITUTE INC.

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Solomon Islands

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

The Project for Improvement of Water Supply System in Honiara and Auki

External Evaluator: Miyuki Sato, Japan Economic Research Institute Inc.

0. Summary

This project was planned to build water supply facilities in Honiara and Auki cities for improving water supply conditions, such as increasing and stabilizing the water supply and improving the quality of water supplied, thereby contributing to the realization of a hygienic environment for living. Since this project was confirmed to be consistent with the development plan and development needs of the Solomon Islands at the time of both planning and ex-post evaluation, and with the Japanese ODA policy at the time of planning, the relevance of this project was high. Regarding the implementation of this project, although the project cost was within the plan, the efficiency of the project can be said to have been fair because some facilities to be installed were not constructed, and the project period greatly exceeded the plan because of prolonged discussion on land acquisition. As for the effectiveness of the project, the water supply volume and the stability of the water supply in Auki City improved as the water supply volume increased after project completion, and the total hours of water supply served per day in the area was achieved at 24 hours. In Honiara City, although the yield from the new water source was below the estimation, a certain water supply volume was secured through construction of the facility, and the water quality during normal operation was so improved as to clear the standard of Honiara City for water quality monitoring. In contrast, the water turbidity problem was not resolved as a turbidity reduction facility was not installed at Kongulai Spring which affected the stability of the water supply by causing water turbidity and temporary shutdowns of the water source during heavy rain. As for the project impacts, sanitation of households and businesses improved on past conditions before the project, as the water supply reached a stable condition through the improvement of water supply facilities. As a result, the reliability of the Solomon Islands Water Authority (hereinafter referred to as “SIWA”), which provides water supply services, increased. Therefore, the effectiveness and impacts of this project were fair. Regarding sustainability, there was no problem with institutional or technical aspects of operation and maintenance and the financial aspects were sound. However, the sustainability can be said to be fair as there were some problems observed; these problems were minor ones in that some facilities were not used because the facilities were not user-friendly enough for the staff to operate. Therefore, the sustainability after project completion is judged to be fair.

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

1. Project Description

Project Locations

Water Transmission Pump Installed through the Project

1.1 Background

At the time of planning, Honiara City, the capital of Solomon Islands, depended on water resources of which 59% was spring water and 41% was groundwater. Kongulai Spring, which accounted for more than 40% of all water resources, had seen water source shutdowns due to the frequent blockages at raw water inlets ("sinkholes") during times of heavy rain and flooding. Furthermore, residents had no choice but to use a supply of water which did not satisfy water quality standards because spring water from Kongulai Spring and Kombito Spring became unsuitable for domestic and commercial use because of the high turbidity of water after heavy rains. Also, there were some other issues, such as an unstable water supply due to the insufficient water distribution system, difficulties in supplying water at peak use times, or insufficient water capacity volume at the distribution reservoir in times of emergency, and so forth.

In Auki City, the second largest city in the Solomon Islands, water resource development was needed, as the total water volume only from Kwaibara Spring, the existing water resource, was not adequate. Since it was impossible to secure enough water from the low volume of water resources, the average daily water consumption per capita in Auki City was 75 liters, about 40% of that in the other cities, and people were forced to undergo water rationing of 4 hours per day.

1.2 Project Outline

The objective of this project was to improve water supply conditions, such as by increasing and stabilizing the water supply, improving the quality of water supplied, and accomplishing fair water distribution to meet the demand, through the rehabilitating and constructing of water supply facilities in Honiara and Auki cities, thereby contributing to the realization of a hygienic environment for living.

Grant Limit / Actual Grant Amount	2,090 million yen / 2,090 million yen
Exchange of Notes Date /Grant Agreement Date	June 2009 / June 2009
Executing Agency	Solomon Islands Water Authority (SIWA)
Project Completion	October 2014
Main Contractor	Kitano Construction Corporation
Main Consultant	Yachiyo Engineering Co., Ltd.
Basic Design	March 2008 – January 2009
Related Projects	<Grant Aid> - The project for the improvement of water supply system in Honiara in Solomon Islands (1996 – 1998) - The Study for Rehabilitation and Improvement of Solomon Islands Water Authority's Water Supply and Sewerage Systems [Development Study] (2005 – 2006) - Follow-up Cooperation on the project for the improvement of water supply system in Honiara in Solomon Islands (2005 – 2006) <Technical Cooperation> The Project for Improvement of Non-Revenue Water Reduction Capacity for Solomon Islands Water Authority (2012 – 2015) <Other International Organization and Donor Agencies etc.> GEF, UNDP, UNEP, SOPAC: Honiara City Water Resources Management (2007 – 2012)

2. Outline of the Evaluation Study

2.1 External Evaluator

Miyuki Sato, Japan Economic Research Institute Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: October, 2017 – November, 2018

Duration of the Field Study: January 21 – February 6, 2018, and April 19 – 27, 2018

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Solomon Islands

At the time of planning, the *Medium-Term Development Strategy 2008 to 2010* developed by the Government of the Solomon Islands stated that promoting a "reliable, safe, and sustainable water supply in urban areas" and "water resource development in Auki City" were priority areas. At the time of ex-post evaluation, the *Medium-Term Development Plan 2016 to 2020* also indicated that the "improvement of water and wastewater facilities" was a priority task and that it was important as a policy to continuously provide an effective and efficient water supply, which included the organizational reform of the SIWA. Furthermore, the *National Development Strategy 2016 to 2035*, the master plan of the development plan and long-term plan above, mentioned that improving water accessibility was one of the highest priority actions to be taken and the improvement of the water supply and sanitation, particularly in urban areas such as Honiara and others, was an urgent need.

Thus, this project can be said to be consistent with the Solomon Islands' policy direction as the improvement of accessibility to the water supply and of water quality in urban areas like Honiara were mentioned in *Mid-Term Development Strategy* and *National Development Strategy* both at the time of planning and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Solomon Islands

At the time of planning, the situation in Honiara and Auki cities were extremely bad as water did not sufficiently reach the end users in some areas and incidents of water quality issues, that is, turbid water, frequently occurred. Therefore, the urgent need of implementing this project was thought to be high at that time. According to the SIWA, water leakage could be seen even at the time of ex-post evaluation because of aging of water pipelines (both transmission and distribution pipelines) as many of the pipelines in Honiara had been in place for more than 60

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

[2] ③: High, ②: Fair, ①: Low

years since their installment. Also, according to the Ministry of Mines, Energy and Rural Electrification, about 40% of non-revenue water (hereinafter referred to as "NRW") came from leakages of pipelines due to dilapidation. Thus, the need for facility improvement still seemed high.

Additionally, at the time of ex-post evaluation, connections to the water supply in both Honiara and Auki cities could not keep pace with the rapid population growth. In Honiara City, as the residential population had increased about 40% over 10 years, the rate of increase in water supply services to that population was less; thus, the service coverage ratio in 2017 dropped to 55% from that of 73% in 2007. Moreover, the service coverage ratio of the water supply in Auki City in 2017 remained at about half of the residential population receiving service. Furthermore, the water supply demand and the volume in both cities exceeded the actual water supply even at the time of ex-post evaluation, and particularly in Auki, the actual water supply volume was less than half of water demand volume. As mentioned in "3.3 Effectiveness and Impact", although water supply volume increased as a result of this project, the water supply needs remained high even after project completion.

Table 1. Population and Water Supply Service Coverage Ratio in 2007 and 2017

City	Honiara City		Auki City	
Year	2007	2017	2007	2017
Residential Population (person) *1	76,232	105,453	5,095	6,220
Serviceable Population (person) *2	55,656	57,999 (71,487)	3,208	3,110 (3,834)
Service Ratio (% of population)	73%	55% (68%)	63%	50% (62%)

Source: Documents provided by JICA and the executing agency

*1 The SIWA's water supply service area

*2 Serviceable populations are calculated by the number of contracted households multiplied by the average number of customers per household. The average number of customers per household in 2007 was calculated at 9 persons while that in 2017 was calculated at approximately 7.3. (Bracketed figures are a reference rate as calculated by the average number persons in year 2007.)

Table 2. Water Supply Volume and Demand as of 2017 in Honiara City and Auki City (at Average and Peak Times)

(Unit: million liter)

City	Average daily water supply volume	Water supply demand (average times)	Water supply demand (peak times)
Honiara	32.5	40.7	44.7
Auki	0.4	1.17	1.31

Source: Documents provided by the executing agency

Notes: Average daily water supply volume was quoted from the actual water supply data as of 2016, and average and peak times of water supply demand were calculated by the SIWA referring to the "Benchmark Database" of the PWWA (Pacific Water and Wastewater Association).

Therefore, the needs to improve water facilities can be said to be continuously high.

3.1.3 Consistency with Japan's ODA Policy

In the 4th Pacific Islands Leaders Meeting held in 2006, the Government of Japan announced to the Pacific Islands, which participated in the meeting, that necessary actions for "water and sanitation" would be taken on as one of the high priority support areas as the "sustainable development". Also, as to the priority areas announced at the meeting, the Government of Japan offered its cooperation to the Government of the Solomon Islands according to their development and strategy. The Government of Japan formulated the infrastructure development program in the project implementation plan to rectify disparities through economic development.

Therefore, this project was said to be consistent with Japan's ODA policy at the time of planning.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project outputs between the plan and the actual are shown in Table 3, and most of the facilities were constructed according to the plan.

Table 3. Planned and Actual Outputs of the Project

Category	Facility Name	Components	Plan (2007)	Actual (2014)
Honiara City				
Water source facility	Borehole facility (4 boreholes) 1) Tasahe 2) Titinge 3) Skyline 4) Borderline	- Construction of boreholes (development of new water source and boreholes) - Use of submersible pumps	Number of boreholes: 16 (4 boreholes x 4 borefields)	As planned
			Number of pumps: 20 (4 units x 4 borefields, 1 unit for stand-by x 4 borefields)	As planned
	Conveyance pipeline	Installment of conveyance pipeline	5.4km long	As planned
	Turbidity reduction facility	Instalment of settling basin, chlorine dosing equipment	Kongulai Spring and Kombito Spring	Kombito Spring only
	Power receiving equipment	Instalment of power receiving equipment (low voltage)	2 sets (1 each for Kongulai Spring and Kombito Spring)	Kombito Spring only (1 set)
	Improvement of spring intake facility	Instalment of screen (water treatment facility)	1 set for Rove Spring	As planned

Category	Facility Name	Components	Plan (2007)	Actual (2014)
Water transmission facility	Water transmission pump station	Instalment of water transmission pump	4 stations (1 station per borefield) 2 pumps for regular use and 1 pump for stand-by	As planned
		Construction of water transmission pump house	4 houses (RC-made, 2-story)	As planned
		Construction of chlorine disinfection facility	4 units (installed at each water transmission facility)	As planned
	Power receiving equipment (high voltage)	Installment of power receiving equipment (high voltage) and transformer	4 sets (installed at each water transmission facility)	As planned
	Emergency generator	Installment of diesel engine generator	4 sets (installed at each water transmission facility)	As planned
	Water transmission main	Installed from water transmission pump station to distribution reservoir	4.1km long	As planned
Water distribution facility	Distribution reservoir	Expansion of distribution reservoir	Tasahe, Titinge, Lower West Kolaa, Skyline, and Panatina	As planned
	Water distribution main	Installment of water distribution main	22.9km long	As planned
Auki City				
Water source facility	Borehole facility	- Construction of boreholes - Use of submersible pumps	Number of boreholes: 2	Number of boreholes: 3
			Number of pumps: 3 (1 for stand-by)	Number of pumps: 4 (1 for stand-by)
	Conveyance pipeline	Installment of conveyance pipeline	0.4km long	As planned
	Emergency generator	Installment of diesel engine generator	1 set	As planned
	Power receiving equipment	Installment of power receiving equipment (low voltage)	1 set	As planned
	Civil and construction works	Construction of electrical house	1 house (RC-made, 1-story)	As planned

Source: Documents provided by JICA and the executing agency

As a part of the change in this project, in Honiara City, a turbidity reduction facility and power receiving equipment were installed at only one site, Kombito Spring, though it was planned to be installed at two sites: Kongulai Spring and Kombito Spring. There were negotiations about land acquisition between the Government of the Solomon Islands and the ethnic group who owned the land around Kongulai Spring; however, the negotiation did not end in an agreement and the land was not acquired for building the facility. In Auki City, the

number of boreholes changed to 3 from 2 in order to secure water volume, and the number of pumps grew to 4 from 3 (1 for stand-by use) under the change.

Also, the Government of the Solomon Islands was to put up fences around the reservoirs and borehole facilities as the obligation of the Solomon Islands side, but at the time of ex-post evaluation, there were no fences surrounding Tasahe reservoir (Honiara City) or the boreholes in Auki City. According to the SIWA's explanation, the fence at Tasahe reservoir was to be erected within the year 2018 and as for the boreholes in Auki City, the whole area including the borehole facilities were being planned to be fenced. At the time of ex-post evaluation, Tasahe reservoir and the borehole facilities were located at the old reservoir site, which was surrounded by an old fence. Additionally, the boreholes in Auki City were chained and locked for the purpose of avoiding water pilfering. The unfenced sites currently do not seem to pose imminent security problems.

Fence built through the project (Borderline Pump Station)

Old fence surrounding the Tasahe pump station where the old reservoir is located

3.2.2 Project Inputs

3.2.2.1 Project Cost

In this project, the project cost was planned at 2,282 million yen including 2,090 million yen in cooperation from the Japanese side. As shown in the table below, the actual cost including both the Japanese and the Solomon Islander sides was 1,983 million Japanese yen, 87% of the planned cost, which was within the plan. Even if the turbidity reduction facility and power receiving equipment, whose installations were abandoned, had been installed as planned, the actual project cost of the Japanese side would have been confirmed at 1,899 million yen, including the would-be 75 million yen for the installations, according to an interview with the project consultant. Also, if the fences, which had not been built by the Solomon Islands, had been erected as planned, the cost from the Solomon Islands would have been 163 million yen, an increase of 4 million yen;

thus, the cost was still within the plan.

Table 4. Project Cost

(Unit: million yen)

Item	Plan	Actual
Japanese side	2,090	1,824
Solomon Islander side	192	159*
Total Project Cost (Japan + Solomon Islands)	2,282	1,983 (87% of planned cost)

Source: documents provided by JICA and the executing agency
Note: Rounded down to the nearest 1 million
* Fencing cost is not included in the actual cost

3.2.2.2 Project Period

The actual project period greatly exceeded the plan, as shown in the table below: 31 months as planned with an actual of 64 months (206% of the planned period). The reasons for which the project period was longer than the plan are as follows: Although the time allotted for discussion on land acquisition had been expected to be prolonged before the project, the negotiation between the ethnic group who had rights over land and the Government of Solomon Islands continued longer than expected, which brought about the delay in bidding for construction (about a 21-month delay); There had been damages to water facilities due to landslides near the construction site caused by heavy rains, and the construction materials were stolen, which brought about a re-procurement of the materials; And, it took time for discussions to hand over the facility after its construction (a 12-month delay during and after its construction). For the reasons stated above, this project was delayed, approximately 33 months longer that the plan.

Table 5. Project Period

Plan	Actual	Comparison
31 months (July 2009 – December 2011)	64 months (July 2009 – October 2014)	206%

Note: Project completion is defined as the time of the completion of the soft component (training for the SIWA staff)): October 2014, which was carried out after both the completion of the construction and the handing over of the facility to the executing agency by the Japanese side.

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

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

3.3.1 Effectiveness

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

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of project planning, as an operation effect generated by the project, it was expected that an increasing and stabilized water supply would be achieved, improving the quality of water supplied and accomplishing fair water distribution that met the demand.

As confirmation of the increase and stabilization of the water supplied, Table 6 shows the actual values of operation indicators after project completion.

Water volume, as a whole, in each of the three years after project completion exceeded the target value for daily maximum water supply in both Honiara and Auki cities. It is considered that a certain volume of water can be secured by the facility constructed through this project, decreasing water leakage through installation of the replacement of water pipes, increasing the capacity of the distribution reservoir by expanding the reservoirs, and so forth. On the other hand, in terms of new water sources in Honiara City, yield from 16 boreholes at 4 borefields, which were newly developed, was lower than the target value in each of the three years after project completion.

Table 6. Operation Indicators

		Baseline	Target	Actual			
		2007	2018	2014	2015	2016	2017
		Year at the Time of Planning	4 Years after Completion	Completion Year	1 Year after Completion	2 Years after Completion	3 Years after Completion
To increase and stabilize water supply volume	Honiara City						
	Daily maximum water supply (Water supply from 4 new boreholes*1)	25,685m^3 /day (0m^3/day)	30,509m^3 /day (12,800m^3/day)	35,000m^3/day (16,182 m^3/day)	34,000m^3/day (8,034m^3/day)	31,200m^3/day (5,769 m^3/day)	31,960 m^3/day (6,370m^3/day)
	Capacity of distribution reservoir*2	7,280 m^3	14,630m^3	12,360 m^3	12,630m^3	12,630m^3	12,810 m^3
	Auki City						
	Daily maximum water supply	540 m^3/day	1,106 m^3/day	1,700 m^3/day	1,703 m^3/day	1,176 m^3/day	1,889 m^3/day

Source: documents provided by JICA and the executing agency

Note: At the time of planning, the target value after project completion was to be set as a value 4 years after project completion. With a project completion date of 2014, the actual value was to be set as that in 2018. However, since it was difficult to get the actual value for 2018 according to the survey schedule, the target value was set as that in 2017, 3 years after project completion.

*1 The total yield of each borehole: Tasahe, Titinge, Skyline, and Borderline

*2 The capacity of the distribution reservoir is the total volume of reservoirs at all the facilities in Honiara City, including those which were constructed through this project. The reservoir in East Kolaa is planned to be constructed in 2018 and the total capacity of the distribution reservoir after the construction will be 16,280 m^3.

According to the explanation from the SIWA, the operation of some boreholes at Titinge, Borderline, and Skyline had been stopped from 2015 to July 2017 because of inadequate water volume from each borehole, and to avoid the risk of a water hammer problem[4] caused by the frequent switching of the large pump and because of poor yields from boreholes and the high cost of electricity for pumping[5]. Because of poor yield from 4 borefields, the SIWA hired an Australian consultant after project completion who reviewed the project in order to confirm whether the borehole design was appropriate. According to the review report written by the Australian consultant, it might have been necessary to conduct more in-depth tests to gain more accurate results, that is, although it is said that a 24-hour pump test for new water sources is generally appropriate[6], the pump test which had been conducted 24 hours after the construction of the boreholes should have been carried out longer (72 hours at least) in order to place more stress on the aquifer. Also, the report stated that since water level in surrounding boreholes in the same borefield had not been recorded during the pump test, it would have been more effective if monitoring of surrounding bores as a part of pump tests had been conducted in order to help to understand and manage any potential issues related to borehole performance or interference from other pumping boreholes.

Furthermore, the review report mentioned that since the existing pump size was too big for yields at present, a borehole had affected another borehole located next to it, lowering the water level when the pump was in operation. Since it affected the yield of another borehole next to it, the report suggested replacing the pump with a slower and smaller one. In response to the comments above, the project consultants commented that there were no problems with the design because precipitation had affected the boreholes, as the boreholes themselves were shallow, and the yields were adequate for the required volume at the time of pump testing during the construction period. Although an adequate volume of water could have been secured in 2014, at the time of handing over the facility, there was a reality that the facilities had not been utilized fully because of the reasons above after 2015. These facilities were constructed according to the plan and there was no defect in the construction. However, it is considered that it was necessary for each, the SIWA, which gave the order for construction of the facilities, consultants who received the construction order, and JICA, which provided funds, to discuss what to do for making full use of the capacity of the facilities. Also, for better

[4] The problem is that of a hammering-like sound coming up from a pipeline and vibrating, which is propagated by a wave of water pressure caused by a sudden change in water pressure through frequent switching of a pump. If there is no treatment taken for the problem, it may cause serious accidents such as damaging or explosion of the valve and water pipe. According to the document provided by JICA, pipeline damages which seemed to have been caused by water hammer actually occurred 6 times at the Skyline pump station from August 2015 to April 2016 . (The damages were all repaired.)

[5] All boreholes at Borderline and Skyline restarted operation in July 2017. Boreholes operating at Titinge (4 boreholes) were the only sites which had not been stopped at the time of ex-post evaluation.

[6] A 24-hour duration of pump testing is also observed under Japanese standards for borehole digging, and it is generally appropriate.

output from future projects when implemented similarly at similar geographical locations, it would be desirable if the comments from the review report were to be referred to as in this event, as an example.

As for increasing the water supply volume, although the new water sources did not secure enough water, the total volume increased. Construction of the facility contributed to securing the water volume to some extent.

Other than the increase in water volume and stability of water supply, Table 7 (Honiara City) and Table 8 (Auki City) show effect indicators which were set to quantitatively identify improvement in water quality and fair distribution.

This project had aimed at a stable water supply by using multiple water sources and newly developed boreholes to reduce the dependency on Kongulai Spring, but as mentioned before, since the yield of the boreholes which were constructed through the project was not adequate, the dependency on Kongulai Spring was still high. Also, since the turbidity reduction facility was not installed at Kongulai Spring, water turbidity caused by heavy rains still occurred, which partially affected the quality of the water supplied. In the case of turbid water, a temporary stoppage of water intake from the spring and a water supply shutdown may have occurred, which may have affected the stability of the water supply to some extent. In fact, according to the data provided by the SIWA, the average water usage volume at the time of the shutdown of Kongulai Spring was less than half of that during normal operation. In light of the situation above, the SIWA made a plan to install a filter in the distribution pipeline at Kongulai Spring for filtering turbidity to reduce the frequency of shutdowns caused by water turbidity. The water turbidity at Kombito Spring, where a turbidity reduction facility was installed, continued to occur because the facility had not been used when the water turbidity occurred; the reason is mentioned later in "3.4 Sustainability".

Additionally, the water supply service ratio in Honiara City was 55%, lower than the target (83%) and below the baseline as of 2007 (73%). The service ratio seemed to have declined but it did not suggest that the number of users was decreasing. The service ratio is calculated by serviceable population[7] divided by resident population in the SIWA's service area. According to the SIWA, and as shown in Table 1, the resident population in the service area in Honiara City grew approximately 1.4 times over 10 years, from 2007 to 2017, while the number for serviceable population grew smaller, which resulted in an outcome below baseline. Although the data for the rate of low-pressure areas could not be obtained, the situation is seen to have been improving according to the qualitative research (water service user interview) mentioned later; the rate of total respondents in Honiara City who said the water pressure had become higher after project completion in 2014 reached 90%, as compared with the time before project.

[7] Serviceable population is a calculated number composed of contracted households multiplied by the average number of people per household. In 2007, the average number per household was calculated to be 9 but it is calculated to be 7.3 per household in 2017.

Additionally, the SIWA explained that they were underway in reviewing the water supply network design with an aim at reducing low pressure areas.

Table 7. Effect Indicators (Honiara City)

		Baseline	Target	Actual	
		2007	2018	2014	2017
		Year at the Time of Planning	4 Years after Completion	Completion Year	3 Years after Completion
To increase and stabilize water supply volume	Water consumption from Kongulai Spring (dependency on the spring)	11,100 m^3/day (43%)	4.100 m^3/day (13%)	11,797m^3/day (26%)	10,425m^3/day (33%)
	Daily average water consumption for domestic (general home) use (reference value: daily average water consumption volume at the time of shutdown of Kongulai Spring) *1	110LCD	170LCD*	174LCD (66LCD)	170LCD (70LCD)
	Low pressure areas (% of serviceable population)	25%	0%	--	--
To stabilize water supply volume and improve quality of water supplied	Frequency of turbid water incidents 1) Kongulai Spring 2) Kombito Spring	1) 18 times 2) 28 times	0 in each spring	18 times/each in 1) and 2)	21 times/each in 1) and 2)
Fair distribution	Water supply service coverage ratio	73%	83%	--	55% (68%) *2

Source: Documents provided by JICA and the executing agency

*1 Even during the shutdowns of Kongulai Spring, ordinary water supply volume should be secured.

*2 Bracketed figures are reference rates as recalculated by the average number per household based on year 2007.

Table 8. Effect Indicators (Auki City)

		Baseline	Target	Actual	
		2007	2018	2014	2007
		Year at the Time of Planning	4 Years after Completion	Completion Year	Year at the Time of Planning
To increase and stabilize water supply volume	Daily average water consumption for domestic (general home) use	75LCD	170LCD	58LCD	150LCD
	Hours of Water supply served	4 hours	24 hours	--	24 hours*

Source: Documents provided by JICA and the executing agency
* 14 hours in some of the commercial areas

In Auki City, the hours of water supply served have greatly increased as service operated 24 hours a day mainly in residential areas at the time of ex-post evaluation, up from 4 hours per day at the time of planning. And, daily average water consumption was a little lower than the target value but greatly improved to twice that of the baseline year. It could be seen that increases of both volume and stabilization of water supply were achieved.

3.3.1.2 Qualitative Effects (Other Effects)

In terms of the qualitative effects of this project, this project was aimed at acquiring comprehension of water systems, facility operation, recording, management, utilization of water volume data, and so on by conducting the soft component (training programs for operation capacity building) attached to this project. As for the soft component of this project, all operation and maintenance staff members (including those among provincial office staff) attended and participated in both the lecture and practice. As a detail to be mentioned in “3.4 Sustainability”, it was confirmed that SIWA staff members had acquired the most basic skills which were necessary for daily facility operation, including operations of the water source facility, pump station, and distribution facility. Also, operations after the completion of facility construction were confirmed to have been conducted without any problem at the time of ex-post evaluation.

3.3.2 Impacts

3.3.2.1 Intended Impacts

As a project impact, by establishing a safe and stable water supply system, it was expected that the reliability of the SIWA for the residents would become higher, and the number of customers would thereby increase while the delays in payment would decrease.

To account for the change in the reliability of the SIWA through the improvement of the

water supply service after the project, interviews[8] were conducted with customers in Honiara City and Auki City to garner qualitative research data. According to the interview, 80% and more of respondents answered that they were satisfied with the water supply service that the SIWA had provided until then. Especially, satisfaction with the water volume and stability of the water supply were high, and most of the residents and business owners in both cities answered that the water supply served after the project improved as well as both the living and business environments could be seen as better, such as in areas of better sanitation, business operation, and so on, by the stabilization of the water supply. In Honiara City specifically, according to a resident, water could be basically used for daily housework such as washing clothes and floor cleaning, thus the sanitation of homes improved. A great deal of the same comments could be seen in Auki City, and in some business areas which had not yet achieved a 24-hour water supply, interviewees even replied that their service provision became stable as the number of hours of water supply service was almost stable every day, which made it easier for business owners to make operating plans.

As for the water quality, qualitative research showed that more than half of the respondents answered that the change in water quality could not be seen before or after the project. The respondents could not identify the change in water quality as the number of household respondents who had drunk tap water both before and after the project were few, 10% or less in the qualitative research, and as the tap water sometimes had become turbid after heavy rains. However, the water monitoring team from the Honiara City Council who were in charge of checking water quality said that the water quality had been very bad, as was reported in the local newspaper in 2014, but that the water quality had greatly improved at the time of interviewing. The water monitoring team explained that the team had conducted water quality monitoring on Tuesdays, through which the residual chlorine had been measured at a level within the city standard (0.21mg per liter), and that almost no coliform had been detected. After project completion, the users could not realize the change, but the water monitoring staff in Honiara City could, as the periodic monitoring conducted by Honiara City had passed inspection; therefore, the water quality in Honiara City can be thought to have improved.

Table 9 summarizes both the number of customers of the SIWA and the collection rate on water billing in order to see the changes above in both Honiara and Auki cities before and after the project.

[8] Outline of the qualitative research conducted: <Target> Residents and business owners selected from the customer list provided by the SIWA who use the water supplied from the facilities constructed by the project. <Number of targets> [Residents] 20 in Honiara City (11 male and 9 female) and 10 in Auki City (7 male and 3 female), [Business owners] 10 in Honiara City and 6 in Auki City <Research method> In depth interviews (individual interviews conducted using questionnaires in meetings)

Table 9. Changes in Number of Customers and Water Bill Collection Rate (2009 – 2017)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Honiara	6,901	6,916	6,926	6,931	6,979	7,199	6,184	6,352	7,943
City	57%	56%	79%	72%	80%	71%	92%	84%	95%
Auki	382	397	407	412	425	424	361	400	423
City	5%	5%	5%	5%	5%	5%	5%	6%	5%

Source: Information provided by the executing agency

Note: The upper row is the number of customers (number of households) and the lower row is the water bill collection rate. Bill collection rate includes the collections on arrears of billings from the previous year. The number of customers in 2015 declined because the SIWA conducted a large-scale disconnection of services because of non-payments on water bills and because of other reasons. After the disconnection, a certain number of customers did not reconnect as reconnection after disconnection was chargeable.

The number of customers gradually increased, and that in 2017 included nearly 8,000 households. The water bill collection rate in Honiara had remained to be sound since 2015, after project completion, and the rate in 2017 was more than 90%. In Honiara City, the SIWA established a service disconnection system which was conducted after three warnings of non-payment on water billings for customers in delinquency, and reconnection was chargeable; the system had been working very well. However, this system was only valid in Honiara City, while other cities, such as Auki City, had not implemented the system then because of a lack of staff members at the provincial office. Thus, water bill collection rates in Auki City, which had no penalty for non-payments by customers, was extremely low, at only 5%. The SIWA was planning to dispatch a staff member that would be used exclusively for bill collecting to certain provinces in order to strengthen bill collecting.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

Regarding impacts on the natural environment from a period of project implementation, as confirmed with the Environmental Conservation Department (hereinafter referred to as “ECD”), there were no relevant documents to obtain, but the ECD said that there were no events which affected the environment negatively nor were there complaints about destruction of natural environment from the local residents after project completion. As for the environmental impacts after the project, according to the interviews with the Ministry of Mines, Energy and Rural Electrification which is in charge of water resources management and SIWA, the executing agency and water supply operator, neither of them mentioned that there had been any negative impacts on natural environment from the water supply operation after the project. Therefore, it can be said that no specific impact occurred to the natural environment.

2) Resettlement and Land Acquisition

During the project period, there were three cases of resettlement at project sites. No documents could be confirmed but in the interview with the SIWA, it could be confirmed that there were no specific troubles nor negative impacts for residents after the resettlement, as the relocation distance is short as only about 10m from the original location, and the SIWA incurred the resettlement fees according to appropriate legal procedure.

In terms of land acquisition, to acquire land at the project-sites-to-be at Kongulai Spring and Titinge distribution reservoir, the Government of the Solomon Islands (Ministry of Lands, Housing and Survey, hereinafter referred to as "Ministry of Lands") negotiated with the ethnic group who owned the lands but did not reach an agreement, therefore the land acquisition was abandoned. As a result, installment of a turbidity reduction facility at Kongulai Spring was cancelled and the construction of the Titinge distribution reservoir had been concluded by changing the shape of the reservoir and constructing it within the land owned by the SIWA. Since a result of land acquisition had not been achieved, there were no specific negative impacts seen on this matter.

3) Other Impacts

At the time of planning, Kongulai Spring was located on land that an ethnic group owned and the SIWA had been paying water charges to the owner of the group whenever taking water from the spring. The SIWA was planning to cooperate with the Ministry of Lands to propose the group change to a new contract stipulating fixed land-leasing fees from water charges by constant rate which correlated to the actual sales volume of water. Since this change was pointed out to have affected the ethnic group in terms of their living expenses, it was confirmed in the ex-post evaluation whether this affected their income.

Regarding the confirmation as to whether the SIWA and/or the Ministry of Lands gave an explanation to the ethnic group on the matter above during the project, the SIWA and the Ministry of Lands answered that both had explained it to the landowner of the ethnic group during project execution. However, as for the result of discussion on the payment of water charges and change of contract, both parties had not paid water charges or land leasing fees to the landowner as of then. According to the high court decision made in 2015, the water charge was illegal because the spring was a public asset, thus there was no need to pay the water charge to the ethnic group. Also, after abolishing water charges, the SIWA and Ministry of Lands were planning to sign a land leasing contract with the landowner, but the landowner and the representative of the ethnic group (whom the group members called a "trustee") had refused the negotiation because they insisted on receiving water charge fees which they had not received from the SIWA as of then. The negotiation had been halted even at the time of ex-post evaluation.

In terms of the impact for the ethnic group's income after cancelling of the payment, the would-be beneficiaries were few in the ethnic group and none of them were in the village after that

because of deaths of beneficiaries or having moved to other places. Therefore, no specific context can be confirmed.

In light of the above, this project has achieved its objectives to some extent. Therefore, effectiveness and impacts of the project are fair.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The SIWA has four sections: operation, strategic, finance and administration, and human resources. Under the operation section, which oversees operation and maintenance (O&M), there are three divisions: network maintenance, network operations and provincial coordination, and NRW and customer connection coordination; and, 67 members, including provincial office staff members, work there. The SIWA's organization chart of the O&M section is shown in figure 1.

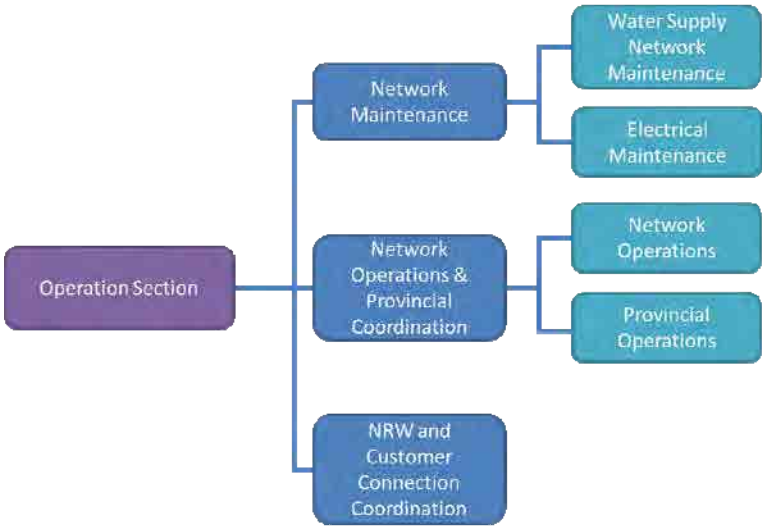


Figure 1. The SIWA's O&M Structure

There are two teams which oversee O&M works: water supply network maintenance and electrical maintenance (25 members in total). According to the SIWA, since many of the team members had adequate O&M maintenance experience and there were relatively few occurrences of staff transfer, it seemed adequate to operate works under the present structure and with the number of staff members at the time.

Technical staff members in each provincial office, who are in the provincial operations team under the network operations and provincial coordination division, are in charge of O&M for water facilities in provinces. In the SIWA Auki Office located in Auki City, there are three staff members in total: two technical staff in charge of facility maintenance and one customer care

and administration staff member. According to a technical staff member in Auki Office, only one technical staff member was tasked with operating the entire O&M works in Auki City since another technical staff member had resigned in 2015. As a result, it took most of the day to do the daily maintenance work, and it was difficult for only one technical staff member to visit non-paying customers to disconnect the water supply. Also, during the billing period, billing to customers was also the member's work, as well as daily maintenance work, but it took a long time for even two staff members, including administration staff, to visit all customers for billing. As some respondents of the qualitative research requested the SIWA staff to visit and read the meter regularly in order to avoid fluctuations in the billing amount, meter reading for billing was not thought to have been periodic. To reduce the workload for the technical staff, a new technical staff member had been assigned as of January 2018, but it potentially required a certain period of time to eliminate the effects of staff shortages until the new member became adept in performing the operation.

Regarding institutional aspects of operation and maintenance, there were no problems at the Honiara City location and it can be seen that the problem had been being addressed in Auki City by adding another staff member.

3.4.2 Technical Aspect of Operation and Maintenance

In terms of facility operation and O&M method, the project consultants held two sets of training programs (lecture and practice) as a soft component attached to this project, and all staff members in charge of O&M attended the programs to acquire necessary skills for performing the daily operation. Also, in this component, the consultants created operation manuals and submitted them to the SIWA. As for knowledge transfer, since the SIWA did not experience transferring of staff between sections and since the changing of members was not very frequent, there was no specific protocol for handing over responsibilities or knowledge transfer among staff. However, when a new staff member joined a section, the skill was certainly transferred without problems through OJT which was conducted by working with experienced staff to acquire the new skill. Therefore, there was no problem with the technical aspect of operation and maintenance at the time. Also, there was no utilization of operation manuals for daily O&M works as mentioned above, but there was no need for referring to the manuals to conduct operations because the operation works know-how had been disseminated among staff. Thus, skill transfer through the manuals was thought to have been achieved. Therefore, the technical aspect of operation and maintenance did not seem to have problems to date.

On the other hand, there were no specific opportunities for present staff to regularly undergo capacity development although SIWA secure the training budget every year. Some staff members had been dispatched to one-time-only international conferences and training courses,

but such opportunities were confined to a certain number of staff members.

3.4.3 Financial Aspect of Operation and Maintenance

The SIWA's recent income and expenditure is shown in Table 10.

Table 10. Breakdown of the SIWA's Major Sources of Income and Expenditures (2014 – 2017)

(Unit: million Solomon Dollars)

		2007	2014	2015	2016	2017
Income	Sales revenue (water bill)	33.7	81.1	84.3	91.9	88.8
	Non-sales revenue	0.6	6.0	16.7	13.6	11.7
	Subsidy from the Solomon Islands government (Community Service Obligation: CSO)	3.2*	3.1	0	4.6	0
	Aid from foreign government(s)		3.0	0.1	2.3	0
	Total	37.5	93.2	101.1	112.4	100.6
Expenditures	Staff salary and benefits	3.9	21.6	22.4	20.1	23.0
	Maintenance cost (operation and repairs and maintenance)	15.5	40.9	40.2	38.6	38.9
	Other expenditures (administration costs, amortization, etc.)	7.9	24.6	31.4	28.4	31.3
	Total	27.4	87.1	94.0	87.1	93.2
Balance		10.2	6.1	7.2	25.3	7.3

Source: Information provided by the executing agency

Notes: Some parts of the breakdown and total may not match because of rounding.

*Mentioned as "Aid from the Solomon Island government and foreign governments" in 2007

The SIWA's recent income greatly increased compared to that in 2007, a base year. The SIWA's main income is sales revenue, collection on water billing, which is 80% of its total annual income. The SIWA is a state-owned enterprise but there is no operational budget allocated from the government; their operation is mainly financed on the sales income collected on water billing. Since 2014, after project completion, sales revenue has multiplied 2.5 times higher than that in 2007 because of an increase in the number of customers, a decrease in that of non-paying customers, an increase of water tariff, and so on. Also, the Government of the Solomon Islands expected to provide a so-called CSO (Community Service Obligation) every year from 2012 for improving water facilities in provinces. However, the subsidy had not been allocated every year, as shown in Table 11; the government refused to allocate the fund in 2015 because, as they explained, the SIWA had not reported its fund usage clearly; and, the government conveyed that they would not allocate the fund in 2017 because of a financial issue of the government. Thus, it is hard to say whether the government subsidy has been a stable funding source.

Table 11. Government Subsidy (CSO) Allocation History

(Unit: million Solomon Island Dollars)

2012	2013	2014	2015	2016	2017	2018
3.0	3.0	3.1	0	4.6	0	3.0

Source: Questionnaire answered by the executing agency

With regard to the actual income and expenditures in the 4 years after the project, as shown in Table 10, although the figures vary to some extent, the SIWA has made a profit for 4 consecutive years and the profit in 2016 significantly increased compared to past fiscal years. The reason was that the sales revenue increased, and furthermore, the subsidy (CSO) from the Solomon Islands government was allocated while aid from foreign governments also increased. Regarding expenditures, the SIWA saved staff cost, and the cost for disposal of equity held in 2014 and 2015 was not incurred in 2016 as they had been completed. During the situation in 2017 in which there had been no aid from foreign governments and the income from water billing had declined, the SIWA secured a certain amount of profit in spite of the cost increase due to software updating and training. Therefore, it can be said that the financial aspect is in good condition. However, the SIWA recognized that the profit was not adequate as there were a lot of areas which required an infusion of funds, such as large-scale facility upgrades, capacity development for staff members, and so on.

Therefore, the financial aspect of operation and maintenance was stable and sound at the time of ex-post evaluation. However, since the funding needs were still high, such as those for NRW, increasing yields, and so on, a situation in which more funds are needed remained.

3.4.4 Status of Operation and Maintenance

In Honiara City, engineers went on daily rounds of the facilities to check operation conditions and cleanliness around the facility, and when they found damages, they made repairs depending on the degree of the damage. Also, they cleaned the inside of the pump once a year. Engineers contacted asset management staff on the network maintenance team to ask for grass cutting around the facility and for cleaning of the inside to be done depending on conditions. In facilities in Auki City, technical staff at Auki Office monitored the conditions of boreholes and electric facilities daily. Also, the staff hired a worker to cut grass once a month and reported the condition of facilities to provincial operations teams weekly. According to the procedures taken above, the facilities in both Honiara and Auki cities as a whole were in good condition and there were no problems in terms of operations.

In addition to the above, in the field survey at the time of ex-post evaluation, some unused facilities and damages to facilities were confirmed, all of which were in Honiara City, as shown in Table 12.

Table 12. Unused facilities and damages (Honiara City)

Item	Facility	Location	Detail (Reasons of unused, damages)	To do next
Unused Facilities	Chlorine dosing equipment at pump station	Tasahe Titinge Borderline	- Burden of staff who hand-carries chlorine for delivery every day. - Stairs to the chlorine facility are too narrow to carry chemicals and there is a danger of staff falling off or from the stairway. - Chlorine feeding pipes are often blocked up.	Install a dosing pump instead of dripping chlorine by force of gravity
	Boreholes and pump station	Titinge	- Yields are poor. - Electricity costs for pumping are too high and produce small yields. - Capacity of transmission pipeline, which is to send water after yielding, is too small.	In progress of Constructing new water transmission pipeline; Water transmission will be re-started after its construction.
	Turbidity reduction facility	Kombito Spring	Pressure to distribute water to end-users through the turbidity reduction facility is too low to distribute because of the increased number of connections at present (Water distributes to the end-user directly from the spring so far not through the facility.)	Not decided yet
Facility breakdown or damage	Breakdown of fans at pump station	Skyline Borderline	Not working when turned on	Replace parts when receiving
	Damages of fence at distribution reservoir	Skyline	Fence was partially buried by the landslide in 2017	To be repaired in 2018

Source: Site visit result and responses of the executing agency

As for unused facilities, since the facilities were constructed according to the plan which had been agreed at the time of basic design study, the reason was neither design and construction failure nor facility breakdown. This was because there had been a difference between the specifications of the facilities and actual operation procedures when using the facilities; some facilities were not user-friendly for SIWA staff and they felt that the operation cost was higher than their expectation. The recognition gap should have been filled in through the project between the project consultants who had designed the facilities and the SIWA which had been the executing agency of the project at the time of basic design study, but regarding the detail of the design, one project member from the SIWA commented that the SIWA could only receive the report from the project consultants because the SIWA did not have enough expertise or experience to evaluate the specifications and give requests at that time. Because of unused

facilities such as the unused turbidity reduction facility and chlorine facilities, some indicators on effectiveness have been affected (e.g., water supply volume from new water sources and frequency of turbidity). Additionally, for the turbidity reduction facility, it was not used in 2015 at the time of inspection. The project consultant advised the SIWA to examine methods on how to provide the water supply effectively and stably and to consider utilizing the facility at Kombito Spring[9]. As for the unused chlorine facility, the SIWA uses some previously used chlorine facilities which had existed before project implementation for water treatment use and thus, there was no impact on effectiveness observed. At the time of basic design study, chlorine facilities were to be installed for supplying chlorine to receiving tanks which stored water from boreholes and transmitted water from the tank, but according to the SIWA, chlorination was actually done at a distribution reservoir or water tanks when water was supplied from receiving tanks. In regard to the water quality, the water quality monitoring team from the Honiara City Council said that the residual chlorine concentration usually met the criteria and there was no problem with the water quality. Yet since facility aging was on-going in some facilities, the SIWA was planning to utilize the unused chlorine facilities by changing the chlorination dosing method.

Unused chlorine facility
(Tasahe Pump Station)

Stairs for chlorine facility
(Tasahe Pump Station)

All dilapidated facilities were planned to be repaired in 2018. According to the SIWA, the spare parts which had been ordered were not difficult to obtain and rapid repair was expected. Therefore, regarding the current status of operation and maintenance, the facilities in operation were in good condition and there was no problem with the current maintenance status.

[9] It was not certain how long the facility had not been utilized after the project completion in 2014 as it could not be confirmed with the executing agency, but since the facility was not being used at the time of ex-post evaluation, it could be possible that the facility had not been used for 3 years, from the inspection in 2015 until the time of ex-post evaluation.

However, some facilities had not been fully utilized, and the current status of operation therefore had some problems. Thus, a few problems had been observed in terms of the current status of operation and maintenance.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was planned to build water supply facilities in Honiara and Auki cities for improving water supply conditions, such as increasing and stabilizing the water supply, improving the quality of water supplied, thereby contributing to the realization of a hygienic environment for living. Since this project was confirmed to be consistent with the development plan and development needs of the Solomon Islands at the time of both planning and ex-post evaluation, and with the Japanese ODA policy at the time of planning, the relevance of this project was high. Regarding the implementation of this project, although the project cost was within the plan, the efficiency of the project can be said to have been fair because some facilities to be installed were not constructed, and the project period greatly exceeded the plan because of prolonged discussion on land acquisition. As for the effectiveness of the project, the water supply volume and the stability of the water supply in Auki City improved as the water supply volume increased after project completion, and the total hours of water supply served per day in the area was achieved at 24 hours. In Honiara City, although the yield from the new water source was below the estimation, a certain water supply volume was secured through construction of the facility, and the water quality during normal operation was so improved as to clear the standard of Honiara City for water quality monitoring. In contrast, the water turbidity problem was not resolved as a turbidity reduction facility was not installed at Kongulai Spring which affected the stability of the water supply by causing water turbidity and temporary shutdowns of the water source during heavy rain. As for the project impacts, sanitation of households and businesses improved on past conditions before the project, as the water supply reached a stable condition through the improvement of water supply facilities. As a result, the reliability of the Solomon Islands Water Authority (hereinafter referred to as “SIWA”), which provides water supply services, increased. Therefore, the effectiveness and impacts of this project were fair. Regarding sustainability, there was no problem with institutional or technical aspects of operation and maintenance and the financial aspects were sound. However, the sustainability can be said to be fair as there were some problems observed; these problems were minor ones in that some facilities were not used because the facilities were not user-friendly enough for the staff to operate. Therefore, the sustainability after project completion is judged to

be 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

(1) The turbidity reduction facility had been installed at Kombito Spring through this project, but the reduction of the turbidity had not been achieved as the facility had not been used because there was not enough water pressure to deliver the water to the end user through the facility, which in turn had been caused by the increase in water service connections. As the project consultants pointed out at the time of inspection, in the facility rehabilitation plan such as the "5-year plan (action plan)" that the SIWA provided, it would be desirable to plan the designing of a water supply system which can be transmitted and distributed through a turbidity reduction facility without any negative impacts on the water pressure in order to achieve a stable water supply and an improvement of water quality.

(2) In this project, thanks to implementing the soft component of the project and utilizing manuals, there was no problem with the staff skills related to maintenance work, but as there was no specific opportunity for continuously maintaining or brushing up their skills within the organization, there may be some concern about future opportunities to maintain or enhance their skills. In order to maintain good facility condition, for instance, several years later when the large-scale replacement of the facilities is completed, it is desirable to secure training opportunities internally.

4.2.2 Recommendations to JICA

The boreholes constructed through this project were installed to secure a sufficient water volume so as to decrease the dependency on Kongulai Spring. However, since 2015, as the situation in which the yields from each borehole had been poor was ongoing, both the electricity cost and the risk of an exploding transmission pipeline from the water hammer problem had become high when pumps operated at low water volume, and consequently, some boreholes and pump stations had been stopped. Although all these facilities were the outputs according to the plan and the handover process had been completed, there may be a need for some actions to be taken for utilizing facilities. To solve the problems above and to return the facilities to operating capacity, as was the original purpose, it can be desirable for JICA to seek possibilities for offering continuous advice and cooperation to the SIWA, such as replacing pumps, as suggested in the review report and so forth, aiming at effective utilization of borehole facilities.

4.3 Lessons Learned

Adequate explanation and facilitating understanding of the plan to the executing agency

In terms of the basic design study before project implementation, there was an observation from a project staff member from the executing agency, who stated, the “SIWA did not have enough skill and expertise to evaluate at the time of the basic design”. As a result, a problem had occurred in which some facilities had not actually been used for a reason other than a breakdown, although the facilities were constructed according to the plan. For better facilities for users to be constructed, it is necessary for the executing agency to become actively involved from the basic design study phase and to have close communication with the project consultants. To achieve the above, it is also important for the project consultants to give well-explained instruction to facilitate understanding of the plan for the executing agency. When a similar project is implemented, more opportunities for discussions and collaborative efforts are desirable for the executing agency and project consultants to improve the capacity of the executing agency. Also, if possible, it may be effective for the project consultants to provide opportunities for having a “mini seminar” or workshop for the staff members of the executing agency in order to confirm the necessary expertise, such as those on holistic comprehension of water supply systems and facilities, designs to improve water supply services in the basic design study. It is desirable to build a system for the executing agency in which they have active involvement in the project and fill in the gap as much as possible between the facility constructed and its actual operation.

Setting the negotiation period and providing an option in order to prevent the delay of the project when the negotiation is not settled

The project was completed 7 years after implementing the basic design study, 3 years later than the planned year of project completion. The delay of negotiations on land acquisition, the main reason of the delay of the project, had been expected at the time of the basic design study, but the negotiation between the government and the ethnic group was delayed more than the expectation, and the land acquisition was ultimately not achieved. If a similar project is implemented in an area which includes land acquisition, like the Solomon Islands, and if it is expected to be difficult to negotiate such acquisition, it is desirable to set a deadline for the end of negotiations and discuss and agree with the executing agency during the basic design study period whether they would change its project scope or adopt an optional plan etc., in case the negotiation is not settled by the due date. It is the most desirable to achieve the land acquisition and construct the facilities as planned, but sometimes it is more desirable to build the facilities quickly rather than extending the project period for negotiations. To provide a facility at the optimal hand-over timing, if the project is centered around its completion within the project period, the project may be more effective and efficient if the optional plan, which is expected to

give comparable effects of the original project design, is separately discussed during the basic design study or the negotiation for the land acquisition.

(End)

Solomon Islands

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for the Improvement of Radio Broadcasting Network for Administration of Disaster Prevention"

External Evaluator: Hisae Takahashi, Ernst & Young ShinNihon LLC

0. Summary

This project was implemented to provide swift and adequate disaster and disaster-prevention information throughout the Solomon Islands by installing short-wave transmitter systems, thereby helping improve the islanders' awareness of disaster-prevention and mitigate damage from natural disasters. Its purpose is consistent with the development strategy of the Solomon Islands which has prioritized improving resilience and related measures when disasters occur and development needs frequently impacted by natural disasters, as well as Japan's aid policy. Thus, the relevance of the project is high. Though the project cost was within the planned budget, the project period largely exceeded the plan due to the extra time needed to respond to land issues and upgrade the transmitter performance. Consequently, efficiency of the project is fair. Implementing the project made short-wave radio broadcasting possible on a 24-hour basis in the event of a disaster and the effect of using weather forecasts obtained through radio broadcasting to prevent damage was confirmed. Conversely, disaster-prevention broadcasting communications radio systems, installed to related agencies handling disaster management information, have not been fully utilized. Accordingly, although this project has achieved its expected objectives to some extent, part of the effect remained limited, so effectiveness and impacts of the project are fair. While the institutional and technical aspect and the condition of the Operation and Maintenance (O&M) for the radio broadcasting system are positive, management and utilization of disaster-prevention broadcasting communications radio system and financial aspect of agencies overseeing operation and maintenance have minor issues. Accordingly, sustainability of the project can be judged as fair.

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

1. Project Description

Project Location (Whole Solomon Islands)

Short Wave Antenna Mast

1.1 Background

Solomon Islands consist of six major islands and about 100 small islands in the South Pacific. It is always exposed to risks of such natural disaster as eruption, earthquakes, tsunamis, tidal waves, cyclones and floods. Information communications infrastructure was vulnerable except for some urban areas and the sole quick means of communication at the time of planning was radio broadcasting. However, the radio broadcasting service was not sufficiently provided due to frequent suspensions caused by failures of transmitters. Moreover, due to dilapidations of facilities, the coverage was much smaller than it was expected, hindering information provision to islanders. Accordingly, there was an situation in which they could not fulfill their full function in case of emergencies such as natural disasters. Thus, it was a pressing need to improve the short-wave broadcasting network, which made it possible to provide emergency broadcasting service nationwide in time of disasters, to ensure a safe and stable living environment for islanders. In the meantime, Solomon Islands Broadcasting Corporation (SIBC), the organization responsible for distributing national information, had a limited budget to upgrade and repair part of the equipment, but upgrading the entire short-wave broadcasting system was considered difficult. Although SIBC had also no problem in operating and maintaining the regular practice of short-wave broadcasting system, it was deemed technically incapable of planning and implementing a large-scale project for upgrading equipment, including constructing and installing an antenna.

Under such circumstances, the Government of the Solomon Islands requested Grant Aid support and a project to improve their capacity to deliver information was launched, including information on emergency disaster and disaster management.

1.2 Project Outline

The objective of this project is to provide the stable radio broadcasting service for disaster-prevention and mitigation throughout Solomon Islands by installing the short-wave

transmitter systems, thereby contributing to the improvement of islander's awareness to disaster-prevention and to the mitigation of damages from natural disasters.

Grant Limit / Actual Grant Amoun	504 million yen / 503 million yen
Exchange of Notes Date/Grant Agreement Date	March 2011 / March 2011
Executing Agency	Solomon Islands Broadcasting Corporation (SIBC)
Project Completion	July 2014
Main Contractors	Kanematsu Corporation (Construction) Hitachi Kokusai Electric Inc., Denki Kogyo Co., Ltd. (Equipment)
Main Consultant	Yachiyo Engineering Co., Ltd.
Basic Design Survey	September 2009 - March 2011
Related Projects	・Technical Cooperation "The Strengthening Community-Based Disaster Risk Management Project in the Pacific Region" (October 2010 -September 2013) ・The Regional Assistance Mission to Solomon Islands (RAMSI) "The Solomon Islands Media Assistance Scheme "(2008 -2010) ・AusAID "Lata Medium-wave transmitter development" (2003) ・Taiwan "Development of Medium-wave transmitters, short-wave transmitter, FM transmitters in Henderson and Gizo" (1999)"

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Ernst & Young ShinNihon LLC

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2017 – November 2018

Duration of the Field Study: January 22 – February 9 and April 18 - 24, 2018

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 Solomon Islands

At the time of planning this project, the Solomon Islands development policy *Medium-term Development Strategy* (2008 - 2010) cited six priority areas. One of these, "providing effective

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

[2] ③: High, ②: Fair, ①: Low

social services", explained communicating prompt and accurate information to the whole country in emergencies such as natural disasters as its mission. The *Solomon CNURA policy* (Coalition for National Unity and Rural Advancement), a measure for economic rebirth and fiscal support at the time, legislated bills for government-funded public corporations and the *SIBC Corporate Bill* were enacted. Accordingly, SIBC was obliged to broadcast the necessary information nationwide as a fair independent and democratic communication network[3].

At the time of ex-post evaluation, the *national development strategy* (2016 - 2035) advocates the improvement of national economic and social life. Among the five main objectives of the strategy, target 4 "Resilient and environmentally sustainable development through effective disaster risk management, response, and recovery", improvement of risk management including preparations prepared for disaster and prompt response were shown[4]. Meanwhile, the country's *national disaster management plan* (2017) clearly sets out the institutional framework for disaster management, operations and recovery arrangements. The decision-making body of the operation and the National Disaster Operation Committee described in this plan are expected to play key roles in disseminating information by involving SIBC as a committee member with a telecommunication companies[5].

As mentioned above, the development strategy of the Solomon Islands has focused on improving risk management and means of information transmission for environmental and climate change from the time of planning until the ex-post evaluation. SIBC also participates as a member of the committee playing a central role in the event of a disaster and the importance of the SIBC role in such event is reconfirmed. Accordingly, the consistency of this project can be confirmed with the country's development strategy; targeting prompt and reliable transmission of disaster prevention information by improving short-wave broadcasting system equipment.

3.1.2 Consistency with the Development Needs of the Solomon Islands

The Solomon Islands, which is a nation comprising more than 900 islands, is volcanic, as well as being particularly prone to cyclones and earthquakes and its inhabitants have always been endangered by various natural disasters. However, at the time of planning, the information communication technology infrastructure in the country remained undeveloped except for some cities and there was a reliance on radio broadcasts as an only means of providing information to the public. Meanwhile, short-wave broadcasting networks at the time of planning are limited to overnight (17:00 - 9:00) due to insufficient functions and equipment failure, also stop affected by insufficient power capacity, hindering broadcasting service, resulted in difficult situation for

[3] Source：Document provided by JICA
[4] Source：*National Development Strategy 2016 to 2035*, pp.1-14, 42-45
[5] Source：*National Disaster Management Plan 2017-Finalized Draft*, pp.38-41

short-wave broadcasting networks to play the role of conveying information in the event of an emergency such as a natural disaster. At the time, given the lack of any effective alternative to disseminate disaster information, improving short-wave broadcasting networks capable of dealing with disasters was considered an urgent task by developing equipment that can make the whole country a service area.

Even after this project got underway, while the country has been damaged by cyclones and various natural disasters (see Table 1), the means of obtaining information, such as mobile phones, the Internet and SNS have all expanded compared to the time of ex-post evaluation and the planning stages. However, such communication networks remain largely inaccessible in rural areas in particular and the communication infrastructure which is possible to transmit information constantly is still limited. Even in urban areas, though the changes to the needs of radio as a means of obtaining daily information has been confirmed, telephone and Internet networks remain vulnerable and there are frequent telecommunication network issues due to insufficient capacity. In the event of a disaster, usage of mobile phones and access to the Internet will soar and it is assumed that servers may well crash. Accordingly, radio is positioned as a key backup tool even in urban areas as means of obtaining information and at the time of ex-post evaluation, the urgent need to improve the radio broadcast network was acknowledged.

Table 1 Natural disaster occurred in the Solomon Islands during the project

Year	Event	Damaged province	Damages
2012	Cyclone(Jasmine)	Isabel province Makira-Ulawa Province	Not clear
	Flooding & landslide	Makira-Ulawa Province	Not clear
2013	Cyclone(Freeda)	Makira, Guadalcanal Province	Not clear
	Earthquake & Tsunami	Temotu Province	Five villages wiped out, damaged cost SBD 38 million
	Flash flood	Malaita Province	Not clear
2014	Cyclone(Ita)	Guadalcanal Province	Not clear
	Flash flood	Guadalcanal province	23people died, 49,000 households
2015	Cyclone(Pam)	Temotu, Malaita, Makira/ Ulawa Province	Not clear

Source: document provided by National Disaster Management Office

3.1.3 Consistency with Japan's ODA Policy

At the 5th Pacific Islands Summit[6] held in May 2009, the Japanese government decided to target efforts to support "environmental and climate change" for the Pacific Islands, including the Solomon Islands, as one of its three pillars. In addition, in light of the dialog on economic cooperation policy in June 2009, key areas of cooperation specified to emphasize in the

[6] The Pacific Islands Leaders' Meeting (PALM) has been held every three years since 1997 with the purpose of strengthening relations between Japan and Pacific Islands comprising Micronesia, Melanesia and Polynesia. Summit-level dialog is also being explored to resolve various issues for stability and prosperity in the Pacific Islands and other countries.

Solomon Islands[7] included "narrowing the disparities through economic development," "improvement of social services," and "strengthening of environmental protection and natural disaster provision." This project aims to ensure information transmission in disaster and to consolidate transmission capacity, which is consistent with the priority items of Japan's support to the Solomon Islands.

In light of the above, implementing this project is highly relevant to the Solomon Islands development policy, development needs and Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

[Japanese side]

The main output of this project comprises the short-wave broadcasting system equipment provided to SIBC and the disaster/disaster-prevention broadcasting communication system (VHF radio equipment) installed at the agencies handling disaster information and consulting service. Table 2 shows the plan and actual output of this project. The output was roughly as planned, except for the removal of the antenna pole of the disaster/disaster-prevention broadcasting communication system, relocation of the installed VHF radio equipment / antenna and a change in the short-wave transmitter frequency.

Table 2 Planned and actual output

Items	Plan	Actual
1. Short wave transmitter system 10kW AM Short wave transmitter, Coaxial patch panel, Directional coupler, Dummy load, Program input equipment	1 set	As planned
2. Short wave antenna system (Wide band dipole antenna) Antenna mast, Antenna element, Antenna feeder, Balun, Earth ground mat	1 set	As planned
3. Power supply equipment for transmitter Isolation and lightning protection transformer, Automatic voltage regulator, Primary Distribution Board	1 set	As planned
4. Disaster/disaster-prevention broadcasting communications radio systems VHF radio transceiver, VHF radio repeater, Power supply for VHF radio transceiver, VHF radio antenna, Antenna pole, Mobile VHF transceiver	1 set	Antenna pole was deleted from procurement of equipment.
5. Program transmission link equipment VHF Audio program transmission link transmitter for short wave broadcasting, Automatic voltage regulator	1 lot	As planned
6. Maintenance equipment and tools Oscilloscope, Spectrum analyzer, Circuit tester, High voltage probe, Linear detector, Distortion meter/oscillator, Audio attenuator, Tool kit, Safety belt	1 set	As planned

[7] Source: document provided by JICA, ODA Country Data book (2009)

7. Spare parts Spare parts for short wave transmitter, Maintenance kit for antenna system	1set	As planned
8. Consumable parts Fan unit for transmitter, Air filter for transmitter, Fuse for transmitter, Surge absorber for isolation transformer, Fuse for PIE, Fuse for Automatic voltage regulator	1set	As planned
9. Consulting service/Capacity building program (Soft component) Plan: Detailed design, Supervision of implementation, Initial trainings for operation and total system of the equipment (manner of equipment operation, measures to damages, initial trainings for operation of daily inspection)		As planned

Source: documents provided by JICA and questionnaire
Note: Training for initial operation was provided to three persons for the short-wave transmitter and antenna and 24 persons for disaster-prevention broadcasting communications radio systems.

The reason for the change and countermeasure are as follows: There is no difference between the achievement expected from planning and the equipment functions and it can be said that there was no issue of imposing these changes.

[Changes of output]

① Delete antenna poles:

(Reason) Although scheduled to be installed on the premises of the National Disaster Management Office (hereinafter referred to as "NDMO"), implementation of this project was delayed due to the antenna pole site problem, and meanwhile the support of the Regional Assistance Mission to Solomon Islands built the multipurpose antenna pole. Overlapping functions of both pieces of equipment were confirmed, thus it was decided not to proceed with the set-up according to the request from the Prime Minister's Office of Solomon Islands[8] after confirming the possibility of using it as an antenna of this project.

② Installation location of VHF radio communication device of the disaster/ disaster-prevention broadcasting communication system, and the VHF radio antenna:

(Reason) To dismantle the Meteorological Agency Building, which was originally planned to be installed and when constructing a new station building, the weather forecast division moved to one room in NDMO, whereupon VHF radio communication device was installed in NDMO[9].

③ Frequency change of short-wave transmitter

(Reason) Initially, plans involved this project using the frequency of the short-wave transmitter at 6080 kHz. The same frequency was used by ABC Radio Australia at the

[8] Source：interview survey with the consulting company and executing agency
[9] Source：interview survey with the consulting company, executing agency, NDMO and Meteorological Agency

time of planning and its usage rights were scheduled to expire at the end of 2009. However, the rights were extended and the decision was made to continue use by ABC Radio Australia. A request to change the frequency from SIBC was submitted and it was decided to use 5020 kHz, which the Solomon Prime Minister's office had previously owned[10].

[Solomon Islands side]

The following eight items were carried out as planned by Solomon Islands side's portion[11]

1. Tax exemption and customs clearance procedures at unloading port
2. Providing a temporary storage location near the site
3. Repair of the transmitting station building
4. Removal of mowing and obstacles in new antenna land
5. Securing the disposal site of removed materials
6. Implementation of test broadcasting
7. Fence setting around the new transmitting antenna
8. Exemption from custom duties

Short-wave transmitter
(Henderson Transmitter site)

Disaster/disaster-prevention broadcasting communication system
(SIBC headquarter)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The Japanese side covered a cost of 503 million yen against the Exchange of Notes (E/N) limit of 504 million yen, which was within (99.8% of) the plan. The planned project cost, including a contribution of about 2 million yen from the Solomon Islands side, was 506

[10] Source : interview survey with the consulting company and executing agency
[11] Source : documents provided by JICA, questionnaire responses from Prime Minister's Office and executing agency

million yen, but since it was not possible to confirm the expenditure incurred by the Solomon Islands side in detail, it was difficult to compare the total project cost. As all the responsibility items on the side of the Solomon Islands were implemented as planned without any issues (see "3.2.1 Output"), the money is considered to have been used as planned.

3.2.2.2 Project Period

Although the planned period of this project[12] was 19 months, it actually took 40 months from April 2011 to July 2014, which significantly exceeded the plan (211% thereof). The delay occurred mainly due to the land problem concerning the installation site of the short-wave antenna and the response to the upgrade of the short-wave transmitter. Details behind each factor are as follows:

【Delay caused by the land issue related to the short-wave antenna site】

After concluding E/N, it emerged that the Henderson antenna site, planned as the venue for installing the short-wave antenna, was private, which meant solving the issue would take longer. Consequently, the need emerged to secure land in which to install an antenna in neighboring nationally owned territory and around 18 months were subsequently required to restart the project[13]. In the Solomon Islands, approximately 90% of national land is customary land, most land is not registered for landowners and special circumstances, the use of unregistered customary land without permission which was one of the factors sparking ethnic conflict, exist. The project obtained a letter from the Ministry of Lands, Housing and Surveys to secure and provide Henderson land at the preparatory stage (2010). This letter, however, cited that the necessary procedure would be taken to secure the land before the project started and that securing said land was not assured. Given the many similar land issues occurring in this country, swiftly solving the same kind of issues is considered difficult, unless the project starts under the circumstances where the required land is assured, not only obtaining a letter committing to provide land.

【Delays to respond for upgrading the short-wave transmitter】

The short-wave transmitter was locally installed after shipping, but the planned contract period (November 2013) had to be extended to ensure its quality could be secured[14]. The short-wave transmitter transmits waves by combining antennas, raising the possibility that

[12] The project period is defined from the contract with the consultant till the month of completion of equipment installation. The starting month is normally set as the month of E/N unless specifically described otherwise in the ex-ante evaluation report. However, since the starting point of the planned project period was not described in the ex-ante evaluation report of this project, the schedule written in the preparatory survey report was applied. This schedule for the planned project period did not include the E/N or Grant Agreement dates, or specify the commencement of the project period as a detailed design meaning the contract day of the consultant. Accordingly, both the plan and actual project commencements was considered to be from the start of detailed design.

[13] Source：Questionnaire response, interview survey with consulting company

[14] During this period, test operation was started to prepare for disasters.

the design functions could be hindered in the actual environment after installing the antenna, as was done in this project[15]. With this in mind, upgrading was suggested by the manufacturer and implementing the same took nine months in response[16]. This case did not come into the category of design issues, but instead, changes were required to improve the function, so it was a delay accompanied by a required equipment upgrade to ensure quality.

As described above, although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[17] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

(1) Available radio broadcasting hours

Before implementing the project, radio broadcasts were limited to nighttime hours (17:00-9 : 00) due to malfunctioning short-wave broadcasting facilities. Accordingly, if disasters were to occur in daytime, the ability to convey information through radio broadcasts were limited in a part of cities such as Honiara, Auki and the others, and doing so would for all the people in the islands proved a challenge.

Implementing this project allowed a system providing a 24-hour short-wave radio broadcasting service to be established after project completion by installing a short-wave radio broadcasting facility including a short-wave transmitter and antenna, power supply equipment for the transmitter and so on. In fact, radio broadcasting is normally provided for 18 hours (5:00 – 23:00) given the limited number of late-night listeners and taking electricity cost and other factors into consideration. The service hours can, however, be extended if disasters or emergencies occur. During the interview with the islanders, it was actually confirmed that radio was broadcast continuously and beyond normal service hours in the event of a downpour in the rainy season to provide information.

[15] It was clarified that the frequency character and distortion were slightly lower than specified values when test operation ensued with overpower (15 kW) output as compared to the normal 10kW. Since no issues arose when used with the normal 10kW, upgrading this equipment was not mandatory. The consultant, however, prioritized efforts to ensure quality and responded to this upgrading.

[16] Source: Consulting firm and interview survey with executing agency

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

Table 3 Available short-wave radio broadcasting hours

	Baseline	Target	Actual	
	2011	2016	2014	2017
		3 Years After Completion	Completion Year	3 Years After Completion
Available Short-wave Radio broadcasting Hours (hrs.)	Night time 17:00～9:00	24 hours	24 hours	24 hours

Source: documents provided by JICA, Questionnaire

(2)Coverage area of radio broadcasting

Coverage of short-wave radio broadcasting in the Solomon Islands remained 100%, even before implementing the project. However, clear sound quality proved unattainable with SIBC equipment owned at the time of planning over an increasingly wide area due to deterioration of transmitters and others. Installing equipment for the short-wave broadcasting system in this project improved this issue, unless the radio receivers have issues. Conversely, the issue of unclear sound quality of short-wave broadcasting was confirmed, but this was attributable to the quality of the radio receivers rather than any transmitter issue[18] in the interview with the executing agency and the site survey in islands outside the capital city[19].

Table 4 Coverage area of short-wave radio broadcasting

	Baseline	Target	Actual	
	2011	2016	2014	2017
		3 Years After Completion	Completion Year	3 Years After Completion
Coverage area of radio broadcasting in the Solomon Islands (%)	100%	Not set	100%	100%

Source: document provided by JICA, questionnaire

3.3.1.2 Qualitative Effects (Other Effects)

(1)Expedited broadcasts for disaster / disaster-prevention

In the Solomon Islands, at the time of planning, means to convey information by related agencies handling the disaster-prevention information included email, telephone and so on. As explained above, the nationwide communications network infrastructure remained poor, even in the capital city of Honiara and mobile phone and email communication frequently failed due to a lack of capacity in the event of emergencies, which meant sourcing

[18] According to the executing agency, more and more cheap radios of poor quality have been imported. Moreover, obtaining high quality radio is difficult outside the capital city.

[19] Group interviews with residents in suburbs of Honiara, Gizo, Temotu and Izavela provinces were conducted to collect information on the qualitative effect and impact. Total of 36 islanders whose areas were outside the mobile network (five each in Tamboco and Gizo, 23 in Lata and three from Isabel) were interviewed and the condition of radio usage, the use of information obtained through radio, the impact on daily life and so on were confirmed. However, it proved impossible to visit Isabel province because the flight was cancelled due to bad weather. Accordingly, interviews with islanders from Isabel province were conducted at a Hotel where evaluators stayed and met people who were visiting Honiara from Isabel province.

information promptly, even among related agencies, was one of the challenges. The project connected to the major stakeholder agencies, including NDMO, the police headquarters, the Ministry of Mines, Energy and Rural Electrification[20] the Meteorological Agency and SIBC with VHF radio. Consequently, it was expected that prompt coordination would be possible in the event of an emergency by utilizing VHF radio as a communication channel.

However, a system allowing swift information communication via VHF radio equipment in the event of an emergency could not be considered established as of the ex-post evaluation. Use of this equipment was limited to a few occasions, as confirmed by policy headquarters[21]. One of the major reasons was explained as the fact that cases involving large-scale disasters did not occur or the number of reportable cases was limited. In addition, NDMO confirmed the operational status through regular test operations by connecting each agency where the equipment was installed right after the project completion, but this was not done since NDMO relocated its office. Circumstances whereby disaster-prevention broadcasting communications radio systems were fully functional and swiftly delivered information in the event of disaster, could not be confirmed, even in other related agencies, for example the equipment was not properly set up (Refer to "3.4.4 Status of Operation and Maintenance " for the utilization status of installed equipment at each agency).

Although delivering information through email and telephone is normally possible for minor disaster-prevention information, as things stand, the related agencies still have a lack of understanding about the importance and needs of using VHF radio for communicating information. However, in this country, the communication infrastructure remains unstable and mobile phone connection problems abound, even in non-emergency cases, meaning the communication methods normally used are often unavailable due to server breakdowns or antenna collapses when a large-scale disasters occur. In these cases, the VHF radio function which can be used as a means of delivering information must be secured for back up. Agencies where equipment was not yet set up must respond before any major disaster occurs and prepare for the same accordingly.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1)Reducing damage from natural disasters

As explained above, there were many cases where people rely on radio in areas outside mobile phone reception even at the time of ex-post evaluation. In such areas, delivering disaster and weather forecast information to islanders via radio broadcasts made advance

[20] The Ministry of Mine, Energy and Rural Electrification is a government agency with jurisdiction over earthquakes and one of the related agencies dealing with national disaster / disaster prevention information.

[21] According to the police headquarters, when the cyclone occurred in Tomotsu in 2015, an example was given that information and alarms of heavy rain and earthquakes could be disseminated to various places, although not recorded.

measures possible. Even when a river flooded Guadalcanal Island in 2014, an appreciation letter was sent to JICA from the Solomon Islands for short wave radio acting quickly to convey information on the damage. Then, while no such cases of damage being mitigated have since been confirmed, the use and usefulness of disaster-prevention information were introduced through radio during interviews with residents. For example, many islanders, who listen to the radio, accessed information of the weather forecast in the morning and evening and particularly when downpours or storms were expected through radio. Depending on this information, they may rush home faster, prepare a stock of water, food, matches and so on, as part of advance measures taken to mitigate damages.

(2)Awareness effect with public broadcasting

It was expected that providing various awareness programs to islanders would be possible through radio broadcasting after implementing the project, which would help improve their awareness of disaster-prevention and health/hygiene and improve their lives indirectly. Awareness programs are actually produced and broadcast not by SIBC independently and have helped promote understanding of disaster prevention among islanders by broadcasting those awareness programs of NDMO, other NGOs and so on to islanders[22]. Islanders also gain insights through awareness activities provided by various organizations such as NGOs as well as awareness programs broadcast through radio. Meanwhile, despite not being awareness activities, it also emerged that many islanders learned about disaster-prevention and ways to react properly through the weather forecast and countermeasures explained in the radio program and practiced the same. For example, according to SIBC listeners, although SIBC used to provide only weather information in forecast earlier, measures to be taken alongside such forecasts have been also broadcast recently and the information is also considered to comprise part of awareness activities.

3.3.2.2 Other Positive and Negative Impacts

(1)Impacts on the natural environment

No negative impact on the natural environment was confirmed by implementing the project. A transmitter was installed inside the existing building and an antenna was installed on nationally owned land. Waste soil produced during the construction was limited; construction noise was minimal and very few private residents were around. Accordingly, no negative impact on the natural environment was confirmed during the project, according to interviews with the executing agency and with consultants.

[22] Source: Interviews with the Red Cross office, provincial police and islanders during the provincial site surveys.

(2)Resettlement and land acquisition

As described in "3.2.2.1 Project Cost", the originally planned sites to be acquired was on private land and it took longer to conclude an agreement with the land owner, prompting a shift to neighboring nationally owned land. Accordingly, no land acquisition and resettlement were generated for this project.

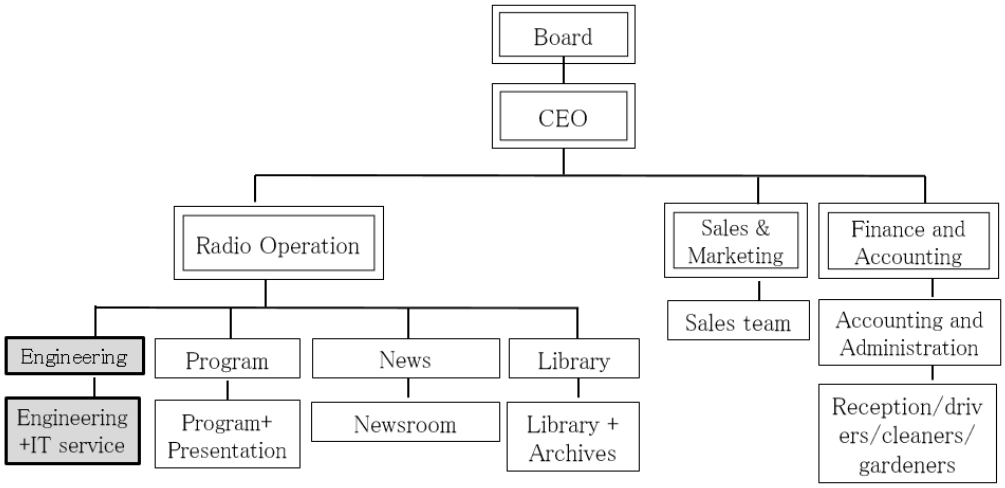
Installing equipment such as a short-wave transmitter and antenna and others improved the sound quality of short-wave broadcasting across the entire Solomon Islands and the system to provide information for 24 hours via radio has been arranged when disasters occur. Though no earthquakes or major cyclones have occurred since the project was completed, the effect of utilizing the scope to give weather forecasts such as storms and downpours through radio to prevent damage pre-emptively through preventive measure, particularly in provinces, was confirmed. Conversely, regarding the disaster-prevention broadcasting communications radio systems installed to the major agencies, which deal with disaster-prevention information, half were not in a serviceable condition to be used in emergencies given the lack of any appropriate configuration and so on after relocating offices. In light of the above, this project has achieved its objectives to some extent. Therefore, effectiveness and impacts of the project are fair.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The SIBC engineering team is responsible for the O&M of procured short-wave broadcasting equipment. Of the 50 SIBC staff members at the time of ex-post evaluation, 40 are technical staff and the remaining ten workers are such as cleaners. Despite the decline in the number of technical staff since project planning due to downsizing in the government sector, there have been no changes in the structure and staff numbers of the team in charge of equipment O&M[23]. Two technical staff are in charge of O&M of the installed short-wave broadcasting system equipment. While no concerns were reported from institutional perspectives at the time of ex-post evaluation, scope to recruit a further two staff members has been examined, with future sustainability in mind.

[23] Source: document provided by JICA, interview survey to executing agency



Source: document provided by executing agency

Figure 1 Organization Structure of SIBC

3.4.2 Technical Aspect of Operation and Maintenance

The staff in charge of SIBC equipment have been worked on radio transmitters as technical staff members and it was confirmed at the project planning stage that their capacity for O&M of facilities and equipment was sufficient to conduct O&M. O&M for the latest installed equipment required basic knowledge, which was conveyed by a Japanese technician as technical transfer, including the operational method of measuring equipment to detect errors, quality management, changing repair parts and so on. They were conducted as a form of On the Job Training, where SIBC staff members also experienced the entire process of installing equipment alongside Japanese technical staff. Accordingly, the SIBC staff members in charge are deemed to properly understand the function of the equipment, measures to be taken and contact information in the event of troubles. While two SIBC staff members understand the O&M methods at the time of ex-post evaluation, SIBC sees the need to share the experiences with other SIBC technical staff in future[24]. Though there are no plans to hold their own training on SIBC, courses on radio broadcasting or equipment are held at Fiji National University once every two years, in which staff may participate as required. Most SIBC technical staff had actually had opportunities to participate trainings in the past.

No issues emerged in terms of obtaining consumables and spare parts up to the time of ex-post evaluation. Stock supplied within the project scope was stored in the store room and it was also confirmed that coolant to cool the transmitter, which had to be regularly purchased, had been procured from Australia. When equipment has some issues, it is also possible to contact and receive some advice from the Japanese supplier. Manuals for short-wave transmitters are placed inside their facility and the use of manuals as required was also

[24] Source: interview survey with executing agency

observed during the site visit. As noted above, there were no concerns on O&M of the equipment provided from a technical aspect.

3.4.3 Financial Aspect of Operation and Maintenance

According to an interview with SIBC, no issues on the O&M budget or procured equipment arose, though the amounts concerned cannot be considered enough. The purchase of consumables, including coolant water for cooling transmitters and other, were also confirmed. No serious issues for financial information were confirmed in the details of SIBC's Income and Expenditure as well as cash flow (Tables 5, 6) up to 2016. The balance of payment up to 2016 shows a surplus and there are no cash flow issues.

Table 5 The breakdown of SIBC's revenue and expenditure

(Unit: Solomon Island Dollars)

	2014	2015	2016
Revenue			
Government grants	375,694	375,694	775,695
COS Note 1	4,006,000	3,900,000	3,930,000
Advertising	3,081,561	3,507,040	3,693,707
Broadcasts	1,240,862	1,426,311	1,486,367
Service messages	1,357,771	1,023,946	841,991
Rental income	195,592	246,560	307,400
Other revenue	231,930	127,695	181,421
Sub total	**10,489,410**	**10,607,246**	**11,216,581**
Expenditure			
Administrative expenses	3,788,427	4,067,413	3,359,607
Depreciation expenses	654,512	721,555	709,568
Direct costs	82,741	41,230	65,632
Employees cost	3,566,539	4,216,388	4,327,003
Finance expenses	20,571		2,877
Repair and maintenance	516,181	551,931	747,692
Sub total	**8,628,971**	**9,598,517**	**9,212,379**
Net profit	**1,860,439**	**1,008,729**	**2,004,202**

Source: documents provided by executing agency

Note 1: Abbreviation of Community Service Obligation. Items to be paid by the Government of the Solomon Islands on behalf of community to government owned companies which provide non-commercial goods and services.

Table 6 Breakdown of cash flow

(Unit: Solomon Island Dollars)

	2014	2015	2016
Cash flows from operating activities	1,444,353	2,557,342	2,072,117
Cash flows from investing activities	(1,481,704)	(1,322,960)	(1,439,663)
Cash flows from financing activities	(450,000)	(650,000)	(600,000)
Net cash flow	(487,351)	584,382	32,454
Cash and cash equivalents	**625,314**	**1,209,696**	**1,242,150**

Source: documents provided by executing agency

On the other hand, the Solomon Star (newspaper) posted an article in 2017 stating that the supply of power to SIBC was restricted due to serious financial difficulties of the government, the operation of the medium-wave transmitter was ceased in December 2017 and moves to shorten the operating time of the short-wave transmitter were also being considered if the situation were to worsen[25]. According to SIBC, measures to remedy this situation are needed and means of further streamlining the power consumption are being examined. For example, the International Telecommunication Union recommends shifting radio transmission of broadcasts from analog to digital format by 2020, which will reduce power consumption by 40%. Since the transmitter provided by this project is convertible to digital, SIBC is considering the feasibility of this implementation including securing the financial resources to fund such conversion.

As mentioned above, despite no serious problems in SIBC's financial situation up to 2016, power provision was stopped in 2017 when the ex-post evaluation was carried out due to unpaid electricity, whereupon the medium-wave broadcasting ceased. Concerns have been confirmed that if the financial situation deteriorates further, it will also hinder the operation of short-wave broadcasting equipment.

3.4.4 Status of Operation and Maintenance

It was confirmed during the interviews with SIBC and the site visit that facilities and equipment, including the short-wave transmitter and antenna and so on, were basically fully utilized and operated. The required O&M such as inspection and cleaning were made and the insides of facilities and premises were kept clean and organized. A problem whereby the transmission frequency-switching system did not automatically occur arose in January 2018, but does not affect the operating system function. SIBC has already contacted the suppliers concerning these issues and ordered the parts needed to inspect the condition and solve the issues. It is clear that SIBC has properly managed the operating equipment in making such responses.

Meanwhile, the scope to which disaster-prevention broadcasting communications radio systems and VHF radio equipment are used and installed in related organizations, allowing quick communication in the event of an emergency, remains not high as shown in Table 7. For example, in NDMO, repeaters, which are part of VHF radio equipment, are kept in SIBC due to the NDMO office relocating[26]. Since the Meteorological Agency was in part of the NDMO

[25] "SIBC battles to stay on air", Solomon Star, dated December 24, 2017.
URL: URL address
http://www.solomonstarnews.com/index.php/news/national/item/19768-sibc-battles-to-stay-on-air
(Accessed June 19, 2018)

[26] NDMO strongly requested reinstallation of the equipment (repeater) in the relocated office. Conversely, SIBC considers that NDMO's current office is located in an area prone to flooding in the event of a disaster, which may hinder the equipment, thus the installation site is considered unsafe. NDMO is planning to relocate the office again

office when the equipment was installed, the Meteorological Agency used NDMO's equipment on a shared basis, but after the NDMO office was relocated, the Meteorological Agency could not set up the VHF radio equipment and it was not usable. Also, in the Ministry of Mines, Energy and Rural Electrification, VHF radio equipment is temporarily installed in a corner of the warehouse due to partial renovation of the office. Accordingly, scope to respond immediately in the event of an emergency is maintained for equipment of SIBC, police headquarters and NDMO excluding repeaters. The reason is that the need for such equipment remains poorly understood and it can be also pointed out that the involvement of the relevant agencies (those where VHF radio equipment is installed) other than the executing agency, SIBC, during the implementation of the project remained extremely limited. When installing the VHF radio equipment, although operating instructions were explained to the relevant agencies, there was no scope for the latter to agree on any details given of other measures to take in the event of relocation, their individual roles for ongoing use of the same and responsibilities. When setting up the equipment, there is a need for the relevant agencies to gather together, nurture understanding, acknowledge the significance of agreement and need to establish the same then clarify the responsibilities and roles etc. of each institution to cooperate in future.

Table 7 Installation and utilization status of VHF radio equipment

Installed place	Installation and utilization status
SIBC	Installed in headquarters and usable in the event of an emergency.
NDMO	Part of equipment relocated to SIBC during office relocation and kept there at the time of ex-post evaluation.
Meteorological Agency	Resetting did not take place at the time of office relocation and it is not in a usable situation.
Police Headquarter	All VHF radio equipment can be used and is actually used to communicate information to prevent disasters both inside and outside the police headquarters.
Ministry of Mines, Energy and Rural Electrification	Along with the renovation of the office, it was shifted to the warehouse.

Source: Interview surveys with each agencies

In light of the above, although the institutional, technical and O&M status of short-wave transmitter are good, some minor problems were observed in the management status of VHF radio equipment for emergency contact and part of the financial situation of the maintenance institution. Therefore, sustainability of the project effects is fair.

and SIBC is considering storing it until relocation and then re-installing it. Even if part of the equipment is not reinstalled, there will be scope to use the VHF radio by using a mobile receiver or similar.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to provide swift and adequate disaster and disaster-prevention information throughout the Solomon Islands by installing short-wave transmitter systems, thereby helping improve the islanders' awareness of disaster-prevention and mitigate damage from natural disasters. Its purpose is consistent with the development strategy of the Solomon Islands which has prioritized improving resilience and related measures when disasters occur and development needs frequently impacted by natural disasters, as well as Japan's aid policy. Thus, the relevance of the project is high. Though the project cost was within the planned budget, the project period largely exceeded the plan due to the extra time needed to respond to land issues and upgrade the transmitter performance. Consequently, efficiency of the project is fair. Implementing the project made short-wave radio broadcasting possible on a 24-hour basis in the event of a disaster and the effect of using weather forecasts obtained through radio broadcasting to prevent damage was confirmed. Conversely, disaster-prevention broadcasting communications radio systems, installed to related agencies handling disaster management information, have not been fully utilized. Accordingly, although this project has achieved its expected objectives to some extent, part of the effect remained limited, so effectiveness and impacts of the project are fair. While the institutional and technical aspect and the condition of the O&M for the radio broadcasting system are positive, management and utilization of disaster-prevention broadcasting communications radio system and financial aspect of agencies overseeing operation and maintenance have minor issues. Accordingly, sustainability of the project can be judged as 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

・Recommendations for effective utilization of VHF radio equipment

At the time of ex-post evaluation, half of the VHF radio equipment provided to related agencies could not be used appropriately in an emergency. If large-scale disasters were to occur, which would preclude the use of mobile phones and the Internet, there would be a need to maintain a system allowing each related agency to keep in touch with the others swiftly via the relevant equipment. First of all, each agency incapable of responding to reinstallation, or where equipment is not installed in an appropriate place, has to establish an environment whereby equipment can be promptly utilized and a test operation to confirm that an environment where information can be communicated has to be performed.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

・Conditioning of project commencement considering the delay factors caused by land issues

In this project, it took time to solve the land problem and the project period exceeded 200% of plan. In the Solomon Islands, where most land landowners remains unregistered, even for past projects, many cases were delayed due to problems related to land expropriation issues, e.g. the landowner who was not identified at the time of planning, would raise their ownership after the project got underway. In areas and sectors where land acquisition and resettlement delaying the project have previously been confirmed, it is desirable to prepare the project as not to interrupt the project implementation by citing conditions for the commencement of the project as the completion of land acquisition and resettlement by the government and executing agency.

・Approach to relevant agencies with the continuous utilization of equipment in mind

In this project, to deliver disaster-prevention information promptly, in addition to improve radio short-wave broadcasting nationwide, VHF radio equipment was installed at major related agencies dealing with disaster information. However, at the time of the ex-post evaluation, it was confirmed that the VHF radio equipment had not been effectively utilized and many agencies were incapable of an immediate response in the event of disaster. As related agencies usually communicated information by telephone or email and large-scale disasters e.g. necessitating the use of VHF radio equipment after the project had not yet occurred in the country, the major factors underlining the importance of VHF radio equipment in the event of a disaster were not sufficiently recognized. In addition, another relevant reason is a lack of clarity as to who is responsible for continuing the communication means using the VHF radio equipment. Given that the executing agency of this project was SIBC and the involvement of related agencies was limited, it is also worth noting that the system/responsibilities concerning its continued utilization to deliver information by utilizing VHF radio equipment of each institution at the time of installation were not clearly defined. When installing equipment to be used by multiple related organizations besides the executing agency, executing agencies and experts need to consider the sustainability of project effectiveness, clarify who is responsible for O&M equipment when installing equipment and then have to prepare a mechanism to be used continuously and fully share the perception of the importance with the relevant agencies.

Republic of Vanuatu

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for the Redevelopment of Vila Central Hospital"

External Evaluator: Atsuko Orimoto, Japan Economic Research Institute Inc.

0. Summary

Vila Central Hospital (hereinafter referred to as "VCH") is the principal hospital providing specialized medical treatments and is the top referral hospital for the whole of Vanuatu. Under this project, which aimed to improve medical services at VCH and strengthen its capacity as an educational facility for medical/health workers, new medical facilities were constructed and medical equipment was procured and installed.

This project was consistent with the development policy and needs of Vanuatu as well as Japan's ODA policy; therefore, the relevance of the project is high. With regard to implementation, the project components were carried out mostly as planned, and the project cost and period were within the plan. Consequently, the efficiency is also high. The quantitative indicators to assess the effectiveness of this project , 'number of operations' and 'number of referrals' were largely achieved, and other indicators (number of emergency outpatients, clinical examination and X-ray pictures taken) were greatly increased (improved). Moreover, the project contributed towards enhancing post graduate training for doctors and nurses and strengthened the capacity of medical workers and staff members within the Maintenance Unit. Patient satisfaction levels were high with regard to the facilities provided by the project and the medical services delivered at VCH; therefore, it was possible to confirm that some positive effects were emerging. Furthermore, significant impacts could be seen as a result of the project, as it has been achieving the overall goal of, 'medical services in quality and quantity in Vanuatu are improved.' Also, resilience to natural disasters was strengthened, as demonstrated by the new building making it possible to resume medical activities, immediately after a super cyclone hit Vanuatu. Therefore, overall effectiveness and impact are assessed as high. With regards to sustainability, there remains a need to further strengthen institutional and technical aspects and major challenges were identified concerning financial aspects, such as, with regard to the excessively long duration required to procure necessary spare parts. This meant that the sustainability of the project was assessed as low.

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

1. Project Description

Project Location

New Hospital Constructed in the project

1.1. Background

Vila Central Hospital (hereinafter referred to as "VCH") has been the main hospital for SHEFA province, which is the most populated province in Vanuatu, as well as the top referral hospital[1] within the referral system for the whole of Vanuatu. VCH also serves as an educational facility; it is a post-graduate training resource for doctors and also acts as an intern training facility for graduates of the Vanuatu College of Nursing Education.

However, the VCH was badly suffering from aging-related degradation, as little refurbishment had been carried out since its foundation in 1974 funded by the British Government. It was also affected by other major problems such as; a lack of emergency care rooms, an insufficient number of operation theaters, damaged buildings (ceiling, floors, etc.), failure of medical equipment, and insanitary conditions. In addition, VCH had a problem with the scattered layout of its buildings, and was struggling to provide a level of medical services appropriate for a principal referral hospital. VCH urgently required improvement of facilities for outpatients and consultations.

In Vanuatu, about 80% of the government budget for the Health Sector was allocated to personnel expenses and operating costs. There had been further increases in expenditure in recent years, which were compensated for by assistance from overseas donors; however, funding remained insufficient to meet the cost of renovation of facilities and renewal of medical equipment. Therefore, the Government of Vanuatu requested Japan to provide Grant Aid to construct new hospital facilities and procure additional medical equipment.

[1] Top referral hospital is the highest referral hospital that patients can be referred to domestically, since it is the hospital which has most advanced medical facilities in Vanuatu.

1.2. Project Outline

The objective of the project is to strengthening medical services at VCH by constructing new medical facilities including new outpatient and laboratories and replacing medical equipment, thereby contributing to improved medical services in the whole of Vanuatu.

Grant Limit / Actual Grant Amount		65 million yen / 62 million yen (Detailed Design) 1,399 million yen / 1,371 million yen (Construction)
Exchange of Notes Date / Grant Agreement Date		January 2012 / January 2012 (Detailed Design) May 2012 / June 2012 (Construction)
Executing Agency		Ministry of Health
Project Completion Date		June 2014
Contractors	Main Contractors	Construction: Dai Nippon Construction Procurement: NBK Corporation
	Consultants	The Consortium of Nihon Sekkei International Inc., Nihon Sekkei, Inc. and EARL Consultants Incorporated
Preparatory Survey		February, 2011 – January, 2012
Related Projects		[Technical Cooperation] The Project for Strengthening the Need-Based In-Service Training for Community Health Nurses (2011 – 2014) Dispatch of Japanese Overseas Cooperation Volunteers to VCH (2006 – current) [Grant Aid] Project for the Improvement of Equipment for National Hospitals (1994 – 1995) The Project for Provision of Incinerator of Medical Waste for Vila Central Hospital (Grant Assistance for Grassroots Human Security Projects, 2006) Non-Project Grant Aid (2006, 2007, 2009, 2010): Procured medical supply with counterpart fund [Other international organizations and donors] Australia: Health sector direct funding (2014 – 2019, total: 6.9 million AUD), dispatch of doctors to VCH, provision of medical equipment, construction of oxygen plant

	France: Construction of Vanuatu College of Nursing Education (at VCH), provision of medical equipment, repairing Northern Provincial Hospital China: Dispatch of medical doctors to VCH and Northern Provincial Hospital, construction of dormitory for doctors (at VCH)

2. Outline of the Evaluation Study

2.1. External Evaluator

Atsuko Orimoto (Japan Economic Research Institute Inc.)[2]

2.2. Duration of Evaluation Study

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

Duration of the Study: October, 2017 – November, 2018

Duration of the Field Study: February 12, 2018 – February 24, 2018 and April 17, 2018 – April 25, 2018

2.3. Constraints during the Evaluation Study

The quantitative indicators to assess the effectiveness of the project, set at the time of planning, were considered to be inappropriate and unrealistic due to an insufficient understanding of the situation. The evaluator was unable to discover details of how the indicators were determined because, all the consultants who directly conducted the survey and administered the project on the Japanese side, as well as, the doctor who provided information to them for the establishment of the indicator regarding the number of colonoscopic examinations on the Vanuatu side, had previously resigned. Therefore, the initial indicators had to be used to assess the effectiveness without confirming its relevance and it could potentially result that the effectiveness of the project does not accurately reflect the reality of the project, thus additional quantitative and qualitative indicators were identified to examine and assess the effectiveness of the project from different angles.

Almost all managers at the Ministry of Health (MoH) and VCH as well as statistician staff members were replaced after the general election held in 2012. It was discovered that the definitions used for some statistical data issued since2013 differed from the base-line data taken in 2010. The evaluation results were assessed using data whose definitions were adjusted to match with those of the base-line as much as possible; nevertheless, some data may still have

[2] The consultant is from Japan Development Service Co., Ltd., who assisted Japan Economic Research Institute Inc. with this ex-post evaluation.

been examined with non-matching conditions, as some base-line data did not have clearly defined definitions.

3. Result of the Evaluation (Overall rating: B[3])

3.1. Relevance (Rating: ③[4])

3.1.1. Consistency with the Development Plan of Vanuatu

At the time of project planning, the health sector was one of six strategic priorities in the development plan of Vanuatu, 'Priority and Action Agenda (PAA) 2006 – 2015'. Moreover, in 'Vanuatu Health Sector Strategies (2010 – 2016)', it is stated that, to improve the health status of the population, it is necessary to enhance promoting health and medical services with all levels of medical services properly equipped and supplied.

'PAA 2006 – 2015' was updated in 2012, after commencement of the project. In the updated PAA, 'improve the quality of healthcare delivered at all levels' was stated as a Policy Objective. In addition, 'upgrade and equip health facilities at all levels of healthcare; from dispensaries, health centers, provincial hospitals and referral hospitals was also included in the aforementioned national strategic priorities.

In the current development plan, 'Vanuatu 2030 (The People's Plan)', 'Quality Health Care' is one of the Society Goals and policy objectives include '3.1 access to quality healthcare resourced and equipped' and '3.4 effective and efficient delivery of quality services'. Also, improving population access to health services (ensuring that the population of Vanuatu has equitable access to affordable, quality healthcare through the fair distribution of facilities that are suitably resourced and equipped) became one of three key strategic directions identified in the newest 'Health Sector Strategy (HSS) (2017 – 2020)', and quality healthcare is an important principle of the health policy in Vanuatu.

Therefore, this project is consistent with the development plans of Vanuatu, both at the time of planning and ex-post evaluation, and is also in conformity to the sector strategies.

3.1.2. Consistency with the Development Needs of Vanuatu

The VCH has been serving as the core hospital of SHEFA Province, which has the largest population in Vanuatu, (approx. 240,000[5] at the time of planning) since its establishment. At the same time, it has been acting as the top referral hospital as the only hospital which can provide specialized treatments for the country. As the principal hospital in Vanuatu, it aims to

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[4] ③: High, ②:Fair, ①: Low
[5] URL address: https://data.worldbank.org/country/Vanuatu/ (accessed on 1 May 2018)

fulfil roles, such as: 1) provide acute phase medical services[6] by specialist doctors, 2) determine overseas referral of patients, 3) accredited post-graduate training facilities (for specialist doctors), and 4) clinical education training facilities for Vanuatu College of Nursing Education.

Nevertheless, at the time of planning, the hospital has been affected by age-related degradation, because little refurbishment has been carried out during the 37 years since its establishment. It has been struggling to provide appropriate medical services, due to the scattered layout of facilities and other problems, and urgently required improvement of the buildings and upgrading of medical equipment.

Table 1 shows the total number of outpatients and hospital outpatients for the whole of Vanuatu, together with the number of outpatients at VCH between 2014 and 2016. The number of outpatients of VCH appears to be decreasing[7]. This may be a result of some success with a policy to enhance Primary Health Care providers, which include: clinics, health centers and provincial hospitals. The MoH has been trying to reduce the number of general outpatients at VCH, because it aims for VCH to concentrate on its referral functions, such as providing specialized medical services, which other Primary Health Care[8] providers cannot offer. Although the number of outpatients at VCH seems to be decreasing, as the top referral hospital, it still receives the greatest patient numbers and provides the best medical services that the local population can access. In addition, it is essential to maintain a certain condition level at VCH so as to be able to treat large numbers of patients at once with high quality, since there are surges in patient numbers due to outbreaks of infectious diseases and/or natural disasters. Therefore, the need and importance of enhancing VCH was very high.

Table 1. Number of Outpatients at Medical Facilities within Vanuatu

	2014	2015	2016
Total number of domestic outpatients	506,833	459,378	495,322
Number of outpatients (hospital[9] total)	191,913	152,796	162,984
Number of outpatients (VCH)	118,728	86,422	82,799

Source: VCH

[6] Acute medical service (care) is a branch of health care where a patient receives active but short-term treatment for a severe injury or episode of illness, an urgent medical condition, or during recovery from surgery.

[7] The accuracy of data is questionable due to a very large scale cyclone directly hitting Port Vila, where VCH is located, in 2015.

[8] A basic level of health care that is provided in primary medical facilities such as clinics and health centers, where patients visit when they get injured or ill.

[9] Total outpatients numbers from five public hospitals including, VCH (VCH, Northern Provincial Hospital, Norsup Hospital, Lenakel Hospital and Lolowai Hospital).

Moreover, the new hospital built under the project has proved to be highly resistant to natural disaster. After a super cyclone hit Vanuatu in 2015 it was recognized that the project had enhanced resilience to natural disaster within the health sector. From this viewpoint, the importance of enhancing VCH was high.

Based on the above, this project has been consistent with the development needs of Vanuatu both at the time of planning and ex-post evaluation.

3.1.3. Consistency with Japan's ODA Policy

At the Fifth Pacific Islands Leaders Meeting held in 2009, aimed towards achieving the Millennium Development Goals (MDGs), the Leaders of Japan and the Pacific Islands Forum confirmed their mutual commitment and underlined the importance of promoting human security, with a particular focus on including capacity building to ensure greater access to health. As a basic principle of ODA for Vanuatu, the 'Islands Area Health and Medical Program'[10] was formulated with the aim of improving health and medical services through the refurbishment of VCH and capacity development of health/medical workers. Therefore, at the time of planning, this project was highly consistent with Japan's key cooperation areas for the Pacific and Vanuatu.

As described above, this project has been highly relevant to the development plans and needs of Vanuatu during the planning, as well as Japan's ODA policy at the time of planning. Therefore, its relevance of this project is high.

3.2. Efficiency (Rating: ③)

3.2.1. Project Outputs

The planned and actual project components are as follows:

[10] Japan's health sector assistant programme to the Pacific Island countries. It aims at strengthening capacity and improving health services by combining schemes, such as, technical cooperation projects, general grant projects, and volunteer and training programmes.

Original

Table 2: Planned Components of This Project

	Major Development
Facility (3,157.56m^2): Interior 2,623.50 m^2 (including ancillary facilities 121.62 m^2) + Exterior Common 534.06 m^2	Two story new OPD building (Operation Theater, Radiology Dept., Lab. Dept., Emergency Dept., Outpatients), Specialized Equipment (Rainwater Utilization System) One story RC structure (some S structure) Ancillary facilities (Elevated Water Tank, Pump Room, Transformer Room, Blower Room, Sewage Treatment Plant, Soak Pit)
Medical Equipment	Equipment necessary for the project facilities; Emergency Department, General Clinic of Outpatients' Department, Operation Theater, Radiology Department and Laboratory Department.

Source: Prepared based on the Preparatory Survey Report

Actual

Both construction of new building and provision of medical equipment were mostly carried out as planned; with the exception of the changes shown below.

Table 3: Changes from the Original Plan

	Description of Changes
Changes from the plan in the preparatory survey	1) Location and number of Hospital Entrances 2) Additional vents and high winds for natural lighting in Outpatient Dept. 3) Layout of the Operation Theatre 4) Area around entrance of Radiology Dept. and Laboratory Dept. 5) Location of Electrical Pipe Space[11]
Changes after the detailed design survey	1) Cancellation of rubble concrete[12] resulting from the building foundation ground survey 2) Synchronization of outside wall color with the old hospital building
Changes after contract (medical equipment)	1) Model of computed radiography (CR) console (a part of the general X-ray machine) 2) Maker of CR system (a part of the general X-ray machine)

Source: Information provided by JICA

As shown in Table 3, the changes were only minor and did not cause any inconvenience, according to the MoH.

With regard to the new building, few problems were found. However, steam from the autoclaves is not extracted to outside and remains in the sterilization chamber and there are wet patches around the drain funnels with the steam splashed back from the drain. It was also pointed out that the external stainless steel handrail and fence had become rusty. Although three autoclaves were provided to the Central Sterile Supplies Department (CSSD), staff

[11] Electrical Pipe Space is space to store electric and communication wirings.
[12] Rubble concrete is concrete in which large stones are added to the freshly placed concrete while it is still soft and plastic.

members cannot operate them all at the same time and have to time the sterilization cycle end in different timing, due to the sterilization chamber filling with steam which is released with great force at the end of the sterilization process. This results in a less efficient operation (it takes longer to sterilize any given amount of medical equipment and materials), and affects the daily operation of the VCH; therefore, it is necessary to improve ventilation and/or drainage to emit steam outside of the chamber. The problem was raised by the Maintenance Unit during the defect liability inspection, which was carried out one year after completion of the project; however, it was subsequently treated as a problem with the fire alarm, which was being set off by the build-up of steam in the sterilization chamber. After the inspection a consultant from a third country visited VCH to check medical equipment; however, it appears that the consultant only checked autoclaves visually and no repair or adjustment work was undertaken and no explanation provided to staff members of the Operation Theater or Maintenance Unit. Moreover, some doctors and nurses, who were interviewed during the study, considered that the reduction in the number of toilets (from two to one for males and females, in comparison with the old operation theatre) inconvenient, since the numbers of staff working, for preparing, cleaning and shift changing, around the theatre area could reach up to 25 to 30 persons. The shortage of a “clean area” for medical supplies was also observed around the operation theater. This was due to there being no anesthetic room allocated in the new building, although there had been one in the old operation theater, and therefore the original stocking room had been converted to an anesthetic room.

Major items of medical equipment, provided under this project, were checked during the study and it was observed that they were mostly utilized effectively. However, the laparoscopes were effectively unused, since no doctors could use the equipment, and the frequency of colonoscopy usage was low. Only two doctors could use the colonoscopy equipment, but there are not enough numbers of operation theatres and they are normally fully booked, and they did not have easy access to the operation theatres, which were always very busy.

In regards to soft components, technical guidance in the following fields was provided as planned for the capacity development of building facility and medical equipment maintenance.

1) Strengthening of daily facility maintenance and formulation of a sustainable maintenance system
2) Daily equipment maintenance
3) Development of a maintenance plan and necessary budgetary allocation

The obligations of the Vanuatu side included administration side support (application

and acquisition of necessary permits, logistic support for Japanese personnel, arrangement of tax exemption, and so on), pre-construction work (demolition of related facilities, construction of temporary road, temporary incoming telephone line wiring, etc.), work during construction (high voltage power supply, city mains water distribution to the site, dismantlement of the existing high voltage power supply, incoming telephone line and wiring route, transfer of IT line), and post-construction work (construction of roads outside the project site, fencing and gate, landscaping and planting, curtains and blinds, general furniture, removal and installation of existing equipment, etc.). All obligations for pre- during and post- construction period were fulfilled, although recovery work of the exterior took sometime after the 2015 cyclone.

3.2.2. Project Inputs

3.2.2.1. Project Cost

The cost of this project borne by Japan was planned to be approximately 1,469 million yen (155 million yen for the detailed survey and construction supervision and 1,314 million yen for construction), with another 33 million yen[13] planned as implementation expenses to be borne by Vanuatu.

Table 4 summarizes the actual costs contributed by Japan and Vanuatu.

Table 4: Actual Project Costs (Unit: million yen)

Country	Item	Cost
Japan	Detailed Survey	62
	Supervision	100
	Facility Construction	977
	Soft Component	138
	Provision of Equipment	157
	Sub-total	1,434
Vanuatu		19
TOTAL		1,453

Source: Prepared from information provided by JICA and MoH

The actual project cost was 1,434 million yen (Japanese side), which was confirmed as within the planned amount (approx. 98% of the plan). Conversely, the cost borne by Vanuatu was approx. 19 million[14], which was much less than the planned amount (approx. 58%). The MoH explained that this was due to the estimation being calculated on an, all the work to be out-sourced, basis but, to save its budget, VCH used their own labor force as much as possible, which was not included in the actual cost, and all work that was

[13] Exchange rate: 1 VUV = 0.90 JPY(As of April, 2011, at the time of planning)
[14] Exchange rate: 1 VUV = 0.99 JPY (As of April, 2018, at the time of ex-post evaluation)

out-sourced was tendered successfully. Therefore, the total cost of the project was 1,453 million yen, which was less than the planned amount (approx. 97%).

3.2.2.2. Project Period

The period of this project was expected to be 28 months, which included five months for a detailed design survey and four months for tendering. The signing date of the Exchange of Notes for the detailed survey was the 24th of January 2012; however, the project period starts with the detailed design and ends in the project completion date. Therefore, the actual project period was 28 months from March 2012 to June 2014, and the project was executed as planned (100%). As both the project costs and period were within the plan the efficiency of the project is high.

3.3. Effectiveness and Impacts[15] (Rating: ③)

3.3.1. Effectiveness

3.3.1.1. Quantitative Effects (Operation and Effect Indicators)

In this project, numbers of operations, outpatients attending general clinic, referrals to the hospital, and colonoscopic examinations, were selected to be the operation indicators and the targets were set as shown in Table 5, subject to fulfilment of pre-conditions.[16]

Unfortunately, the operation indicators, which had been determined at the time of planning, seemed to be inappropriate and unrealistic due to insufficient understanding of the actual situation.[17] Therefore, in this study three additional indicators, being; number

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

[16] Pre-conditions: number of operations and outpatients to general clinic: no significant shortage in medical supplies and medical staff happen, number of referrals to the hospital: there is no change in roles of VCH as the top referral hospital in the country, number of colonoscopic examinations: The medical specialist continues to be in place

[17] 1) Increase in numbers of operations: at the time of planning, it had been expected that minor operations would be carried out at the Emergency Department upon completion of the project, however, nurse practitioners have never been allocated at the Emergency Department, and no operations had taken place in the Emergency Department. Shortage of medical personnel had been recognised during the planning period, and, to plan and determine indicators, the project plan considered the availability of only existing staff members (not allowing for future expansion), therefore, the basis of increasing the number of operations was inconsistent to the situation. 2) Increase in numbers of outpatients to general clinic: the Government of Vanuatu is aiming to enhance access to basic primary health care for the rural population, and, through strengthening clinics, health centers and provincial hospitals which provide primary health care, general outpatients were encouraged to make their initial visit to primary health care providers. Therefore, a decrease in general outpatients attending the top referral hospital, VCH had been expected, and this indicator to target an increase in general outpatients was against the policy of the MoH and not policy sensitive. However, the number of emergency outpatients increased due to the enhancement of Emergency Department through facility improvement. 3) Increase in numbers of referrals: unofficial figures from VCH were used for the base-line, and these could differ dependent on the definition of referrals from other years: although the number of referrals was very large in 2010, it was treated as if smaller at the time of planning, thus, the target, 'to recover to the figure of the average of the last three years (2007 – 2009)', was set unrealistically high. At the same time, the situation of the provincial hospitals was improving, and referral of patients to the Northern Provincial Hospital from the three Northern provinces was encouraged (it was not policy sensitive during the planning). 4) 360 cases of colonoscopic examinations per year: the numbers of doctors who can utilize the equipment was extremely limited (medical specialists in endoscope have never been present at VCH, and the pre-condition was not fulfilled). It is possible that examining the feasibility of the colonoscopic examinations, such as securing the space for the examination and if

of emergency outpatients, clinical examinations and X-ray pictures taken, were examined. These were used to assess the effectiveness of the project as evidence directly affected by the new hospital building and the provision of medical equipment.

Table 5. Quantitative Indicators to Assess the Effectiveness of This Project

Indicators	Baseline	Target	Actual*1		
	2010	2017	2014	2016	2017
	Baseline Year	3 Years After Completion	Completion Year	2 years After Completion	3 Years After Completion
Number of operations	2,183	2,344*2	1,891	1,896	(1,945) 2,191*3
Number of outpatients to general clinic	61,770	82,000	29,111	44,710	(45,199) 56,773*4
Number of referrals to the hospital	351	480 (203)*5	301	149	227
Number of colonoscopic examinations	-	360	0	8	2

Source: Preparatory Survey Report, Data provided by MoH and VCH

*1: Due to missing data and credibility issues after the cyclone hit Vanuatu in 2015, statistical data from 2015, one year after completion, was not used in this report.
*2: Calculated result (2,344 operations) of the preparation study was used as the target.
*3: Numbers of general operations, cesarean, amputation and operations by visiting doctors were included in the base-line data (2010), therefore, the same types of operations were added to the official figure for the year 2017 (numbers of cesarean and operations by visiting doctors were not available for the year 2014 and 2016). The top line of year 2017 had the same condition of accounting as 2014 and 2016.
*4: General, emergency and pediatric outpatients were included in the base-line data (2010), however, pediatric outpatients and general outpatients were split and the number of pediatric outpatients has not been included in the official statistical data of 'number of outpatients' since 2014. The figure in 2010 cannot separate the pediatric outpatients from others, number of pediatric outpatients was added to the official figure for the year 2017 (the top line of year 2017 was the official figure for general and emergency outpatients only).
*5: In accordance to MoH 2009 Annual Report, the number of referrals to VCH from 2007 to 2009 were 180, 269 and 160 cases respectively, and the average of the past three year (2007 – 2009), as stated in the narrative target, was 203 cases.

doctors able to use it actually can conduct the examinations, was not sufficient during the period of planning and determining the indicator.

Table 6. Other Quantitative Indicators to Assess the Effectiveness of This Project

Indicators	2013	2014	2015	2016	2017
		Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
Number of Emergency Outpatients	Not Available	1,680*1	Not Available	Not Available	12,455
Numbers of Clinical Examinations	59,810*2	74,479*2	119,235	129,034	145,338
Numbers of X-ray pictures taken	17,994*2	25,660*2	26,400	26,693	28,921

Source: Data provided by VCH

*1: Numbers for emergency outpatients were included within general outpatients until 2014. The data for year 2014 includes the number of emergency outpatients after having moved to the new hospital in September 2014 for 3.5 months.

*2: Laboratories moved to a new building in the late half of year 2014, therefore, the figures for year 2013 were before the laboratories moved, and the numbers in year 2014 were a combined number for both old and new buildings.

The average number of planned operations is approx. 10 per day, and the number could reach 2,600 a year if all planned operations were carried out. However, extra, urgent patients, which normally need more time and care than planned operations, arrive at VCH every day, and many planned operations were cancelled/postponed depending on the level of the operation. Although the number of operations did not achieve the target, it reached over 80% and it was confirmed that the operation theatre was fully utilized (the occupancy rate of both theaters was very high).

The number of outpatients did not reach the level of the target, though it should be considered that this indicator ran against the direction of the Ministry's policy at the time of planning. However, the Emergency Department gained three rooms and six beds in contrast with only one bed within general outpatients in the old building. Table 6 shows that the number of emergency outpatients became eight times greater, compared with the period when it acted as part of general outpatients (pre-project period), and a direct positive effect in the Emergency Department was observed.

The number of referrals varies year to year due to natural disasters and outbreaks of infectious diseases in accordance to the past data.[18] Moreover, referrals from remote islands are very costly in Vanuatu because of airfares (tickets or charters depending on the urgency), and in fact, the vast majority of the referral budget is consumed by airfares.[19]

[18] Number of referral to VCH varies in each year: 67 (2005), 368 (2006), 180 (2007), 269 (2008), 160 (2009), 351 (2010, base-line), 319 (2011), 204 (2012), 265 (2013), 301 (2014, year of completion), 429 (2015, super size cyclone hit Vanuatu), 149 (2016), 227 (2017)

[19] The amount for the yearly referral budget (domestic/overseas) has been unchanged for some time and it is approx. 33 million vatu (approx. 33 million yen at the time of study). When the fund is exhausted, the Ministry of Health delays the payment to airline companies or starts using the budget for the next fiscal year.

The referral budget has not been sufficient and it is more economical to make referrals from northern provinces such as TORBA, MALAMPA and PENAMA to the Northern Provincial Hospital (NPH) in Esprit Santo Island rather than VCH in Efate Island which is located in the southern part of Vanuatu. Therefore, the Government of Vanuatu (MoH) has been enhancing the Northern Provincial Hospital (more specialist doctors making it possible to have more operations and widened area of consultation) to encourage sending patients to NPH from medical facilities within the northern provinces. In addition, there was a mistake in base-line data attained during planning[20], and the number of referrals in 2010 was treated as being high and thus unsuitable for use as an indicator. In accordance to the narrative part of the target, the target should be 'to recover to the level of the average for the past three years (2007 – 2009)', and, in that case, the actual target should be 203 cases and has been achieved.

There have never been colonoscopic specialists at VCH, and as a pre-condition for the indicator, the number of colonoscopic examinations could not be fulfilled. Therefore, this number was excluded as part of the evaluation. Remarkable effects were observed in the number of X-ray pictures taken and the number of clinical examinations. Filmless equipment was introduced and it has reduced the time necessary to obtain results. As shown in Table 6, the number of X-ray pictures is approx. 1.6 times greater than before the project. The number of clinical examinations increased by approx. 2.4 times. This outcome was not solely due to the updated equipment but also enhanced by the new building as all units were brought together in one place and the technicians find it considerably easier to handle specimens.

Waiting Area of Outpatients

Doctors Who Are Taking Training in Lab.

3.3.1.2. Qualitative Effects (Other Effects)

At the time of planning, the following qualitative effects were expected through the implementation of this project.

1) The project contributes to the improvement of performance of doctors and nurses

[20] Cf. '*5' of Table 5. Operation Indicators of This Project

2) The project contributes to the reduction of post-surgery infection risks
3) Efficiency in healthcare services is improved

With regard to "1)", it was confirmed that the majority of equipment provided under the project was being utilized for post-graduate training, and young doctors who had certified to be doctors and had returned from overseas expressed their gratitude for being able to continue improving their skills by using the equipment, which they had learnt to use during their medical education. However, regarding to the soft-component, many doctors and nurses had retired or were transferred after taking its training, and the degree of effect differed between sections. The staff members of the Maintenance Unit commented that the training held under the soft component of the project was considered to be somewhat effective, since it improved the way doctors and nurses handle equipment.

VCH has never recorded statistics regarding post-surgery infections, but theatre nurses and surgeons commented that they did not notice particular changes in post-surgery infections after moved to the new building. Therefore, it was not possible to assess if the project had contributed in a reduction of post-surgery infections described under "2)".

Regarding "3)", over 90% of staff members of VCH who answered the questionnaire or interview, stated that the efficiency of medical services had been improved. In particular, the Emergency Department facility was expanded and improved so that more patients could be accepted at any one time, and the total number of emergency outpatients throughout the year accepted at VCH increased dramatically. One of the objectives of the soft component of the project, "to acknowledge the significance of maintenance training for conducting routine, periodical maintenance activities by VCH staff", was more or less achieved and the efficiency of the medical service was improved as equipment was in usable condition when required, although the degree of achievement varied between each Department. Types (quality) and number (quantity) of clinical examinations had been increased in the Laboratory, and both quality and quantity of X-ray pictures were improved in the X-ray Unit. Moreover, all outpatients and their family members interviewed considered that the medical service of VCH was improved compared to before completion of the project and they were satisfied with the new facilities.

In addition to the above, an examination was made of any quality improvement in the acceptance of referrals at VCH. The majority of private clinics in Port Vila and provincial hospitals, which replied to the questionnaire, considered that not much change had occurred regarding how referrals were received. This may be because the number and capacity of staff members at the Emergency Department remained the same and little

change was noticeable in the speed of treatment and the allocation of patients to appropriate departments.

3.3.2. Impacts

3.3.2.1. Intended Impacts

At the time of project planning, the overall goal was set as "(considering that VCH is the nationwide referral hospital, a post graduate training facility for doctors and an intern training facility for graduates of Vanuatu College of Nursing Education for nurses), Medical services in quality and quantity in Vanuatu are improved." There was no particular indicator provided to assess the level of achievement of the overall goal. Therefore, it was decided to ascertain if any improvement had been made using major key health indicators for Vanuatu, such as: infant mortality rate, maternal mortality rate, number of health/medical specialists per population, and access rate to safe water.

Table 7. Key Health Indicators

	2013	2014	2015	2016
Under five year old infant mortality rate (per 1,000)	29.1	28.7	28.2	27.6
Maternal mortality rate (per 100,000)	84	81	78	unknown
Number of health/medical specialists (per 100,000)	unknown	unknown	14.6	17
Access rate to safe water (%)	unknown	92.1	93.3	94.5

Source: Materials provided by MoH and public data of World Bank[21]

Since there was only limited data available for the major key health indicators of Vanuatu and data maintenance at the MoH is not sufficient level, public data from the World Bank also was referenced, as shown in Table 7. Both the under five year old mortality rate and the maternal mortality rate showed a decreasing trend. Also, the number of health/medical specialists per 100,000 is increasing and access rate to safe water is improving. Since VCH has been consistently the sole top referral hospital in Vanuatu the period between planning and ex-post evaluation, and this project assisted with the enhancement of medical service to VCH, it may be inferred that the project has contributed and therefore achieved the overall goal of "Medical services in quality and quantity in Vanuatu are improved."

Of the VCH staff members (both medical workers and general administrative workers including members of the Maintenance Unit), who responded to the qualitative survey, more than 90% of respondents considered that the efficiency of medical service in VCH

[21] https://data.worldbank.org/country/Vanuatu/ (data extracted on the 1st of May, 2018)

was improved. However, only half of staff members confirmed that the project contributed indirectly towards the achievement of the overall goal; the another half stated that it could not say or did not know, since there were other factors (quality of medical and general staff members, management capacity of the Ministry and shortage of health budget, etc.) which needed to be considered.

3.3.2.2. Other Positive and Negative Impacts

1) Impacts on the Natural Environment

It was considered that this project would not cause any undesirable impacts on the natural environment as the project consisted of development of facilities and the procurement of equipment at the existing hospital. In actuality, this project had positive impacts on the natural environment. This was due to the introduction of the CR system that enabled VCH to get rid of waste chemical liquid such as developing fluid and fixing solution through the use of filmless X-ray.

2) Land Acquisition and Resettlement

Neither resident resettlement, nor land acquisition was required, as the components of this project required construction of facilities within the existing hospital premises (1/5 of the premises), and no problems were found.

3) Other Impacts

Enhancement of resilience to natural disaster / Influence over Vanuatu regulatory policy (positive impact)

A super-sized cyclone hit Port Vila where the VCH is situated, Vanuatu in 2015, but the new hospital and facilities built under this project was almost undamaged due to its robust structure. It would not have been possible to resume medical activities as quickly without the new hospital building. All interviewees, not only staff members of MoH and VCH, but also representatives from other Ministries, donors, neighboring clinics and outpatients, unanimously agreed that resilience to natural disaster had been strengthened by the project and evaluated this project highly. This project also influenced a strengthening of policy towards applying the Vanuatu building code to all medical facilities. As a result of the cyclone the necessity to have cyclone proof medical infrastructure was re-acknowledged and the MoH set a new policy that all medical buildings should be category 5 cyclone proof.

Indirect economic effect (positive impact)

Both New Zealand and Australia accept seasonal workers for fruit picking from

Vanuatu (NZ: 3,726, Australia: 1,198 in 2015), and this scheme has become an important source of foreign currency income (export industry) for Vanuatu. It is a requirement to submit an X-ray picture as part of the scheme's health check and the new filmless radiological equipment enables the production of clearer pictures quickly without conflicting with the requirement for X-ray pictures needed for the medical treatment of patients. The provision of the filmless X-ray machine has improved both the quality of X-ray pictures and efficiency, while additionally the project has indirectly contributed towards job creation and the export industry.

Certified improvement of clinical department by external audit (positive impact)

VCH Department of Pathology was audited by an external audit body, the Pacific Paramedic Training Centre[22], in November 2017. With the new facilities provided under this project, the level of clinical examinations and services were improved. VCH achieved a three star level and has the aim of achieving five stars by 2020.[23] Once five stars is achieved, the VCH will potentially qualify to receive intern doctors from Australia, New Zealand and Fiji. It was confirmed that this project contributed towards VCH becoming a recognized medical facility providing clinical examination at an accepted standard.

Increased electricity bill (negative impact)

At the time of planning, it was expected that the cost of electricity would increase by approx. 9 million vatu (approx. 8 million yen)[24], however, the actual increase was approx. 15 million vatu[25] (approx. 14 million yen) in 2017 as shown in Table 8.

One third of the operational budget of VCH is for electricity. To secure a maintenance budget for building, facilities and medical equipment, it will be essential to take action to reduce electricity expenses.

[22] The Pacific Paramedical Training Centre collaborating with WHO, promotes improvement of functions, services and performances of clinical laboratory's services of Pacific Island countries including those of South East Asia through external audit and guidance utilizing the tool called Stepwise Laboratory Improvement Process Towards Accreditation (SLIPTA), which was originally developed for African countries by WHO.

[23] This is a framework for countries in their efforts to strengthen national laboratory services through fulfilment of the requirements in the ISO 15189 standard, which the Japan Accreditation Board also adopted as an international standard. Full score is 2,580, 0 star: 0 – 1,429 points (55% or less), 3 star: 1,920 – 2,178 points (75% - 84%), and 5 stars: 2,440 – 2,580 points (95% or more)

[24] Exchange rate 1 VUV = 0.90 JPY (As of April, 2011, at the time of planning)

[25] Electricity consumption after 2014 is total electricity consumption and invoiced amount of old building and new building, therefore, electric usage (cost) for new building is estimated as total amount minus invoiced amount of 2013.

Table 8. VCH Power Consumption and Invoiced Amount of Electricity

	2010 Base-line	2013 Old hospital	2014 Moving to new hospital	2015 1st year after completion	2016 2nd year after completion	2017 3rd year after completion
Power Consumption (kWh)	501,368	465,286	621,372	777,992	852,711	838,328
Invoiced Amount (VUV)	22,816,186	22,913,631	29,928,034	36,022,534	35,514,346	37,931,083
Unit Price (VUV)	45.51	49.25	48.16	46.30	41.65	45.25

Source: Data provided by UNELCO ENGIE[26]

With regard to effectiveness, the consistency of statistical data was questionable, due to changes in management of VCH and MoH and many staff members in 2013 resulting from the 2012 general election. It is possible that this caused the indicators set during planning to be inappropriate. However, the 'number of operations' reached over 80% of the target and the 'number of referrals' (using the corrected data and re-calculation) also achieved its target. The indicator regarding 'number of outpatients' was not attained, as it ran contrary to the MoH policy of strengthening primary health care facilities such as; clinics, health centers and provincial hospitals. This policy aimed to reduce outpatient numbers at VCH so that it could better concentrate on emergency and referral functions as the top referral hospital. The result of 'Number of colonoscopic examinations' was excluded from the assessment of effectiveness as its pre-condition had been not fulfilled. However, there has been remarkable increases in 'number of emergency outpatients', 'number of clinical examinations' and 'number of X-ray pictures'. With regard to qualitative effects, improvements in the performance of doctors and nurses, and efficiency in healthcare service, could be confirmed. Although a reduction of post-surgery infection risk could not be confirmed. Therefore, it is considered that positive effects have been materializing.

As to the impact of the project, no land acquisition or resettlement cases have occurred, and many positive impacts were observed. However, there was one negative impact, that being an increase in electricity costs by an amount more than estimated. Positive impacts included: natural environment (less waste on X-ray films and chemical liquids), enhancement of resilience against natural disasters, positive influence over implementation of Vanuatu building code, indirect contribution towards economic effects, and recognition of laboratory improvement by external audit.

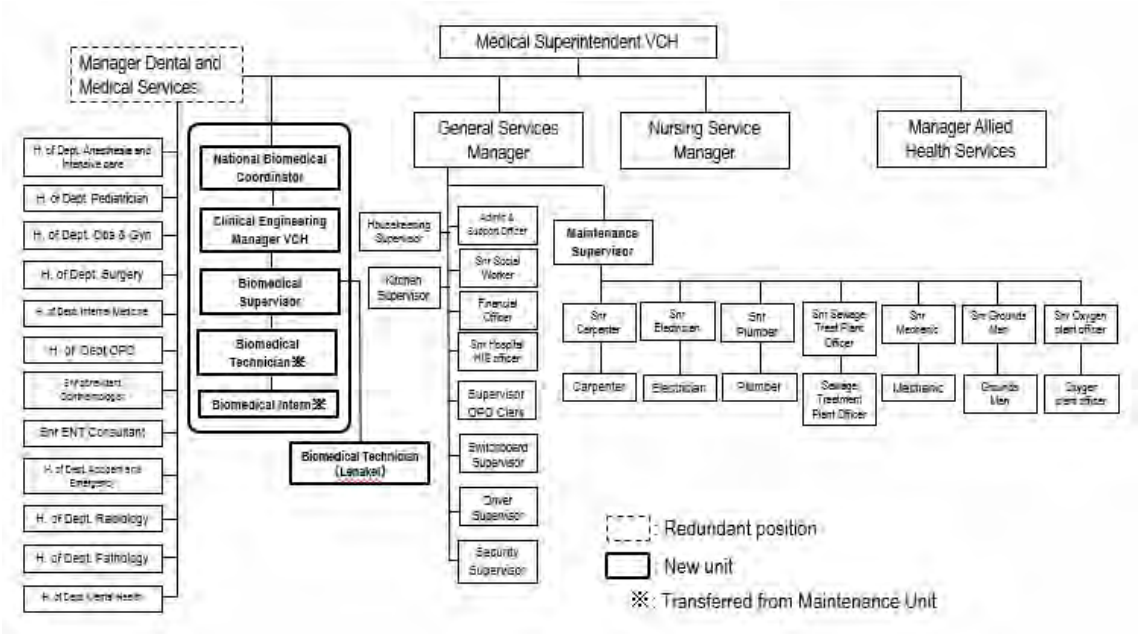
[26] UNELCO ENGIE is the largest French electric power company

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

3.4. Sustainability (Rating: ①)

3.4.1. Institutional Aspect of Operation and Maintenance

The implementation agency of this project was MoH, however, VCH, as the top referral hospital, has been handling operation and maintenance (major changes and problems regarding buildings and/or facilities within the VCH premises are managed directly by MoH (Asset Management Unit).



Source: Prepared based on Ministry of Health Structure (2017-2030)

Figure 1. Structure of VCH (2017)

As shown in Figure 1, a comprehensive structural reform took place in MoH in April 2017, and VCH, was in transition at the time of the ex-post evaluation. With regards to the Maintenance Unit, the Maintenance Supervisor position has not been filled since the former supervisor's retirement in 2010; currently the Senior Carpenter is serving as Acting Maintenance Supervisor. Due to an absence of leadership it can be difficult to confirm long-term plans and to negotiate with VCH management to secure a budget necessary to implement a systematic maintenance plan. Under the new structure, the Senior Carpenter is supposed to be confirmed as Maintenance Supervisor and the situation is then expected to improve. In addition, the Bio-med unit is supposed to become independent under the new structure; however, the Senior Electrician is formally assigned as Senior Bio-Medical

technician (concurrently holding both positions at this moment). New Senior Electrician) has not yet been confirmed.

As shown in Figure 1, the total number of positions within the Maintenance Unit is 15, out of which 11 positions are currently filled; plus a JOCV attachment, as of April 2018.

The Acting Maintenance Supervisor (Senior Carpenter) and Senior Electrician (Senior Bio-med technician) are undertaking leadership roles concerning daily maintenance and basic repair of medical equipment and building. Although the number of maintenance section staff has increased, the permanent position of Maintenance Supervisor has not been filled since 2010, and there remains space for improvement of institutional aspects within operation and maintenance.

3.4.2. Technical Aspect of Operation and Maintenance

According to VCH, the level of medical technicians, such as: doctors, nurses and clinical technicians, is sufficiently high to operate medical equipment and, with the soft component training provided under the project, these medical personnel routinely use/operate equipment without particular problems. However, after completing training, many doctors and nurses were transferred or retired without appropriate handing-over within their respective sections; therefore, it will be necessary that the Maintenance Unit act as a pipe-line for the transfer of knowledge.

Regarding the technical level of operation and maintenance, including inspection and repair, staff members of the Maintenance Unit have no problem conducting routine inspection and maintenance and repair of simple equipment utilizing manuals and checklists created during the soft component of the project. However, the technical skill level is insufficient to repair complicated specialist equipment. At the time of the ex-post evaluation, the Senior Bio-med Technician/Senior Electrician, who started work as an electrician in 2011, is not only looking after medical equipment, but also other electrical devices and facilities in addition to teaching new staff members in the unit.

Historically, New Zealand and JICA have sent bio-med volunteers to support the unit through OJT (On the Job Training). A Bio-med JICA volunteer arrived in April 2018, and this is expected to enhance operation and maintenance of medical equipment.

There are other activities aiming to enhance technical capacity in operation and maintenance. In the last three years, since 2015, JICA has provided one technical training course per year towards strengthening medical equipment technicians. Two technicians from VCH and one from NPH have participated in the training. Since 2012, annual meetings and training for Bio-meds had been held by the Fiji National University; however, the programme ended in 2016.

Therefore, in regard to technical aspects of operation and maintenance, there were no particular concerns regarding maintenance of general facilities; however, it will be necessary to further enhance capacity in order to maintain more complicated medical equipment.

3.4.3. Financial Aspect of Operation and Maintenance

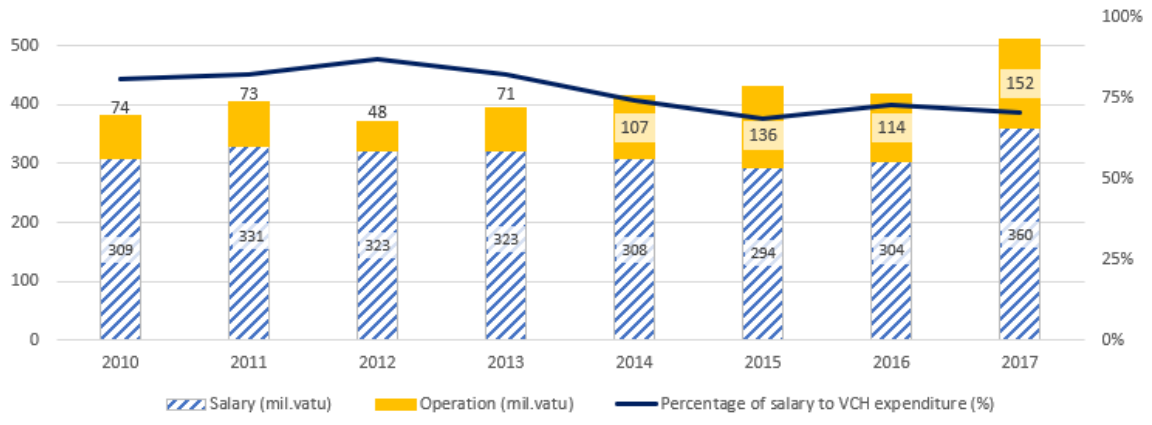
Both VCH's and the overall Health budget have tended to increase; however, the MoH budget as a proportion of the national budget has been getting smaller. While at the same time, the portion of VCH's budget within the Health budget has been getting larger.

Table 9. National Budget, Budget of MoH and VCH, Expenditure of VCH and its Breakdown

(Unit: million vatu)

	2010	2011	2012	2013	2014	2015	2016	2017
National Budget	16,061	15,661	16,183	16,726	17,523	18,175	21,449	23,670
Budget of MoH (% to national budget)	1,736 (10.8)	1,685 (10.8)	1,535 (9.5)	1,610 (9.6)	1,682 (9.6)	1,963 (9.3)	1,735 (8.1)	2,018 (8.6)
Budget of VCH (% to MoH budget)	355 (20.4)	382 (22.7)	337 (21.9)	394 (24.5)	411 (24.4)	432 (22.0)	421 (24.2)	509 (25.2)
Expenditure of VCH	383	404	371	394	415	430	418	512
- Salary and personal	309	331	323	323	308	294	304	360
- Operation	74	73	48	71	107	136	114	152
(Building)	(2.3)	(1.9)	(1.2)	(1.9)	(7.5)	(7.0)	(3.4)	(1.9)
(Equipment)	(10.5)	(2.8)	(1.2)	(2.4)	(3.9)	(17.2)	(9.9)	(9.4)
(Electricity)	(20.8)	(0.6)	(11.1)	(0.9)	(32.8)	(37.5)	(29.0)	(46.1)
(Other Maintenance)[27]	(4.8)	(6.7)	(4.5)	(6.6)	(7.2)	(9.3)	(7.1)	(8.0)

Source: Data provided by MoH



Source: Prepared from materials provided by MoH

Figure 2. Total Expenditure of VCH and Proportion of Salaries and Operation

[27] Other maintenance includes out-sourced cleaning fee, maintenance of accommodation and vehicles, and maintenance contracts.

Health Sector Programme, financial support by Australian Aid to partially cover operation and salaries, has been ongoing from 2014 to 2019 (Approx. 82.5 million JPY per year, Total: 6500 – 570 million JPY)[28]. It had originally been planned to run from 2011 to 2016. This financial support has helped to increase the budget of the MoH and boost the operational budget of VCH since 2014 (completion year of the project). However, the shortage of maintenance expenditure is serious, since salary and personal expenses constitute the vast majority of expenses, and with approximately one third of operation expenditure used to cover electricity usage. This has caused long delays in procurement and has made it impossible for VCH to practice 'preventive maintenance' through keeping an adequate stock of materials, equipment and parts which need regular replacement. Some equipment is so vital to the good operation of the hospital that it would be highly detrimental should the parts run out.

Due to the absence of a permanent Maintenance Supervisor and shortage of finance; one of the objectives of the soft component 'To establish and include the maintenance budgetary plan into the annual business plan' had, at the time of ex-post evaluation, not yet been achieved.

Since it has not been confirmed if Australian Aid will continue financial support to the Health Sector since 2019, there is a significant challenge with regards to sustainability in financial aspects of operation and maintenance.

3.4.4. Status of Operation and Maintenance

It was confirmed that all facilities and equipment, apart from colonoscopy and laparoscopes, were being utilized fully and contributed to VCH's medical operation. With regards to the built facilities; cracks on the walls, mended after the defect liability inspection, were visible again and there were problems with the autoclaves at CSSD[29]. Nonetheless all facilities were essentially well used and in good condition, cleaned daily, and with minor problems attended to by the Maintenance Unit.

In the event of problems with equipment, the concerned department should make a report to the Maintenance Unit. After investigation to determine the cause, Maintenance Unit staff members will make inquires to the equipment's agent(s) either in country and/or overseas. Overall, most equipment was being used in a correct manner. The Maintenance Unit conducts checks, cleaning and repair of facilities and equipment, either; every two weeks, one month or three months, in accordance with the maintenance plan and schedule created

[28] Interview from Team Leader of Australian Aid funded Vanuatu Health Resource Mechanism. Exchange rate: 1 AUD=81.41JPY (April 2018)
[29] cf.: page 8, line 3 - 9

under the guidance during the soft component training. In addition, materials created during the training, such as, a maintenance manual, equipment ledgers, lists, repair inquiry sheets, flow charts, and maintenance record forms (daily reports/monthly reports), were stored in the workshop of the Maintenance Unit, and utilized when necessary.

At the time of the ex-post evaluation, it was considered that the most significant difficulty was an insufficient operational (maintenance) budget for proper operation and maintenance. On completion of the soft component training, regarding to the technical facilities and equipment, it had been recommended that maintenance contracts with the suppliers/agents regionally should be signed. It was also recommended that two air blowers and a conductivity meter, necessary to measure the hardness of tap water[30], should be procured. However, none of these recommendations were carried out due to lacking of funding. The Maintenance Unit has been replacing medical equipment components as scheduled, but there is considerable concern over the inadequacy of purchasing/storage of spare parts for equipment originally provided under the project. For example, although not originally purchased under the project, procurement applications submitted in accordance with the maintenance plan for minimal materials and parts, that would directly affect the use of medical equipment, such as electrocardiograph paper rolls to record readings, could sometimes take up to one year until completed. On the other hand, where an air-conditioning supplier was selected on the basis that the company had an agent in Fiji, it was found to be quick and easy to undertake inquires and purchase spare parts. Such local/regional access to suppliers was evaluated as highly desirable by the Maintenance Unit and Management of VCH.

In regards to the status of operation and maintenance, there were no particular problems found with built facilities, however, with regard to equipment there were problems, which derived from an insufficient operational budget.

Major problems have been observed in terms of the financial aspect. Therefore, sustainability of the project effects is low.

4. Conclusion, Recommendations and Lessons Learned

4.1. Conclusion

VCH is the principal hospital providing specialized medical treatments and is the top referral hospital for the whole of Vanuatu. Under this project, which aimed to improve medical services at VCH and strengthen its capacity as an educational facility for medical/health workers, new medical facilities were constructed and medical equipment was procured and installed.

[30] Water provided by public water supply.

This project was consistent with the development policy and needs of Vanuatu as well as the priority areas of Japan's ODA policy regarding the effect of the project; therefore, the relevance of the project is high. With regard to implementation, the project components were carried out mostly as planned, and the project cost and period were within the plan. Consequently, the efficiency is also high. The quantitative indicators to assess the effectiveness of this project, 'number of operations' and 'number of referrals' were largely achieved, and other indicators (number of emergency outpatients, clinical examination and X-ray pictures taken) were greatly increased (improved). Moreover, the project contributed towards enhancing post graduate training for doctors and nurses and strengthened the capacity of medical workers and staff members within the Maintenance Unit. Patient satisfaction levels were high with regard to the facilities provided by the project and the medical services delivered at VCH; therefore, it was possible to confirm that some positive effects were emerging. Furthermore, significant impacts could be seen as a result of the project, as it has been achieving the overall goal of, 'medical services in quality and quantity in Vanuatu are improved.' Also, resilience to natural disasters was strengthened, as demonstrated by the new building making it possible to resume medical activities, immediately after a super cyclone hit Vanuatu. Therefore, overall effectiveness and impact are assessed as high. With regards to sustainability, there remains a need to further strengthen institutional and technical aspects and major challenges were identified concerning financial aspects, such as, with regard to the excessively long duration required to procure necessary spare parts. This meant that the sustainability of the project was assessed as low.

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

4.2. Recommendations

4.2.1. Recommendations to the Implementing Agency

Inclusion of CR unit cost in recurrent budget

Among the equipment provided under this project, the filmless X-ray machine (CR system) was evaluated extremely highly due to its quality and efficiency. This was reported not only by the implementing organization but also by private clinics. The CR unit is essential for operation of the filmless X-ray machine. To prevent this service ceasing, it will be necessary for the Ministry of Health to negotiate with the Department of Finance to purchase one unit within this year, and to include the cost within the recurrent budget every two years.

Inclusion of maintenance plan within the business plan of VCH

One of the objectives of the soft component 'To establish and include the maintenance budgetary plan into the annual business plan' has not yet been achieved due to an insufficient

budget. However, the Maintenance Unit do create a maintenance plan, including the costing of spare parts, which VCH management could incorporate within their budget.

Examine means to reduce electricity costs at VCH (energy saving / introduction of solar power generation)

The poor result found on sustainability for the project was due to the serious situation concerning the level of finance (an insufficient Health Budget). As shown in Table 9, salaries and personal expenses consume the vast majority of the VCH budget; however, approx. one third of the operation budget is taken up by power usage. The Northern Provincial Hospital has been saving electricity costs by using solar power and utilizes some of the savings to cover other operational costs. To help ease the pressure on the operation theatre and maintenance budgets, with the extension and improvement of the operation theatre and collaboration of electricity company, the introduction of alternative energy supplies (solar power generation, etc.) is recommended.

In addition to developing measures to cut the cost of electricity, although it is difficult to implement energy-saving in all departments in hospital setting, it would be advantageous to review power usage in both old and new buildings and promote adoption of energy-saving practices.

Capacity development for staff members for the collection of accurate and consistent data

Since 2013, and following the general election of 2012, many staff members of the MoH have been replaced. Due to these major changes in both management and staff members, problems with data missing, or being of questionable consistency, were found during statistics data collection for the ex-post evaluation. To understand the genuine health status in the country, it is important that the MoH should further confirm health statistics' definitions, standards, collection and data saving methods, etc. Using a more standardized system, it should be possible to secure consistency of data collection, utilizing the same conditions, even when staff members are replaced. At the same time, it will be necessary to strengthen capacity of staff members through holding workshops on a regular basis to share and update information regarding handling of health data and new standards.

4.2.2. Recommendations to JICA

Consideration of assisting in solving the problems in the operation theatre (CSSD)

In the sterilization chamber, steam from the autoclaves is not emitted to outside but returns into the room through the drain funnel, and this leaves the floor almost always flooded. Autoclaves are heavily used and essential equipment, and as all three autoclaves are

unable to operate at the same time, the efficiency of daily operations are negatively affected. It is recommended that assistance to make sure pressured steam be emitted outside through improving ventilation and/or drainage be considered. Especially, as the problem was first identified in January 2015, immediately after the operation theatre moved and began working within the new hospital building.

Consideration to assist with follow-up measures to be taken by the Vanuatu government towards reducing electricity costs

As one third of the VCH operation budget is taken up by electricity costs; it is recommended that assistance and follow-up to support Government of Vanuatu initiatives towards electricity bill reduction be considered on an as needed basis.

4.3. Lessons Learned

Careful examination, during the preparatory survey, of quantitative indicators to assess the effectiveness of the project

Among the operation indicators used to assess effectiveness of the project, and determined during planning stage, some were inappropriate and others had problems with mis-handled data. All indicators were found to have problems to some degree. While determining operation indicators, the section-in-charge of JICA should verify them with the utmost care. Attention should be taken to ensure that; there is no discrepancy with the partner country's policy, pre-conditions and definitions of data are clear, and/or that targets are not set based on the opinion of only a few people, etc. Ideally, before confirming indicators, it would be beneficial to obtain input from either, the evaluation section of JICA, or evaluation experts to examine what is effective and to check if the indicators are sufficiently logically sound to assess the effectiveness of the project reality. Moreover, to prevent simple mistakes in the handling of data and mistakes in typing numbers, consulting companies should be obliged to double check by the third person that; sources of data, reports and calculation results are written correctly during creating the survey report.

Easy maintenance as a procurement principle (good practice)

In this project, regarding to the procurement, the air-conditioner brand was chosen, based on availability of agent(s) within the region (Fiji) due to easy maintenance. This has allowed greater ease in the ordering of spare parts. Careful consideration of maintenance during procurement resulted in easier maintenance, and this was recognized and highly regarded. In future projects of a similar type, it will be beneficial to purchase more equipment from manufacturers that have agents within the country, or at least neighboring countries, in order to

obtain parts when it is necessary.

Building design which takes into account environmental conditions (good practice)

Large scale cyclones hit somewhere in Vanuatu every few years. Buildings with structures sufficient to withstand extreme natural disasters can create great impacts, and the project is highly commended. It is desirable to fully consider the natural environment during design, should there be plans to construct future hospital buildings in the countries vulnerable to natural disasters.

END//

Mongolia

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

"The Programme for Ulaanbaatar Water Supply Development in Gachuurt"

External Evaluator: Keisuke Nishikawa, Japan Economic Research Institute Inc.

0. Summary

In this project, a new water source was developed, and water transmission mains were laid in Gachuurt, an eastern suburb of Ulaanbaatar City, to improve the situation of water supply for residents in the ger districts in Ulaanbaatar City. The relevance of this project is high as it was consistent with the development plans and development needs of Mongolia and Ulaanbaatar City at the time of both planning and ex-post evaluation in terms of a stable and sufficient supply of water, and it was also consistent with Japan's ODA policy at the time of planning to support the development of infrastructure for promoting economic activities. As for implementation of the project, the project outputs were largely as planned, and the project costs and periods were within the plan. Therefore, the efficiency is high. With regard to project effects, in addition to the achievement of operation indicators, a stable water supply and the elimination of users' waiting time at kiosks were confirmed. However, the water supply volume did not increase as expected because of an economic growth lower than expected at the time of planning and because of water saving measures imposed by the executing agency, showing an aspect of this project that did not necessarily contribute in a sufficient manner. Regarding the impact, a reduction in the burden of water-drawing and improvements in the hygienic environment were observed, and there were no issues in terms of negative impacts to the natural environment or resettlement and land acquisition. Therefore, the effectiveness and impact of this project are fair. With respect to operation and maintenance, there were no major problems in terms of all institutional, technical, financial aspects or the operation and maintenance status. Therefore, sustainability is judged to be high.

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

1. Project Description

Project Location

Chlorination / Operation House and Reservoir

1.1 Background

Ulaanbaatar, the capital city of Mongolia, has characteristics in terms of living patterns and water use in which apartment areas have individual water supply connections whereas ger districts require residents to purchase domestic water at drinking water sales offices (hereinafter referred to as 'kiosks'). As for the volume of water use, there was a big gap that revealed ger residents were using 8.7 liters per person per day while apartment residents were using 236 liters per person per day in 2009. In ger districts, there were kiosks with supply hour restrictions due to the shortage in water supply volumes, requiring the users to continue waiting for resumption of service whenever the water supply was suspended.

Water supply facilities in the city were constructed with the assistance of the former Soviet Union over a period from the 1950s to the 1980s. After that, owing to the city's individual efforts or to assistance from donors, expansion of water supply capacities was made through facility development, measures against water leakages, transition to a metered tariff system, efforts on water saving awareness and other efforts were made. However, the expansion of water supply capacities was an urgent challenge because of a water demand increase caused by a rapid population increase and population relocation from ger districts to apartment areas based on the national housing policy.

The Water Supply and Sewerage Authority of Ulaanbaatar City (hereinafter referred to as the 'USUG') was supplying water by pumping groundwater at four water sources. However, as the existing water sources did not have any potential for further development, it was necessary to develop a new water source in Gachuurt, the eastern part of Ulaanbaatar, which was proposed as the best location in a previous survey.

1.2 Project Outline

The objective of the project was to improve water supply conditions for residents of Ulaanbaatar City (particularly in the ger districts) by developing a new water source and laying water transmission mains in Gachuurt, the eastern suburb of Ulaanbaatar City, thereby contributing to the improvement of the hygienic and living environment of residents.

Grant Limit / Actual Grant Amount	Detailed Design: 102 million yen / 102 million yen Main Works: 3,305 million yen / 2,514 million yen
Exchange of Notes Date / Grant Agreement Date	Detailed Design: September, 2010 / September, 2010 Main Works: June, 2011 / June, 2011
Executing Agency	The Water Supply and Sewerage Authority of Ulaanbaatar City (USUG)
Project Completion	November, 2014

Main Contractor	Dai Nippon Construction
Main Consultant	CTI Engineering International Co., Ltd.
Preparatory Survey	July, 2009 – March, 2010
Related Projects	[Technical Cooperation] Study on Water Supply Systems in Ulaanbaatar and Surroundings (1993 – 1995) The Study on City Master Plan and Urban Development Program of Ulaanbaatar City (2007 – 2009) Study on the Strategic Planning for Water Supply and Sewerage Sector in Ulaanbaatar City (2012 – 2013) [Grant Aid] Rehabilitation of Water Supply Facilities in Ulaanbaatar City (1996) The Project for Improvement of Water Supply Facilities in Ulaanbaatar (2004) [Other International and Aid Organizations] (World Bank) Ulaanbaatar Services Improvement Project (1997 – 2003) Second Ulaanbaatar Services Improvement Project (2004 – 2012) Ulaanbaatar City Water Supply and Sewerage Master Plan (2006) (The Netherlands) Water Operators' Partnership Project (2007 – 2010) (Asian Development Bank / European Investment Bank) Ulaanbaatar Urban Services and Ger Areas Development Investment Program (2012 –)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keisuke Nishikawa, Japan Economic Research Institute Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: October, 2017 – November, 2018

Duration of the Field Study: January 28, 2018 – February 9, 2018, and April 1, 2018 – April 7, 2018

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Mongolia

At the time of planning of this project, in the *MDG-based Comprehensive National Development Strategy of Mongolia* (targeting 2008 – 2021), which was positioned as the overarching development plan of Mongolia, a potable water supply to ger districts in the capital of Ulaanbaatar was set as an important agenda item in the strategic goals on urban planning and construction. In addition, in the *City Master Plan and Urban Development Program of Ulaanbaatar City* (formulated in 2009) regarding water supply, water demand was projected to exceed the supply capacity by around 2011, and the development of water supply facilities was set as a priority project.

The *Mongolia Sustainable Development Vision 2030* (formulated in 2016) targeting the entire area of Mongolia was set as a development plan at the time of ex-post evaluation, and 'Environmental Sustainability' was put up as one of the four pillars in the vision. Among the pillars, an increase in the supply of potable water, one that met hygienic standards, was set as one of the goals of integrated water resource management. In addition, in the *Ulaanbaatar 2020 Master Plan and Development Approaches for 2030*, which was the comprehensive development plan of Ulaanbaatar City formulated in 2014, it was indicated that the proportion of apartments and houses equipped with infrastructure would increase from 43% in 2010 to 78% in 2030. In contrast, it was planned that the proportion of ger districts would decrease from 25% in 2010 to 3% in 2030. Along with the plan, the volume of domestic water use was planned to be halved in ger districts while that in apartment areas would be 2.5 times larger in 2030 compared to 2010.

Based on the above, it can be said that this project is consistent with the national development plans at both points of time in terms of the supply of a sufficient volume of potable water. Regarding the consistency with Ulaanbaatar City's plan, including the plan for the water sector, it is planned that ger districts in the city will be scaled down in the future. However, there is a need to supply sufficient water to residents in ger districts until the planned decrease is to be accomplished and water supply networks in the present ger districts chosen to be redeveloped as apartment areas in the future need to be developed in advance.

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

[2] ③: High, ②: Fair, ①: Low

In this light, this project can be judged to have been in line with the development direction of Ulaanbaatar City.

3.1.2 Consistency with the Development Needs of Mongolia

At the time of planning of this project (in 2009), there was a big gap in terms of the volumes of water used by Ulaanbaatar residents, as evidenced by ger residents using 8.7 liters per person per day[3] in contrast to apartment residents using 236 liters per person per day. However, there were kiosks with supply hour restrictions due to the shortage in water supply volumes in ger districts, requiring the users to continue waiting for resumption of service whenever the water supply was suspended. Moreover, there were even ger residents using unsanitary surface water. Regarding the relationship with the above policies, an expansion of water supply capacities was an urgent issue because of the sudden population increase and an increase in water demand caused by population shifts of ger districts to apartment areas in Ulaanbaatar City. This project was implemented to respond to these challenges.

While this project had the components to develop a water source for enhancing water intake capacities, the development of distribution networks remained necessary at the time of ex-post evaluation as the number of kiosks in ger districts requiring water supply by water trucks was 320 among the 640 kiosks. In addition, the executing agency has realized in recent years the prepaid card-operated water supply system at 120 kiosks among the 320 kiosks connected to distribution networks. At these kiosks, a 24-hour water supply had become possible without staffing. It is expected by residents that the number of such kiosks will increase further[4].

A stable water supply is indispensable for the social and economic activities of Ulaanbaatar City residents. The daily average water supply volume in the city and the water supply volume per person per day to apartment areas and ger districts in recent years are shown below.

[3] Information provided by the executing agency (identical to the data for 2009 shown in Table 1)
[4] At the time of ex-post evaluation, assistance was being provided by the Millennium Challenge Corporation, a US donor agency, to enable prepaid card-based payment at all kiosks.

Table 1: Water Supply Situations in Ulaanbaatar City

	2009	2015	2016	2017
Daily average water supply volume (m^3/day)[Note]	152,000	142,700	143,500	144,000
Water supply volume in apartment areas (ℓ/person-day)	236.0	156.2	149.2	140.4
Water supply volume in ger districts (ℓ/person-day)	8.7	8.1	8.1	8.8

Source: Document provided by the executing agency

Note: Only the data of sales volume of water not the actual volume of water supplied are recorded.

With regard to water supply situations in all of Ulaanbaatar City, the water supply volume per capita has decreased – contrary to the expectation at the time of planning – because of delays in the progress of a plan to transform ger districts to apartment areas, which in turn were caused by a sudden slowdown of economic growth since November 2014 (refer to Table 2), raising of the water tariff[5], increases in water meter installations[6], measures against water leakages in distribution networks, and so forth.

Table 2: Economic Growth Rate, Inflation Rate and Income (for reference)

	2013	2014	2015	2016
Real growth rate of gross domestic product	11.6%	7.9%	2.4%	1.0%
Inflation rate	12.5%	11.0%	1.9%	1.1%
Nominal gross national income per capita (Tugrik in thousands)	6,241	6,891	7,021	7,209

Source: Taken from the Mongolia Yearbook (2016 version)

In the ger districts targeted in this project, a similar pattern elucidating that water supply volumes remained unchanged while the population increased was observed, leading to a reduction of per capita water supply volume compared to that at the time of planning (refer to Table 3). In 2009, residents were purchasing more water than necessary for fear of not being able to obtain it, as much of the water was supplied through water trucks. However, the development of distribution networks and stability in obtaining water at kiosks gradually had become prevalent at the time of ex-post evaluation. Therefore, a change in which residents efficiently purchased and used water is considered to be the factor for the reduction.

[5] Revised upwards by an average of 10% every year since 2014

[6] The installation rate of water meters in apartment areas was 32% in 2009, but it subsequently rose significantly, reaching 70% in 2017 (based on the information provided by the executing agency).

Table 3: Population and Water Supply Volume in the Ger Districts Targeted in This Project

Name of Ger Districts	2009		2015		2016		2017	
	Population (person)	Water sales volume (ton/year)	Population (person)	Water sales volume (ton/year)	Population (person)	Water sales volume (ton/year)	Population (person)	Water sales volume (ton/year)
Hailast	61,165	179,113	66,000	195,645	68,261	191,588	60,322	204,317
Denjiin Myanga	5,798	44,949	11,900	31,521	11,844	36,038	7,560	36,650
Radio & TV Authority Naran Zuragt	7,599	51,561	15,412	57,350	14,112	57,340	21,890	50,976
In and around North-East Reservoir	5,075	45,360	10,300	24,222	8,820	23,598	10,774	23,578
Chingeltei	12,026	94,295	13,365	45,443	13,364	43,674	17,971	46,715
Dambadarjaa	21,148	57,450	29,289	106,599	28,760	97,010	26,216	114,455
Dari Ekh	15,126	114,144	32,047	96,544	39,437	96,469	23,746	98,194
3,4,5,6,7 Buudal,7th Khoroolol	5,841	27,099	12,226	44,892	12,226	44,144	13,790	40,974
Total	**133,778**	**613,971**	**190,539**	**602,216**	**196,824**	**589,861**	**182,269**	**615,859**
Water supply volume per capita (day-ℓ)	-	*12.6*	-	*8.7*	-	*8.2*	-	*9.3*

Source: Document provided by the executing agency

In the ger districts targeted in this project, no increase in water demand associated with the implementation of this project has been observed. However, in the entire city of Ulaanbaatar, a proportion of residents living in apartment areas has gradually become higher in line with the government policy. As shown in Table 4, the proportion of residents in apartment areas, which was 38.5% of the total in 2009, rose to 43.5% in 2017. In contrast, while the population in ger districts had been increasing, the rate of increase has slowed down in recent years. In the comprehensive development plan of Ulaanbaatar City (formulated in 2014), it was planned that the number of households able to partially use utility services (electricity, water, and so on) in ger districts would reduce to 10,000 in 2030 from 65,338 in 2010 and that the number of households able to fully use utility services in apartment areas would increase from 115,196 to 240,280 during the same period.

Table 4: Number of Residents in Ger Districts and Apartment Areas

(Unit: person)

	2009	2015	2016	2017
Ger district	658,052 (60.9%)	785,472 (58.4%)	792,099 (57.4%)	795,344 (56.1%)
Apartment area	415,159 (38.5%)	554,225 (41.2%)	582,159 (42.2%)	615,962 (43.5%)
Other Note	6,508 (0.6%)	5,803 (0.4%)	6,534 (0.5%)	6,090 (0.4%)
Total	1,079,719	1,345,500	1,380,792	1,417,396

Source: Document provided by the National Statistics Office of Mongolia

Note: Indicating the population living in places such as manholes and garages, which cannot be classified as houses

In Ulaanbaatar City, water supply volumes in the 2010s remained unchanged because of delays in the progress of a plan to transform ger districts to apartment areas caused by a sudden slowdown of economic growth as well as measures taken by the executing agency for water saving. However, it is expected that the water supply volume will gradually increase because (1) the proportion of residents in apartment areas is gradually becoming higher; (2) there is a plan to shift the population from ger districts to apartment areas where the volume of water consumption per capita is higher; (3) economic growth rates will recover[7]; and so forth. Moreover, the importance of a stable water supply in the ger districts were high at the time of both planning and ex-post evaluation. Therefore, this project, as a social infrastructure development project, can be said to be consistent with the development needs.

Water supply at a kiosk
(at the time of ex-post evaluation)

Water supply through a water truck
(at the time of ex-post evaluation)

[7] According to the country report published by the IMF, the expected GDP growth rates are: 5.0% for 2018; 6.3% for 2019; 5.0% for 2020; 5.8% for 2021; 8.2% for 2022; and 7.0% for 2023, showing higher rates than those of 2015 and 2016.

3.1.3 Consistency with Japan's ODA Policy

In Japan's *Country Assistance Policy for Mongolia* (formulated in 2004) at the time of planning, 'Assistance on infrastructure development for promoting economic activities' was one of the focus areas of assistance, which aimed at strengthening urban functions of Ulaanbaatar City, including improvements in water supply conditions. Also, JICA had established the *Urban Development Program of Ulaanbaatar City* and positioned this project in this program.

As this project contained the execution of infrastructure development of Ulaanbaatar City and measures to respond to issues in the ger districts of the city as well as the increases in water demand, this project can be said to have been consistent with the focus areas of Japan's assistance for Mongolia mentioned above.

It was confirmed that this project was consistent with the development and sector plans as well as development needs of Mongolia at the time of both planning and ex-post evaluation, and with Japan's ODA policy for Mongolia at the time of planning.

Based on the above, the relevance of this project is judged to be high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

It was planned in this project that a new water source would be developed along the Tuul River basin in Gachuurt, in the eastern suburb of Ulaanbaatar City, and transmission mains to Ulaanbaatar City would be laid. Table 5 summarizes the planned components and the altered points captured at the time of ex-post evaluation.

Table 5: Planned Components and Altered Points of This Project (portions contributed by Japan)

Item	Planned Component	Altered Point
Transmission mains	Transmission mains (18,813m), Valve chamber (a total of 33 locations), etc.	Transmission mains (18,870m)
Conveyance / collecting pipes	Conveyance / collecting pipes (7,060m), Valve chamber (a total of 4 locations), etc.	Conveyance / collecting pipes (6,892m)
Reservoir	Inflow pipes, Outflow pipes, Discharge pipes, Water gauge, Flow meter, etc.	None (Construction of the reservoir itself was borne by the Mongolian side)
Wells	21 wells (pumping volume: 1,200m^3/day/well), Construction of pump house (21 locations)	None
Chlorination Unit Operation House	Storage room, Chlorination room Operation room, Electrical room, Lavatory	None

Source: Prepared using the *Preparatory Survey Report* of this project and information provided by JICA and the executing agency

One of the wells constructed through this project

Maintenance bridge (left) and temporary bridge

Items altered and not described in Table 5 were as follows:

- Change in the construction method for inverted siphon at the point traversing Tuul River
- Location changes for 4 pumping wells and the associated changes in the lengths of conveyance / collection pipes
- Specification change of pump outputs and valves
- Reduction of water hammer pressures in transmission mains
- Addition of a fire alarm system in the Chlorination Unit Operation House
- Removal and restoration of pavement of roads over transmission mains
- Leaving the temporary bridge crossing Tuul River at Gachuurt Water Source intact
- Change in the type of pipes used for transmission mains (reinforced plastic duplex pipe)
- Addition of fences at the location where high voltage power lines for pump houses are drawn in

It was confirmed that these minor changes were the ones associated with the results of a detailed survey or with an enhancement of safety measures and did not cause any negative impacts for the generation of project effects.

A follow-up cooperation effort of this project was carried out from 2015 to 2016, whose main components were (1) the installation of perforated valves to stabilize the pumping volume for controlling the automatic stopping of valves associated with unexpected drops in underground water levels and (2) instruction on facility operations. As a result of this project, pumps do not stop automatically even when water levels drop excessively during the winter season.

The above were the outputs through cooperation offered by Japan, and the items borne by

the Mongolian side (except for general procedures) were as follows: securing of a temporary yard; construction of reservoir (6,000m^3); installation of distribution lines; installation of fences at well pumps; construction of a maintenance bridge; and monitoring of environmental and social impacts.

These items were confirmed to have been all executed at the time of ex-post evaluation. Regarding the maintenance bridge crossing Tuul River, while the construction was completed in July 2015, the temporary bridge installed during the construction period of this project was left intact at the time of ex-post evaluation. The reason was that when the components by Japan were completed in November 2014, the temporary bridge was temporarily needed for maintenance purposes as the maintenance bridge had not been completed. It seems to have been a necessary measure for the generation of project effects through appropriate management of the wells. At the time of ex-post evaluation, the permanent bridge, completed in July 2015, was being used and passing over the temporary bridge was prohibited[8].

3.2.2 Project Inputs

3.2.2.1 Project Cost

This project was planned at a total cost of 3,557 million yen and was composed of Japan's project cost contribution of 3,407 million yen (102 million yen for the detailed design and 3,305 million yen for the main construction) and Mongolia's project cost contribution of 150 million yen.

The actual project cost borne is shown in Table 6: a total of 2,950 million yen[9] comprising Japan's project cost of 2,616 million yen and Mongolia's cost of 5,455 million Tugrik (334 million yen[10]).

[8] At the time of ex-post evaluation, the executing agency had been considering the utilization of the bridge by relocating the materials of the temporary bridge to a different location.

[9] The project cost of the follow-up cooperation effort described in '3.2.1 Project Outputs' was 55 million yen. However, it is not included in the cost of this project as it was not expected as an item necessary for the generation of project effects at the time of planning but rather a project implemented in response to the situation where a significant drop of water levels in winter had unexpectedly occurred.

[10] Calculated based on the average rate of the project period by referring to the exchange rate data of the International Financial Statistics (IFS) of the International Monetary Fund. The cost was a sum of the costs for the construction of a reservoir (6,000m^3), installation of distribution lines, installation of fences at well pumps and the construction of a maintenance bridge.

Table 6: Breakdown of the Actual Cost of This Project

(Unit: million yen)

Breakdown			Project cost
Japan side	Detailed design		102
	Construction		2,395
		Direct construction	2,041
		Other construction	354
	Design and supervision		119
Amount borne by Mongolia			334
Total			2,950

Source: Prepared based on the documents provided by JICA and information provided by the executing agency

According to the executing agency, the cost borne by Mongolia substantially exceeded the planned amount because of a surge in local materials prices and labor costs. However, as Japan's project cost was significantly lower than the planned amount because of competitive bidding among contractors, the total project cost was within the plan (83% of the plan).

3.2.2.2 Project Period

The period of this project, including the detailed design period, was planned at 52 months. The actual project period was 51 months: from September 2010, when the grant agreement of the detailed design was signed, till November 2014, when the main work was completed[11].

With regard to the items borne by the Mongolian side, there was a delay seen in the construction of the maintenance bridge as described above. Concretely, as it became clear that the construction work would drag on into winter following a delay in the tender process, bridge construction was delayed[12] till the following year and finally completed in July 2015. However, maintenance of wells was not disturbed at all as the temporary bridge, installed in the construction works through this project, was in use for a little over half a year and the delay in construction had few negative impacts on the generation of project effects. Therefore, the delay in the construction of the permanent maintenance bridge is not regarded as a delay of the project period. Consequently, the period of this project is judged to have been within the plan (98% of the plan).

The outputs of this project were executed largely as planned except for minor changes, and the project cost was within the plan. Regarding the project period, while there was a delay in

[11] The detailed design period was between September 2010 and May 2011, and the tender and main work were executed from June 2011 till November 2014.

[12] As Mongolia's winters are extremely cold, outdoor construction works are not usually conducted.

some of the construction of the items borne by the Mongolian side, negative impacts on the generation of project effects were extremely limited. Therefore, it is not regarded as a project delay but rather as a project that was completed within the planned period.

Based on the above, the efficiency is judged to be high.

3.3 Effectiveness and Impacts[13] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects

At the time of planning of this project, the enhancement of water supply capacities (daily maximum water supply capacity) was expected as an operation indicator.

Table 7: Operation Indicator of This Project

	Baseline	Target	Actual			
	2009	2017	2014	2015	2016	2017
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
Water supply capacity (Daily maximum water supply volume) (ten thousand m^3/day)	24.0	26.5	26.5	26.5	26.5	26.5

Source: Summary of ex-ante evaluation, information provided by the executing agency
Note: Indicating the water supply capacity for all areas of Ulaanbaatar City

The target value of the operation indicator can be said to have been achieved as an increase of 25,200m^3/day in supply capacity has been realized[14] through the execution of this project. However, as described above, the actual daily maximum water supply volume (effect indicator) has been flat since this project was completed because of the rapid slowdown of economic growth in recent years, upward revisions of the water tariff, increases in the installations of water meters (apartment areas: 23% in 2009 -> 70% in 2017), decreases in non-revenue water (16% in 2009 -> 14% in 2017), and so forth. Therefore, the actual values of the daily maximum water supply volume in Ulaanbaatar City has been hovering at around a little over 150 thousand m^3/day, as indicated in Table 8. As for the Gachuurt Water Source developed in this project, the pumped amount has been at around 9,000m^3/day - 12,000m^3/day on an annual average[15].

[13] Sub-rating for Effectiveness is to be put with consideration of Impact.
[14] The pumping capacity of each well is 1,200m^3/day. As 21 wells were constructed, the total has become 25,200m^3/day.
[15] According to the executing agency, the actual water intake capacity of Gachuurt in March and April every year, when water levels are the lowest, is 5,000m^3/day – 6,000m^3/day.

Table 8: Actual Values of Daily Maximum Water Supply Volume (Effect Indicator) in Ulaanbaatar City

	2014	2015	2016	2017
Daily Maximum Water Supply Volume: Actual Value (ten thousand m^3/day)	15.3	15.2	15.1	15.4

Source: Documents provided by the executing agency

Thus, the actual water supply volume has not increased in terms of per capita volume and entire volume because of external factors such as the delay in the progress of a plan to transform ger districts to apartment areas caused by a sudden slowdown in economic growth and operational factors such as upward revisions of the water tariff, increases in the installations of water meters, and decreases in non-revenue water. Moreover, although transmission mains were to be built and water was to be supplied to residents in the ger districts and apartment areas to the west of the North-East Reservoir, which was the end point of the transmission mains at the time of planning of this project, the project had yet to be completed at the time of ex-post evaluation[16]. Consequently, more years were expected to pass till the water from the Gachuurt Water Source would reach the 390,000 people, which was anticipated at the time of planning.

With regard to the projection of water supply volume, the executing agency is expecting in the strategic plan targeting 2016 – 2020 that the daily average water supply volume in Ulaanbaatar City, which was 144,000m^3/day in 2017, will gradually increase to 148,800m^3/day in 2018, 150,400m^3/day in 2019, and 150,700m^3/day in 2020. However, this is a very moderate increase, and if the demand expected at the time of planning had manifested, the daily average water supply volume would have been 225,000m^3/day in 2015. The actual demand, being stagnant at around two-thirds the level, implies that the gap with the planned value will not be narrowed.

It was heard that the executing agency was instructed by the Ministry of Environment and Tourism to set the average proportion of water intake at a level of around 60-70% of the facilities' capacities to avoid both drops of water levels and negative effects on environment[17], and based on the instructed level of capacity, water needs to be supplied at

[16] The name of the project is 'Ulaanbaatar Urban Services and Ger Areas Development Investment Program', being executed through the assistance of the Asian Development Bank and the European Investment Bank. The project to lay transmission mains was commenced in 2014, but a long time was required for its designing, and it is expected that there will be a significant delay without being completed in 2018 as initially planned because of the additional fact that it is a project requiring relocation of residents. Also, the executing agency was planning to expand the capacity of the North-East Reservoir from its current level of 6,000m^3 to 24,000m^3, and its design had just been completed at the time of ex-post evaluation.

[17] The Ministry of Environment and Tourism conducted a survey from 2014 – 2015 to identify the amount of available water resources among the water sources of Ulaanbaatar City, and based on the result, set the level of water that can be used. The cause seemed to be a lack of a sufficient amount of water accumulated in the catchment areas of water sources due to urbanization of the city. In a notification letter issued by the ministry in December 2017, it was required that facilities at some water sources operate at 50% of the water intake capacities and all water sources of

an amount of between 159,000m^3/day and 185,000m^3/day on average. As the actual growth rate of water demand has been low, the actual amount of water supply at the time of planning has not exceeded the level projected at the time of planning. However, considering the situation in which the proportion of water intake has been restricted, only 10-20% of the reserve supply capacity is available. Therefore, because of the slowdown of demand caused by external factors, a small amount of reserve supply capacity is secured, even under the conditions of lower water intake levels by the notification from the Ministry of Environment and Tourism, making it possible to meet the demand until 2020 with the current supply capacities. However, in terms of meeting the increasing demand, approximately 40% to 50% reserve supply capacities as a whole would still be available in Ulaanbaatar City if no restrictions on the water intake rate were imposed by the Ministry of Environment and Tourism. Therefore, considering the background that the supply capacity was increased to meet the growing demand, the quantitative effects expected at the time of planning of this project cannot be said to have been achieved in the original sense though the operation indicator was achieved.

3.3.1.2 Qualitative Effects (Other Effects)

At the time of planning of this project, it was expected as a qualitative effect that after project implementation, increases in the amount of water supplied to ger districts would eliminate water shortages at kiosks and enable a long-time water supply, leading to the reduction of waiting time of users.

According to the executing agency, reserve supply capacities of water became sufficiently secured through execution of this project, enabling a stable water supply to all parts of the areas targeted in this project. It is difficult from the viewpoint of operation and maintenance of facilities to keep supplying water at a level close to the maximum value of the water supply capacity, and it is necessary to have a certain amount of reserve supply capacity. Therefore, this project is considered to have been effective in terms of securing a stable water supply.

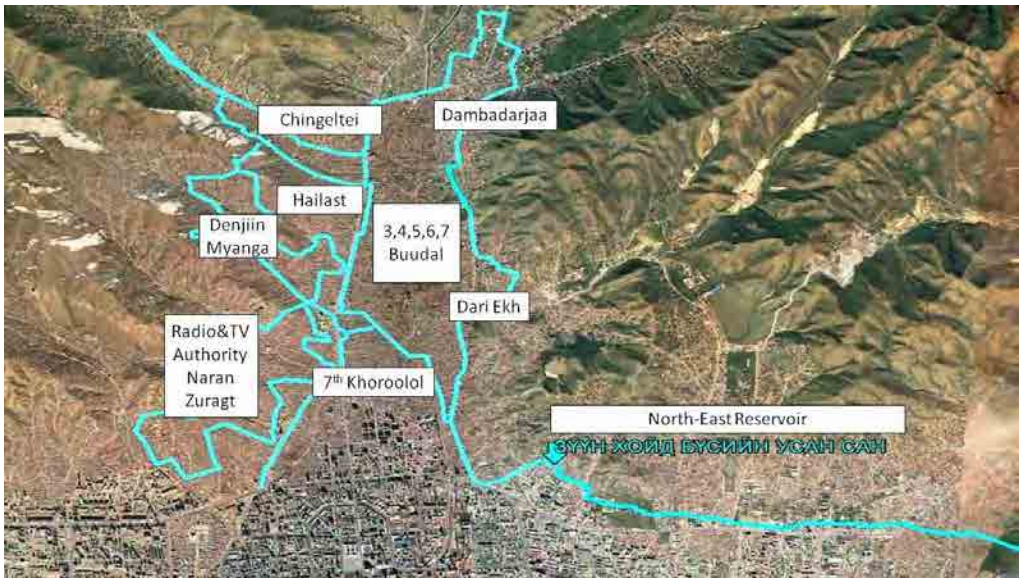
In the ex-post evaluation, an interview survey was conducted[18] in five khoroos (i.e, administrative subdivisions of Ulaanbaatar City) among the ger districts in which the following comments were uniformly obtained; before the project, there were cases when water could not be delivered to residents who were at the back of the queues though they lined up for water trucks, particularly in the area where they were dependent on them;

Ulaanbaatar City as a whole operate at a 60-70% level. The Gachuurt water source is located within a protected area without any major development in the catchment area; therefore, it is not added to the restricted list of water sources.

[18] Five khoroos along main streets (having better access) in the ger districts with large population sizes (Hailast, Dambadarjaa, Dari Ekh, Radio & TV Authority, Naran Zuragt) were visited. In Hailast, a district with an especially large population, two khoroos were visited.

however, such situations all disappeared after project implementation, and waiting time was substantially reduced as a result of the areas being connected to distribution networks[19] (Figure 1). The Gachuurt Water Source, developed in this project, can be said to have contributed to a stable supply as it provides sufficient water to the North-East Reservoir which distributes water to these ger districts. Also, the survey revealed that each kiosk in the area always has sufficient water stored and there is no complaint as to any shortage of water lodged at the khoroos. However, there were some comments in the khoroos with ger districts expanding in recent years that as the number of kiosks was not sufficient in the expanded areas and distribution networks were not developed, some new residents were feeling inconvenienced.

Based on the above, sufficient water has been supplied to kiosks in such ger districts and this project can be said to have contributed to the elimination of users' waiting time. In addition, as described above, a 24-hour water supply through introducing the prepaid card system has been realized at some kiosks, leading to the improvement of convenience.



Source: Information provided by the executing agency

Figure 1: Transmission Mains and Distribution Pipes (light blue) Installed in the Target Areas of This Project

The Gachuurt Water Source was newly developed at a location with the highest elevation among the water sources of Ulaanbaatar. Water from the Gachuurt Water Source

[19] Together with the implementation of this project, in the area targeted in this project, distribution pipes were developed and the number of kiosks was increased through the assistance of the World Bank, whose construction was completed as scheduled by the completion of this project.

to the North-East Reservoir can be transmitted by the gravity flow without pumps, meaning a system to transmit water to the target areas of this project without energy force has been established. According to the executing agency, electricity costs have been saved, though it has not been captured quantitatively. It is planned that the capacity of the North-East Reservoir will be expanded from the current level of 6,000m^3 to 24,000m^3, further stabilizing the water supply to ger districts through storing water from Gachuurt.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The following impacts were expected upon implementing this project.

(1) Improvements of the hygienic environment were expected through increases in the volume of water supply and improvements in the water quality.

(2) Water-drawing work at kiosks was often the task of women. However, reducing the waiting time at kiosks and improving hygienic environments of women and children through increasing the amount of water used were expected through this project.

(3) The main water supply areas of this project were those in ger districts where the people lived in poverty. This project is expected to be of benefit to approximately 390,000 residents in those ger districts and to contribute to the progress of poverty reduction.

Regarding the quality of water supplied to the target areas of this project, opinions were obtained from each khoroo that it was at a good enough level before this project and that good-quality water continued to be supplied even after execution of this project. In addition, water quality inspections conducted every few days by the executing agency confirmed that no particular water quality deterioration (exceeding the standard values) had occurred. It was also heard from several khoroos that each resident could receive a sufficient volume of water, which realized a more hygienic environment. Openings of a number of shower facilities for residents in ger districts, which were made possible through this project by a sufficient volume of water reaching the areas, are examples. Therefore, it is considered that there is an aspect that the hygienic environment of the target area has been improved through this project.

Shower facility in Ger area (exterior)

Shower facility in Ger area (interior)

It was not observed that water-drawing works became the job of all peoples, that is, males, females, and children, nor that only the burdens of water drawing by women and children were reduced after project implementation. Based on the interviews at khoroos and kiosks, merits of eliminating the waiting time were being enjoyed by all residents using kiosks. It was also heard that an increasing number of residents came to kiosks to draw water with their own cars in recent years, and it was often men driving the cars in such cases. For the households owning private cars, the amount of water that can be transported at one time has increased and it can be said that this has been made possible by realizing a sufficient supply of water.

While no cases were observed where new economic and social activities increased by reducing water-drawing burdens, comments were obtained in the interviews at khoroos and kiosks that the time that could be used for activities other than water drawing had increased in their daily life, implying that the project has generated certain impacts.

With regard to the expectation that 390,000 residents in the target ger districts of this project would benefit, the effects of this project were limited to a little over 180,000 ger residents receiving water directly from the North-East Reservoir at the time of ex-post evaluation because of the delay in the progress of a different project, as described above. It is presumed that the number of beneficiaries will increase significantly once the project is completed. As for the expectation that an expansion of water supply areas would contribute to the progress in poverty reduction, no particular information was obtained.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

This project contained the construction of pumping wells and transmission facilities in

the protected area of the water source, and the large-scale pumping of groundwater exceeding a level of 20,000m^3/day at a maximum was expected. It was thought that it could cause serious impacts to the environment and society, such as those concerning water use, ground subsidence, and so on. Therefore, a detailed environmental impact assessment was conducted. There were no procedural issues, as it was confirmed that project implementation was subsequently approved by the Ministry of Environment and Tourism in June 2010, prior to the commencement of this project.

According to the executing agency and the interviews in ger districts, no particular negative impacts on the natural environment occurred during or after the implementation of this project. It is considered that there were no particular issues as a whole since the Ministry of Environment and Tourism commented that no information had been filed regarding the occurrence of any environmentally negative impacts at that time.

The executing agency has always been monitoring groundwater levels. At the time of ex-post evaluation, it was confirmed that the amount of water taken in has been reduced[20] and has kept the water level above a certain level to avoid disruptions to pumping operations when drops in water levels occur (in March and April every year). It was expected at the time of planning that the operational speed would be adjusted so that drops in water levels exceeding two meters would not occur. In fact, there haven't been any occurrences in which the standard water level had dropped two meters or more[21], and no ground subsidence caused by excessive water pumping has been seen.

Based on the above, it is considered that there were no problems, as no negative impacts on natural environment were seen throughout this project at any phase.

(2) Resettlement and Land Acquisition

Along with the implementation of this project, it was thought that the transmission mains would mainly run through four residential properties affecting approximately 20 households. It was also possible that a temporary relocation of mobile houses and other similar constructions could occur, but in such cases, it was planned that the Mongolian side would provide the necessary compensations and that monitoring by the organizations concerned would be carried out.

These items were checked with the executing agency at the time of ex-post evaluation, which showed that fences and buildings of some households in the sections along the

[20] According to the executing agency, annual averages are between 9,000m^3/day and 12,000m^3/day, and adjusted between 5,000m^3/day and 6,000m^3/day during the winter when water levels drop.

[21] There was a setting installed on the pumps of each well targeted in this project for which sensors would respond to the water levels if the levels went two meters lower than the standard value, then the pumps would automatically stop and sound the alarm. According to the executing agency, when a pump stops, staff switch the well to be used from the control house.

installation route of transmission mains in ger districts were temporarily relocated or removed. It was also confirmed that, when fences and other structures were on the installation route of transmission mains, individual contracts were signed between the USUG and the residents in the ger districts not to reinstall them after the mains were laid. The number of households affected was 82, and a total value of 781 million Tugrik (46 million yen) [22] was paid as compensation by order of the Ulaanbaatar mayor.

According to the executing agency and the interviews in ger districts, it was considered that there was no problem as a whole because no major complaints regarding land acquisitions, temporary relocation, or removal had been lodged by residents.

The operation indicator expected in this project was achieved and positive effects, such as the reduction of waiting time at kiosks in ger districts as well as a stable water supply, were confirmed. However, the amount of water supply in Ulaanbaatar City has not increased from the time of planning due to the reasons such as a sudden slowdown of economic growth, upward revisions of the water tariff, increases in the installations of water meters, and decreases in water leakages. This was the aspect seen for which this project cannot be said to have made full contributions. With regard to the impacts, improvements of the hygienic environment were achieved and there were neither negative impacts to the natural environment nor resident resettlements through the execution of this project. There were no issues in terms of the process of land acquisition.

In light of the above, this project has achieved its objectives to some extent. Therefore, the effectiveness and impacts of the project are fair.

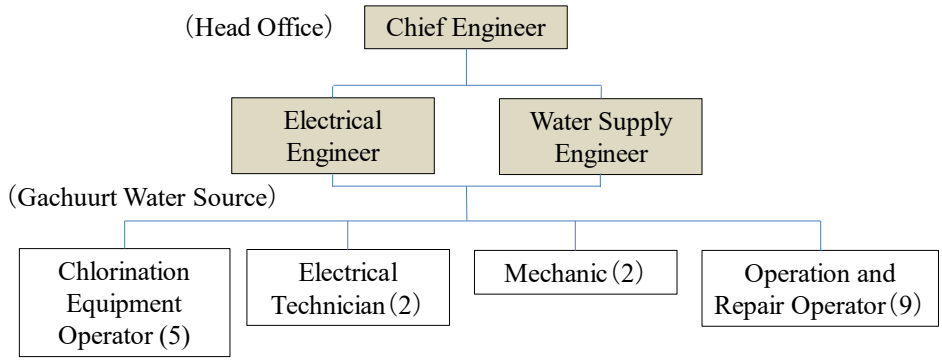
3.4 Sustainability (Rating: ③)

3.4.1 Institutional Aspects of Operation and Maintenance

The water supply and sewerage services of Ulaanbaatar City are taken care of by the USUG which has a total of 1,810 staff members. Operation and maintenance of the facilities and equipment developed through this project are carried out by the section in charge of the Gachuurt Water Source, newly established under the Eastern Area Operations Group within the Division for Water Supply Operations (staff number: 237). In addition to 18 resident staff members including operators and workers at the water source, three members are responsible at the head office: a chief engineer, an electrical engineer, and a water supply engineer. Among the resident staff members, 12 members are split into three groups, each with four

[22] Calculated based on the average rate (¥1 = approximately 16.98 Tugrik) between June 2013 and August 2014, when the compensations were actually paid out.

members, carrying out 24-hour operation and maintenance works. The breakdown of the staff is shown in Figure 2.



Source: Document provided by the executing agency
Note: Figures in brackets indicate the number of staff members

Figure 2: Operation and Maintenance Structure of the Gachuurt Water Source

The water quality control is carried out by the staff in charge of water quality analysis, dispatched from the USUG head office four days a week, through taking water from the reservoir and inspecting it. While periodic maintenance works on the facilities, including the purchase of spare parts, are conducted by the maintenance team in the Division for Water Supply Operations, there is a structure to carry out repair work in cooperation with the Emergency Control Division in cases of occurrences of serious damages. This organizational structure has remained unchanged in recent years and it seemed to be a sufficient structure for operation and maintenance of the facilities developed through this project.

The operational data and water quality information of the Gachuurt Water Source is recorded every day and reported to the head office by phone at the time of ex-post evaluation. However, through the assistance of the Asian Development Bank, the USUG is establishing a centrally controlled system using optic fiber networks, and it is expected that the data of the Gachuurt Water Source will be captured remotely by the head office of the USUG by the end of 2018[23]. With this system, the number of staff residents at the water source is planned to decrease.

3.4.2 Technical Aspects of Operation and Maintenance

After the completion of this project, a drop of water levels far lower than ever recorded before that time occurred during the winter of the first year of operation, which led to

[23] Fiber optic cables were installed at the time of ex-post evaluation and the operation was planned to commence in November 2018.

automatic stoppages of well pumps caused by excessive pumping and freezing of pumping pipes (two locations). Therefore, JICA's Follow-up Cooperation offering instruction on pump and valve operations was executed between November 2015 and February 2016. As a result, occurrences of automatic stopping of pumps eventually ceased, and stable, continuous operations of pumps were realized through the capacity development gained through instruction on operations. At the time of ex-post evaluation, continuous operations of pumps were secured after several years of operating experiences, and no technical issues were observed. It was heard that the operation manual for each piece of equipment was stored by the chief engineer and was referred to when there were problems.

With regard to training for the staff in charge of operation and maintenance, the training division of the USUG annually conducts special training sessions for electrical technicians, mechanics, and chlorination operators as well as training sessions for new staff members. The original staff members at the Gachuurt Water Source have remained since the commencement of operations. While it cannot be assumed that all staff members are transferred to new posts at the same time, it is considered important to sequentially provide training at the head office and in the field as new staff members are assigned.

3.4.3 Financial Aspects of Operation and Maintenance

The financial situation of the USUG in recent years is shown in Table 9. While operating revenues have gradually been increasing, partly with the rising water tariff every year, the operating expenditures have also been increasing, resulting in the continuously negative operating balance.

Table 9: Operating Balance of USUG

(Unit: million Tugrik)

Item	2014	2015	2016	2017
Operating revenues	**36,661**	**45,137**	**44,752**	**49,429**
Water supply	20,088	25,126	24,349	27,096
Sewerage	12,282	16,282	17,021	19,100
Other revenue	4,241	3,728	3,382	3,232
Operating expenditures	**41,989**	**48,791**	**54,671**	**58,994**
Personnel expenses (salary, social security, training, etc.)	15,403	18,308	19,541	22,422
Materials (chlorine, gasoline, spare parts, etc.)	4,579	4,431	3,962	3,329
Operation cost (electricity, transportation, etc.)	7,766	9,546	10,718	10,692
Maintenance (facility, equipment, etc.)	801	948	1,159	1,353
Office-related cost	290	293	324	451
Consumables (work clothes, gloves, work shoes, washing detergent, etc.)	245	261	833	434
Inspection of water quality, etc. (chemical reagent, etc.)	98	70	91	107
Other (including taxes)	4,120	4,243	4,334	5,012
Depreciation	8,688	10,690	13,709	15,193
Operating balance	**-5,328**	**-3,654**	**-9,919**	**-9,565**

Source: Information provided by the executing agency

The USUG has not received subsidies from Ulaanbaatar City and is required to operate businesses under a financially independent system. Conversely, the USUG does not have the independent authority to decide the water tariff, as it is decided by the national government (the Urban Water Supply and Sewerage Coordinating Committee under the prime minister). However, upward revisions of the water tariff by approximately 10% per annum have been made since 2014, and price increases of around 20% per annum are planned toward 2020 under the USUG's strategic plan. As the water tariffs have been raised and water revenues have subsequently increased in this way, operating revenues have been consistently increasing. However, the operating expenditure has also been increasing and a trend of negative balances has continued. A significant factor is the water supply by water trucks in ger districts costing 12 Tugrik per liter while the revenue from water supply is one Tugrik. Moreover, a flat rate system is set for households without installations of water meters.

Nevertheless, while the operating balances are negative, the large amount of depreciation is the most significant factor. Since much of the depreciation is from the facilities and equipment through aid projects and from the budget of Ulaanbaatar City, there are no influences on the actual financing. While it is presumed impossible to achieve growth under

a structure heavily dependent on external assistance for capital investment unless it becomes profitable including depreciation, it is highly prospective that under circumstances where neither independent authority to decide the water tariff nor subsidies are provided, capital investments in the water sector covered through donor assistance and spending by Ulaanbaatar City be made. Therefore, it is possible to regard the actual financial problems as minor.

As indicated in the expenditure item, the USUG has appropriated maintenance costs annually for the entire organization, a portion of which is allocated to the Gachuurt Water Source. The amounts of expenditures by the Gachuurt Water Source in recent years are shown in Table 10.

Table 10: Expenditures of the Gachuurt Water Source

(Unit: thousand Tugrik)

	2016	2017
Salary	91,908	378,788
Medical allowance	644	195
Social security	29,553	31,918
Food	9,586	13,476
Chlorine	18,266	15,128
Spare parts	10,588	5,423
Cleaning materials	614	483
Gasoline	8,906	10,377
Electricity	301,076	279,345
Equipment maintenance	4,140	70
Maintenance of facilities, etc.	7,403	1,910
Work clothes	1,420	2,135
Gloves	324	142
Work shoes	1,123	700
Milk	933	962
Washing detergent	124	68
Tax	667	0
Other	1,782	275
Total	489,057	732,394

Source: Document provided by the executing agency

While it was heard that the total amount of annual expenditures by the Gachuurt Water Source fluctuates year by year because of account processing, maintenance of the facilities and equipment developed through this project did not pile up because of any budget shortage. Therefore, it is considered that there are no issues in terms of financial aspects of operation and maintenance.

3.4.4 Current Status of Operation and Maintenance

As described above, water levels dropped substantially during the first year of operation after this project was completed, which led to the occurrences of automatic stoppages of pumps caused by excessive pumping as well as freezing of pumps. However, partly because of the effects of implementing the Follow-up Cooperation, no problems were observed at the time of ex-post evaluation. According to the executing agency, the pumps have never stopped automatically after the adjustment valves were installed through the cooperation effort, and it is thought to have been effective as an additional cooperation effort for the sustainability of the project effects. Additionally, operational status of other well pumping facilities, chlorination equipment, transmission mains and ancillary facilities, and collection and conveyance pipes as well as their ancillary equipment was checked, revealing that all of them were adequately operated and maintained[24].

It was also confirmed that each facility and equipment developed through this project was inspected, recorded, and reported every day by resident staff members in accordance with the maintenance schedule.

There were no issues in terms of institutional, technical, or financial aspects of operation and maintenance or in terms of the maintenance condition, and it can be judged that sufficient operation and maintenance were carried out. Therefore, the sustainability of the project effects generated through this project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In this project, a new water source was developed, and water transmission mains were laid in Gachuurt, an eastern suburb of Ulaanbaatar City, to improve the situation of water supply for residents in the ger districts in Ulaanbaatar City. The relevance of this project is high as it was consistent with the development plans and development needs of Mongolia and Ulaanbaatar City at the time of both planning and ex-post evaluation in terms of a stable and sufficient supply of water, and it was also consistent with Japan's ODA policy at the time of planning to support the development of infrastructure for promoting economic activities. As for implementation of the project, the project outputs were largely as planned, and the project costs and periods were within the plan. Therefore, the efficiency is high. With regard to project effects, in addition to the achievement of operation indicators, a stable water supply and the elimination of users' waiting time at kiosks were confirmed. However, the water supply volume did not

[24] Although a total of nine pumps had failures after 2016, an agreement on their repair was reached with the supplying company, and there were no issues seen at the time of ex-post evaluation.

increase as expected because of an economic growth lower than expected at the time of planning and because of water saving measures imposed by the executing agency, showing an aspect of this project that did not necessarily contribute in a sufficient manner. Regarding the impact, a reduction in the burden of water-drawing and improvements in the hygienic environment were observed, and there were no issues in terms of negative impacts to the natural environment or resettlement and land acquisition. Therefore, the effectiveness and impact of this project are fair. With respect to operation and maintenance, there were no major problems in terms of all institutional, technical, financial aspects or the operation and maintenance status. Therefore, sustainability is judged to be high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Through the implementation of this project, a stable water supply to ger districts has been realized and water use by residents became significantly more convenient. In addition to the elimination of water shortages through this project, the executing agency has been independently progressing water supply service through the use of the prepaid-card system, enabling the residents in ger districts to draw water at kiosks at any time. However, as the locations introduced are still limited to some areas, it is desirable to introduce more of them to realize a 24-hour water supply in a larger number of areas so that the living environment of residents will improve further.

Moreover, as the transmission mains leading to the North-East Reservoir were constructed through this project and the distribution networks to the surrounding ger districts were developed through the World Bank project, sufficient water now reaches the ger districts around the reservoir. However, distribution of water to the areas farther west, where it was planned to supply water from the Gachuurt Water Source, has not been sufficiently realized because of the delay in the progress of another project on the development of transmission and distribution networks. It is important to implement the project activities steadily to supply sufficient water to a larger number of residents.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

<u>Execution of Operation Instruction Together with the Development of Facilities and Equipment</u>

In this project, a significant drop in groundwater levels to which the executing agency could

not fully respond occurred unexpectedly during the winter of the first year after commencing operations of facilities and equipment. In this project, additional valves were installed to the wells, followed by instruction on the operation of the facilities as an additional provision of the Follow-up Cooperation, subsequently leading to stable operations. However, as the temperature falls below minus 40 degrees Celsius in Mongolia's winter, it is considered desirable in a project under such harsh climate conditions to plan sufficient measures in preparation for unforeseen circumstances, such as sufficient comprehension of operation and maintenance capacities of the executing agency followed by supplemental instruction on operations to ensure stable operations of facilities and equipment in addition to the development of new facilities.

(End)