Ex-Post Project Evaluation 2017:

Package IV - 5

(Pakistan, Bangladesh)

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JAPAN INTERNATIONAL COOPERATION AGENCY

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The Islamic Republic of Pakistan

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

"Project for the Improvement of Water Supply System in Abbottabad"

External Evaluator: Hideyuki Takagi, Ernst & Young ShinNihon LLC

0. Summary

This project was implemented to provide safe and stable water supply services in Abbottabad city and 4 neighboring areas, a medium-scale urban area located in Abbottabad district of Khyber Pakhtunkhwa province in the northern part of Pakistan, by newly developing a gravity-flow surface water supply system (hereinafter referred to as "surface water supply system") and the renewal and enhancement of the groundwater system. The Project thereby contributed to increasing the water supply coverage ratio and access to safe water for the residents in the project area, where water supply capacity was insufficient despite an expected population increase due to expansion of the urban area.

This project was highly relevant as it was consistent with the development plan and development needs of Pakistan, as well as Japan's ODA policy. The efficiency of the Project is fair as the project period exceeded the plan, although project outputs were almost as planned and the project cost was within the plan. As an effect of the Project, the amount of water distributed from the supply side is almost as planned; however, the quantity and quality of water received by the local residents from tap water in their house has been far below the target, which seems due to leakage from the water distribution network. Therefore, improvement of access to safe water for the residents has not been fully achieved yet. The effectiveness and impacts of the Project are concluded as fair considering that the surface water supply system, the main part of the Project, supports the local water supply. The sustainability of the effects of the Project is fair as there are some minor problems to be improved in the technical and financial aspect of the newly established wide water supply area utility. In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description

Source: Website of the district government of Abbottabad[1]

Project Location
(Map of the Abbottabad District)

Photo 1. Newly constructed water treatment plant of the surface water supply system (a distant view as of July 2015)

1.1 Background

Although Abbottabad city and the surrounding area in Khyber Pakhtunkhwa province had relied on groundwater for its water supply for many years, an urgent need to increase the water supply capacity arose in order to deal with the expansion of urban area and population increase, and the reduction of the pumping capacity of existing tube wells. Although the development policy of the Pakistan government at the time of planning of this project aimed to improve access to safe water from 65% in 2005 to 76% in 2010, and 93% in 2015, in the "Mid-term Development Framework 2005-2010," the water service coverage ratio in that area was below the national average of 57% as of 2009 and the water supply was unstable in many places as the duration of water supply per day was less than 1 hour. In terms of water supply operation, the operation cost was high as it pumped groundwater into a high water reservoir, which financially pressed the water supply operation. In addition, as maintenance and management of tube well pumps etc. was not carried out properly, among some tube wells there was conspicuous underground water shortage and significant aging of the pumps due to excessive pumping, and these tube wells could not be used in the long term.

In light of this situation, the government of Abbottabad district formulated a plan for water supply by gravity flow from the valley in the eastern part of Abbottabad City in 1990. Thereafter, the feasibility study (F/S) was conducted by the Asian Development Bank (ADB) in 1994, and in December 2000 a request was made for grant aid to the Government of Japan. In response to this request, the Japan International Cooperation Agency (JICA) conducted a preliminary survey in 2002 and a basic design study in 2004. After a four-year interruption

[1] Website: http://dga.com.pk/district-profile/ Access: June 6, 2018

due to the North Earthquake which occurred in October 2005 and the settlement of a water rights issue with downstream municipalities, JICA conducted a preparatory survey in 2009. Based on the survey, this project was planned with the goal of improving the access to safe water for local residents, including the increase of the water supply coverage ratio, by newly developing a gravity-flow surface water supply system and updating/strengthening the existing groundwater supply system in Abbottabad City and the surrounding 4 areas in Abbottabad district.

1.2 Project Outline

The objective of this project is to provide safe and stable water supply services in Abbottabad City (including Nawanshehr area) and the surrounding 4 areas in Abbottabad district by constructing a gravity-flow surface water supply system, improving the groundwater system and providing technical assistance for maintenance and management of water supply facilities to the engineers of the executing agency, thereby contributing to an increase in the water supply coverage ratio and improvement of the living environment of the residents in the project area[2].

Grant Limit / Actual Grant Amount	Detail design: 53 million yen / 53 million yen Construction: 3,644 million yen / 3,559 million yen Total: 3,697 million yen / 3,612 million yen
Exchange of Notes Date / Grant Agreement Date	Detail design: February 17, 2010 / February 17, 2010 Construction: July 27, 2010 / September 14, 2010
Executing Agency	The Government of Abbottabad District
Project Completion	July 2014
Main Contractors	Tobishima Corporation / Dai Nippon Construction (JV)
Main Consultants	Nihon Suido Consultants Co., Ltd. / Japan Techno Co., Ltd. (JV)
Basic Design / Preparatory Survey	July 2003 – July 2004 / April – September 2009
Related Projects	German Government-owned Development Bank (KfW): Ÿ Drinking Water Supply and Sanitation Measures in the Northern Uplands/Chitral District (1996) ADB: Ÿ NWFP Urban Development Sector Project (2001 – 2008)

[2] The following additions are made to the “purpose of the project” described in the ex-ante evaluation summary report of this project: geographic information and quantitative / qualitative impact (referred to the "objective of the project" in the summary of the preliminary study report)

	Ÿ Khyber Pakhtunkhwa Intermediate Cities Improvement Investment Project (in progress)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hideyuki Takagi, Ernst & Young ShinNihon LLC

2.2 Duration of Evaluation Study

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

Duration of the study: November 2017 – November 2018

Third-country meeting: February 18 – 21 and May 6 – 9, 2018

Duration of the Field Study: March 4 – 23 and June 6 – 9, 2018 (The field study was carried out by a local consultant.)

2.3 Constraints during the Evaluation Study

The evaluator did not enter Pakistan for security reasons and a local consultant carried out the entire process of the field survey under the direction of the evaluator. The evaluator performed a desktop evaluation based on the results of information gathering, interviews, site examinations, etc. by the local consultant. The evaluator and the local consultant had a preliminary meeting in the third country (Thailand) before the field study to give the local consultant an explanation about the method and subject of field survey, how to share the results of field survey result and the analysis result, and how to explain the provisional evaluation result to the water utilities (Public Health Engineering Department Abbottabad (hereinafter referred to as "PHED") and Water and Sanitation Services Company Abbottabad (hereinafter referred to as "WSSCA[3]"), etc.

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

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Pakistan

(1) Consistency with the national development plan

Although the national development policy of Pakistan differs between the *medium-term development framework* at the time of the planning of the Project and the 5-year plan and the *medium- to long-term growth strategy* at the time of ex-post evaluation, the policy goal

[3] Established in 2015 as a public enterprise integrating and managing water supply, sanitation and solid waste management services in the Abbottabad urban area, it began providing services in April 2017 (for details, refer to "Organizational aspect of operation and maintenance").

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

[5] ③: High, ②: Fair, ①: Low

to ensure drinking water for people has consistently been maintained.

The *Medium Term Development Framework 2005-2010* at the time of planning aimed to increase the rate of public access to safe water from 65% in 2005 (85% in urban areas, 55% in rural areas) to 76% by 2010 (95% in urban areas, 65% in rural areas) and up to 93% in urban areas by 2015. The national development policy at the time of ex-post evaluation, *11th Five Year Plan 2013-2018*, deals with water shortages as a serious problem in "energy, water and food safety," one of the seven pillars of policy, and it has promoted comprehensive measures including construction of dams for securing agriculture, industrial and household water. In addition, the future medium- to long-term growth strategy *Vision 2025* approved by the government in May 2014 aims to secure clean drinking water for all people in the country as a goal of the "energy, water and food safety" policy pillar.

(2) Consistency with the sector development plan

With the amendment of the Constitution in 2012, the Federal Government has transferred the authority of water administration to the provincial government. For this reason, consistency between the Project and the sector development policy on drinking water at the time of ex-post evaluation was confirmed with the *National Drinking Water Policy 2009* as well as the development policy of the Khyber Pakhtunkhwa province. Although there are differences between the sector development policy before and after the project implementation, the main policy of providing safe drinking water has consistently been maintained.

From the time of planning, the *National Drinking Water Policy* aimed to reduce water-borne diseases and mortality and improve the quality of life by supplying safe and sustainable drinking water to all citizens by 2025. At the time of ex-post evaluation, the water supply policy of Khyber Pakhtunkhwa province[6] is placed as one of the major policies *of the Integrated Development Strategy 2014 – 2018*. The water supply policy states that safe drinking water and hygiene are the most effective means for improving people's health and are social services to be provided as basic rights of citizens.

3.1.2 Consistency with the Development Needs of Pakistan

The urban area of Abbottabad district is a mid-sized city with a population of 200,000, and it was expected at the time of planning of the Project that the population would increase due to the expansion of the urban area. On the other hand, there was an urgent need to increase the water supply capacity, as there had been progressive reduction in the pumping

[6] As the formulation of water policies was transferred from the federal government to the provincial government by the revision of the Constitution in 2012, the consistency between the sector development policy and this project was confirmed with the development policy of Khyber Pakhtunkhwa province.

capacity of tube wells and aging of facilities.

The population in the project area was estimated to increase about 17% from the time of planning through the target year (2015, two years after project completion) to about 235,000 people with 32,500 households. The actual population increase by the time of the ex-post evaluation (2017) was 25% with 40% increase in households, which is almost the same as the increase as expected at the time of planning[7]. Therefore, the Project is consistent with the development needs to enhance water supply capacity to cope with population increase.

Table 1. Status of population increase in the project area

(Unit: People, Households)

Water supply area*1	Baseline (2009) (estimation)		Actual at the time of ex-post evaluation (2017)			
	Population	Households	Population (% increase)		Households (% increase)	
Abbottabad city	67,450	8,875	70,100	4%	11,229	27%
Nawanshehr area	27,338	3,645	50,486	85%	7,736	112%
Sheikhuk Bandi	19,033	2,799	26,158	37%	4,171	49%
Salhad	23,392	3,440	36,018	54%	6,068	76%
Mirpur	13,287	1,954	46,206	248%	6,668	241%
Jhangi	49,749	7,316	20,764	-58%	3,230	-56%
Total	200,249	28,029	249,732	25%	39,102	40%

Source: Baseline was the estimate at planning based on the census in 1981 and 1998 and population growth rate (materials provided by JICA) / Actual at the time of ex-post evaluation refers to the census in 2017 (materials provided by the executing agency).

*1 The administrative divisions of the water supply area were changed between 1998 Census, the base year of the estimated population and the number of households, and 2017 Census. For this reason, whereas the total of the entire water supply areas compares the population at the time of planning and ex-post evaluation, its breakdown is treated as reference information because of the change in area of administrative divisions.

3.1.3 Consistency with Japan's ODA Policy

This project was consistent with Japan's aid policy as follows during planning of the Project.

(1) Country assistance program

The Project was positioned as a "program to secure water and sanitation" in the "Securing human security and human development" aid priority area of the *Country Assistance Program (February 2005)* to Pakistan.

(2) JICA's aid policy

In the *Country Assistance Implementation Policy (June 2009)* to the Islamic Republic of

[7] There were overcrowded conditions in Abbottabad district urban area at the time of ex-post evaluation, influenced by refugees of the 2005 major earthquake and 2009 Waziristan conflict.

Pakistan, the water supply and sewerage sector was positioned as an important development field contributing to poverty reduction. Regarding municipal water supply, the main support policy was to secure access to safe drinking water, to promote safe living conditions with improved public hygiene in the urban environment by the improvement of water supply and sewerage, to strengthen autonomy and improve operation efficiency and effectiveness of operating agency, and to promote participation of beneficiaries and consideration for the poor etc. for improving water services.

This project has been sufficiently consistent with the development plan and development needs of Pakistan, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The outputs of the Project were the construction of a surface water supply system and the improvement of groundwater supply system (renewal and new construction) and consulting services related to design and construction as hard component works, and technical assistance on maintenance and management to the engineers of the executing agency as technical assistance.

1) Construction Works

(1) Gravity-flow surface water supply system

This is a major part of the Project, which doubles the amount of water supply in the city of Abbottabad by constructing a new surface water supply system. Changes from the facility outline and the plan are as follows. Although there were minor changes from the plan with regard to land acquisition, etc., it was constructed almost as planned.

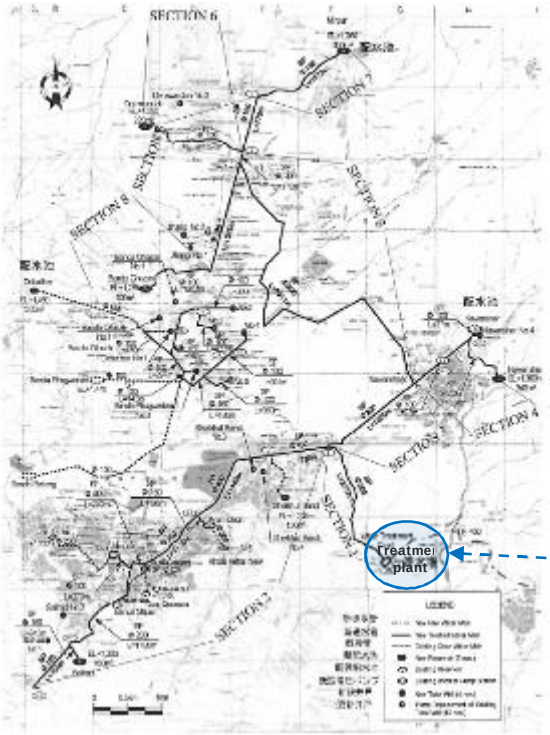
Table 2. Outline of the facility and changes from plan (Surface water supply system)

Facility	Scale	Changes from the plan
Water intake facility	4 locations (Bagh river, Gaya river, Namly Mira river and Bandi river) Intake amount: 17,280m^3/day (200 liters/sec)	Location and structure of Namly Mira intake facility (effect of flooding in 2010) Construction site and structure of Bandi intake facility (moved to upstream 200m due to overlap with road construction site)
Raw water transmission mains	Total length: 20.9km Diameter: 100 - 500mm	Route and extension of raw water transmission mains due to the change of the construction site of the Bandi intake facility and water treatment plant
Water treatment plant	Water treatment process: Sedimentation pond →Roughing filtration pond → Slow filtration pond → Chlorination →Purified	Layout of the facility as a result of changing the construction site to an adjacent place (as a result of negotiations with landowners)

	water reservoir Treatment capacity: 17,280m^3/day (200 liters/sec)	
Treated water transmission mains	Total length: 25.8km Diameter: 100 - 500mm	Route and extension of treated water transmission mains due to changes in the construction site of the water treatment plant
Distribution reservoir	6 locations (Nawanshehr, Sheikhuk Bandi, Salhad, Mirpur, Derawandah and Banda Ghazan) Total capacity: 1,320m^3	No particular change

Source: Materials provided by JICA

The surface water supply system distributes water from a water source located in a valley in the southeastern part of Abbottabad city, with the gravity-flow facility from water intake facilities to water treatment plant through transmission mains and distribution reservoirs. As it does not rely on electric power nor use a pump, it solves the problems of instability and cost burden of electric power. Water is distributed to the Abbottabad urban area through the newly constructed reservoirs, along with the groundwater supply system of which tube well as source of water.



Source: Materials provided by JICA

Figure 1. Location and arrangement of the facilities in the water distribution area

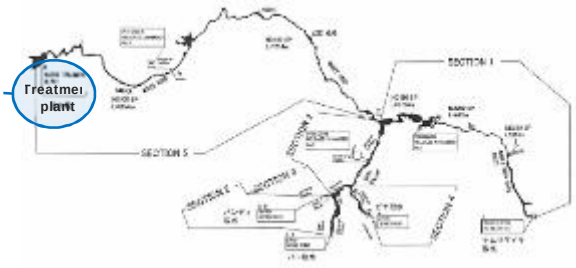


Figure 2. Surface water system (intake facilities - water treatment plant)

(2) Groundwater supply system

Changes from the facility outline and the plan of groundwater supply system are as follows. It was almost as planned; however, the change related to the implementation of replacement work at 8 tube well pumps affected the project period as well.

Table 3. Outline of the facility and changes from plan (groundwater supply system)

Facility	Scale	Changes from the plan
Water intake facilities	New tube wells: 4 locations (at Dobathar) Intake amount: 1,814m^3/day (21 liters/sec)	Construction site of well No.4
	Renewal of existing tube wells: 12 locations (at Nawanshehr, Sheikhuk Bandi (2), Salhad (2), Derawandah, Jhangi (2), Banda Ghazan, Banda Dilazak, Banda Phugwarian and Dobathar) Intake amount: 3,197m^3/day (37 liters/sec)	Replacement work of 8 tube well pumps to be conducted by Pakistan side (because of diminished water supply from surface water due to more severe drought conditions than usual during the scheduled period of pump replacement, pumping of these tube wells could not be stopped for replacement. In addition, delay in the installation of the stabilizing device to address the large voltage fluctuation was also a factor behind replacement work being delayed.)
Transmission mains	Total length: 4.5km Diameter: 100 - 150mm	Extension of water supply pipe due to change of construction site of well No.4
Distribution reservoir	1 location (at Dobathar) Total capacity: 300m^3	No particular change

Source: Materials provided by JICA

2) Consulting services and technical assistance

Consulting services and technical assistance were implemented almost as planned. In the technical assistance, technology transfer was made towards the following outputs.

Table 4. Implementation result of technical assistance

Item	Contents and achievements
Output 1	"Capacity development of well management and operation and maintenance of pumps" Ÿ Acquisition of basic knowledge on well management and pump operation maintenance management as well as strengthening of the capacity of operators were carried out through seminars, training and OJT. Ÿ "System Operation Manual for Tube Well" was prepared.
Output 2	"Development and strengthening of the organizational structure for the operation and maintenance of surface water supply system" Ÿ A draft policy on surface water supply committee and unit was prepared. Ÿ An agreement was reached on the volume of water supply and water tariff supplied to the wide water supply area by the surface water supply system. Ÿ The organizational structure for operating and maintaining the surface water supply system was developed.
Output 3	"Strengthening of the administrative and technical divisions of surface water supply system" Ÿ Seminar and OJT were implemented for the technical division of the surface water supply system to acquire the operation and maintenance technology of the slow filtration system.

	Ÿ "Manual for System Operation & Maintenance and Chlorination for Gravity-Flow Water Supply System" and "Final Report for Management Guidance of Gravity-Flow Water Supply System (Operation and Maintenance of Slow Sand Filtration System)" were prepared. Ÿ Lectures were given to the management department. Ÿ "Text for Water Supply Management and Accounting" was prepared.
Output 4	"Improvement of the environment for establishment of metered tariff system" Ÿ Public information activities and questionnaire survey for residents, and training for meter readers were conducted. Ÿ "General Description of New Water Supply System" was prepared as a support activity for consensus building between three water utilities and residents for establishing a metered rate water tariff system. In addition, "Typical Questions and Answers regarding New Water Supply System" was prepared by each water utility and distributed to the residents. As a result, the environment for shifting to tariff collection under a metered rate water tariff has been enhanced.

Source: Materials provided by JICA

3) Pakistan side implementation part

Land acquisitions, renewal and extension of water distribution pipes, procurement and installation of water meters, etc. were carried out by the Pakistan side. A breakdown of the works is as shown in Table 5 "Comparison of the planned and actual project cost."

3.2.2 Project Inputs

3.2.2.1 Project Cost

Out of the inputs of the Project, the total project cost fell within the plan as it was 95% of the planned amount (the project cost was 98% of the planned amount by the Japanese side, and 82% of the planned amount by the Pakistan side).

Table 5. Comparison of the planned and actual of the project cost

(Unit: Million yen)

Breakdown	Plan	Actual	% of the plan
Japanese side:			
Detail design	53	53	100
Main construction work	3,644	3,559	98
Subtotal	**3,697**	**3,612**	**98**
Pakistan side:			
Land acquisition	84	12	14
Construction of access roads to the project sites	53	86	162
Power and telephone lines to the water treatment plant and power to the tube wells	45	10	22
Connection between the existing and new distribution reservoirs	33	50	152

Renewal and extension of water distribution pipes	162	158	98
Procurement and installation of water meters	82	69	84
Others	145	108	74
Subtotal	**606**	**496**	**82**
Total project cost	**4,303**	**4,108**	**95**

Source: Materials were provided by JICA for the plan and actual of Japanese side costs and by the executing agency for the actual of Pakistan side costs (answer to the questionnaire).

3.2.2.2 Project Period

The actual project period exceeded the plan as it was 144% of the planned project period. The main reason for exceeding the planned period was that there were delays of about 8 months before completion of the surface water system in October 2013 due to the changes in the location and structure of the project facilities[8], and about 7 months to wait for the conditions necessary for the renewal of the existing tube well pumps which were delayed due to lack of water supply from the surface water system as an effect of seasonal fluctuations of rainfall and a more severe drought than usual. The renewal of existing tube well pumps was handed over to Pakistan side, and it was decided that the main construction was completed with preparation for the replacement of the tube well pumps in July 2014. Then an agreement was reached with the Pakistan side to complete the replacement of the tube well pumps by September 2015[9].

Table 6. Comparison of the planned and actual of the project period

	Plan	Actual	Difference
Process	Start of detail planning[10] – completion of technical assistance	Start of detail planning – completion of the main construction work	The end point of the actual project period was changed to completion of main construction work as it was completed after the completion of the technical assistance.
Period	February 2010 – February 2013 (36 months)	April 2010 – July 2014 (52 months)	144% of the planned period

Source: Materials were provided by JICA

Although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the Project is fair.

[8] Partial completion certificates were issued in December 2013 as to components other than replacement of existing tube well pumps (surface water supply system and construction of new tube well facilities).
[9] Of the eight works on the Pakistan side, four were completed at the time of agreement and the rest were completed after the agreement.
[10] Since the starting point of the project period is not specified in the ex-ante evaluation summary report of the Project, the starting point of detail design was adopted for both planned and actual results, which is the starting point of the implementation process chart of the preparatory study.

3.3 Effectiveness and Impacts[11] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

1) Operation indicators

Water distribution volume (daily maximum and daily average), average hours of water supply, and rate of the utilization of water treatment plant[12] were set as operation indicators of the water supply facilities developed by the Project. Comparison of the target and actual results is as follows.

Table 7. Comparison of the target and actual of the operation indicators

	Baseline	Target	Actual		
	2009	2015	2014	2016	2017
	At planning	2 years after completion	Year of completion	2 years after completion	As of ex-post evaluation
Indicator 1-1. Maximum water distribution per day (m^3/day):					
Surface water supply system	—	16,894	16,891	17,387	17,230
Groundwater supply system	No data	13,958	No data	No data	15,660
Total	No data	30,852	No data	No data	32,890
Indicator 1-2. Average water distribution per day (m^3/day):					
Surface water supply system	—	14,690	No data	12,802	8,592
Groundwater supply system	12,195	12,137	No data	No data	11,880
Total	12,195	26,826	No data	No data	20,472
Indicator 2. Average hours of water supply (hour/day)*1	1 time/week–10 days,< 1 hour/day	24 hours/day	No data	No data	2-3 times/week, < 1 hour/day
Indicator 3. Rate of utilization of the water treatment plant (average %)	—	N/A	No data	No data	No data

Source: Materials were provided by JICA for the baseline and target, and by the executing agency for the actual at the time of ex-post evaluation (answer to the questionnaire and interview).

*1 Planned and actual of average hours of water supply are based on interviews with residents in the qualitative survey.

(1) Volume of water distribution to the project area[13] (Maximum and average per day)

Comparison of the target and actual of the volume of water distribution in each water supply area of the Project is as follows.

[11] Sub-rating for Effectiveness is to be performed with consideration to Impacts.

[12] Rate of utilization of the water treatment plant was added in the ex-post evaluation. However, data for this indicator was not obtained from the executing agency.

[13] Although there are flow meters of the water pipe in the Abbottabad water supply, the water supply amount on the demand side cannot be calculated as the installation of the house water meter is not proceeding and the installed meters are hardly in operation at present. For this reason, analysis was made on the water production amount based on the supply side data, and the effectiveness indicator "water supply volume" set at the time of planning was changed to "water distribution amount".

Table 8. Volume of water distribution in each water supply area of the Project

(Unit: m^3/day)

Water supply area*1	Baseline (2009)	Target (2015)*2		Actual at the time of ex-post evaluation (2017)					
	Ave./day	Max./day	Ave./day	Max./day			Ave./day		
	Ground water	Surface + Groundwater		Surface water	Ground water	Total	Surface water	Ground water	Total
Abbottabad city	6,247	11,469	9,973	9,994	1,350	11,344	5,517	1,080	6,597
Nawanshehr area	3,240	4,540	3,948	2,068	2,700	4,768	900	1,620	2,520
Sheikhuk Bandi	357	2,659	2,312	1,292	2,160	3,452	900	1,620	2,520
Salhad	530	3,174	2,760	1,292	1,080	2,372	200	1,080	1,280
Mirpur	272	1,945	1,691	1,292	1,890	3,182	726	1,890	2,616
Jhangi	1,549	7,065	6,142	1,292	6,480	7,772	349	4,590	4,939
Total	**12,195**	**30,852**	**26,826**	**17,230**	**15,660**	**32,890**	**8,592**	**11,880**	**20,472**

Source: Materials were provided by JICA for the baseline and target, and by the executing agency for the actual at the time of ex-post evaluation (answer to the questionnaire and interview).

*1 As stated in the note to table 1, there was a change in the administrative divisions in the water supply area. Therefore, whereas the total of the entire water supply areas compares the volume of water distribution at the time of planning and ex-post evaluation, its breakdown is treated as reference information because of the change in area of administrative divisions.

*2 The target value is the volume of water demand in 2015 (two years after 2013, which was the original target year of project completion) assumed at the time of project planning.

Surface water supply system

As shown in Table 7, the actual result of maximum daily water distribution in the target year (2016) was 17,387m^3 (103% of the plan) and the actual result at the time of ex-post evaluation (2017) was 17,230m^3 (102% of the plan), which were higher compared to the planned target of 16,894m^3. The target for average daily water distribution was 14,690m^3, whereas the actual result in the target year was 12,802m^3 (87% of the plan) and the actual result at the time of ex-post evaluation was 8,592m^3 (58% of the plan), which has decreased from the previous year.

With respect to daily average water distribution, in which the actual amount at the time of ex-post evaluation was lower than the target year, an average value across the year was also analyzed based on the understanding that the surface water is greatly influenced by the precipitation amount, which varies from year to year. As a result, the average for the two years from the target year to the ex-post evaluation was 10,697m^3 (73% of the plan). Since the amount of water intake facilities during this period was 158 liters/second (79% of the facility design value of 200 liters/second), the fact that the intake amount was less than planned is considered to be the main factor causing less daily average water distribution than the plan.

In addition, Bandi water intake facility has suspended its operation since around 2014, right after its completion due to concern about pollution of water sources by domestic

wastewater by the migrants of about 50 households to the upstream after the earthquake in 2005. The inhabitants also take water from the river for their daily life. As an effect, the volume of water flow nearby the water intake facility has been very low (approximately 4 to 5 liters/second at the time of site inspection). (Refer to the lessons learned on "Water source preservation").

The three water intake facilities in operation may also be lower than the design value; however, because the amount of water at Namly Mira is large, the overall surface water supply is complemented to just under 80% (average[14]) of the plan.

Photo 2. Abundant water flow at Namly Mira water intake facility (taken during interview at site inspection)

Table 9. Volume of water flow at site inspection (for reference)

(Unit: liters/second)

Water intake facilities	Designed capacity	Actual at site inspection	Difference from designed capacity	
			Difference	%
Namly Mira	52	65	13	25%
Gaya	49	35	-14	-29%
Bagh	54	45	-9	-17%
Bandi	45	0*1	-45	-100%
Total	200	145	-55	-28%

Source: Executing agency (interview at site inspection)

*1 The volume of water flow is shown as 0 as its operation has been suspended.

Groundwater supply system

The planned maximum daily water distribution was 13,958m^3, whereas the actual result at the time of ex-post evaluation was 15,660m^3 (112% of the plan). The planned daily average water distribution volume was 12,137m^3, whereas the actual result at the time of the ex-post evaluation was 11,880m^3 (98% of the plan); therefore, both of the actual results have almost achieved the target.

On the other hand, there are some differences in the operation status of water intake facilities of the groundwater system (well/spring) in the target area from the assumption at planning. Specifically, 8 of the 27 facilities which were in operation or scheduled to continue

[14] The average water intake amount from September 2015 to May 2018 that data could be obtained in the ex-post evaluation survey.

operating by renewing pumps (one of the 27 facilities is spring water) have been in a disposal or inoperable state[15]. Also, 1 out of the 4 tube wells newly established by the Project has not been in operation as it was damaged about one year ago but has not yet been repaired. Meanwhile, the executing agency has restored the old tube wells that had not been operated according to budget available for the restoration; therefore, 16 restored water intake facilities (including 1 spring) have been in operation. As a result, a total of 38 groundwater intake facilities are in operation at the time of ex-post evaluation, which secures the same level of water distribution as the target of the Project.

The entire water supply system

The planned maximum daily water distribution was 30,852m^3, whereas the actual result at the time of ex-post evaluation was 32,890m^3 (107% of the plan). The planned average daily water distribution was 26,826m^3, whereas the actual result at the time of ex-post evaluation was 20,472m^3 (76% of the plan). On the other hand, the actual result of average daily water distribution at the time of ex-post evaluation is calculated as 22,577m^3 (surface water 10,697m^3 + groundwater 11,880m^3), which becomes 84% in comparison with the target based on the average of actual water volume over the last two years considering the annual fluctuations of rainfall.

Based on the above analysis, the target for this indicator is considered to have been almost achieved.

(2) Average hours of water supply in the project area

The actual water supply situation in the target area as a whole has been about 2 to 3 times per week of water supply with just under 1 hour per time at the time of ex-post evaluation, although about 24 hours/day of water supply was targeted by the Project. Based on the above, it is concluded that the achievement of the target for this indicator was low. However, according to the interview with the local residents conducted in the qualitative survey[16], the frequency of water supply for each house before the Project was once a week to 10 days for about 1 hour per time. Therefore, the water supply frequency has been improved by about 2-3 times of that compared to before the Project. Although the degree is not significant in comparison with the target, improvement to some extent has been observed in the hours of water supply by the Project.

(3) Rate of utilization of the water treatment plant (average %)

Although the data of actual water treatment volume was not obtained by the by the

[15] Two of these tube wells were subject to the renewal of pumps by the Project.
[16] Refer to “Outline of the qualitative survey” in 3.3.1.2 Qualitative Effects (Pg. 18).

executing agency, the water treatment plant has been operated properly since the commencement of its operation according to its explanation. As described in "Stability of water supply" in the qualitative effects below, there are seasonal fluctuations in the water distribution volume of the surface water system. However, the average water distribution volume is about 70% of the target value and the volume of water intake has been about 80% of the designed capacity. Therefore, it is assumed that the facility utilization rate of the water treatment plant has been maintained at about 70 to 80%. Based on the above analysis, the target for this indicator is considered to have been almost achieved.

2) Effect indicator

Water supply per capita was set as an effect indicator of the water supply facilities developed by the Project. The comparison between the target and actual is as follows.

Table 10. Comparison of the target and actual of the effect indicator

	Baseline	Target*1	Actual*2		
	2009	2015	2014	2016	2017
	At planning	2 years after completion	Year of completion	2 years after completion	As of ex-post evaluation
Indicator 1. Water supply per capita (liters/person/day)					
Abbottabad city	44	103	No data	No data	47～60
Nawanshehr area	48	103	No data	No data	
Surrounding 4 areas	No data	95	No data	No data	

Source: Materials were provided by JICA for the baseline and target and by the executing agency for the actual at the time of ex-post evaluation (answer to the questionnaire and interview)

*1 The target includes the volume of water for commercial use.

*2 The actual value has a range which shows the difference by region.

(1) Water supply per capita in the project area (average unit volume of water supply)

The actual water supply at the time of ex-post evaluation was in a range of 47 to 60 liters/person/day, compared to the target of 95 to 103 liters/person/day. Although the increase rate was supposed to be 115% from the baseline of 46 to target of 99 liters/person/day, the actual of average water supply was 53.5 liters/person/day, a slight increase of 16% from the baseline. It cannot be concluded since these figures are not measured values of the water meter, but the achievement rate of the target value of this index is assumed to be low (the comparison was calculated using the median for both the target and actual).

3.3.1.2 Qualitative Effects (Other Effects)

Regarding qualitative effects, the status of improvement of the water supply service was

confirmed through interviews with local residents, who are the users of water service, about the assumed effects of the enhancement of water supply capacity by the Project.

(1) Stability of water supply

As mentioned in the average hours of water supply in the quantitative indicator above, there continues to be a restricted water supply to certain hours (intermittent water supply) at the time of ex-post evaluation as before the Project began, and the water supply volume is still below the target as with the water supply per capita of the effect indicator. The local residents have been receiving an unstable and small volume of water supply to their house connections, and it is not certain for the residents when and to which water supply area water is supplied. The duration of water disruption is usually about 2 days at most, it may be longer if there are technical causes or when water intake is suspended temporarily due to turbid water in the rainy season. There are also seasonal fluctuations of water supply due to a decrease in water intake during winter. However, the frequency of water supply, which was once a week to 10 days and around 1 hour per time before this project, has improved to about 3 times a week since implementation. Therefore, there is considered to have been improvement to some extent in the effectiveness with respect to this indicator.

(2) Improvement of water pressure

Given that there continues to be a restricted water supply to certain hours (intermittent water supply), it is assumed that the water pressure is still low. According to the interview with the local residents conducted in the qualitative survey, they are concerned that due to the low water pressure, the amount of water storage in the water storage tank at each household will be reduced if a suction pump is not operated at the time of water supply[17]. Based on the above, effectiveness with respect to this indicator is considered low[18].

(3) Improvement of water quality

It is assumed that elimination of the negative water pressure will suppress the inflow of pollutants into the water pipe as an effect mainly due to the increase in the amount and duration of water supply. However, the current situation is a restricted water supply to certain hours (intermittent water supply). For this reason, it seems that sewage may infiltrate the water pipe during negative pressure conditions, which may cause contamination of water inside the pipe. The executing agency is also receiving complaints from local residents on water quality. According to the local residents, there is a bad smell which seems to be the

[17] However, the use of the suction pump is not accepted from the legal and ethical point of view and it is said that it should be eradicated. The user can be fined 15,000 to 30,000 Pakistan Rupees (Cantonment Board Abbottabad website http://cba.gov.pk/water-supply-branch/ Access: November 20, 2017).

[18] The executing agency answered the questionnaire that the problem of low water pressure improved greatly after this project. However, it is concluded in this evaluation that improvement for beneficiaries is low based on the water supply volume, hours of water supply and interviews with local residents.

infiltration of sewage from the sewer pipe laid in parallel with the water pipe. In this regard, the executing agency conducts regular water quality management at a frequency of twice per month. In addition, when receiving residents' complaints about water quality, they inspect the area's water and address the issue with the addition of chlorine etc. based on the inspection result. From the above, there is still room for improvement in the quality of tap water; therefore, effectiveness with respect to this indicator is considered low.

Outline of the qualitative survey: The qualitative survey was conducted at each water supply area of Abbottabad City, Sheikhuk Bandi and Jhangi in the project area through group interviews (Focus Group Discussions: FGDs). About 5 male or female interviewees were invited to each FGD (about 30 people in total), to discuss mainly the safety and stability of water supply service and improvement of the living environment before and after the Project.

Photo 3. Qualitative survey
(FGD with women's group)

From the above, the water distribution volume on the supply side has largely achieved the target level due to the implementation of the Project. On the other hand, the amount of water and water quality received by the local residents from tap water in their house is assumed far below the target, and it is far from the 24-hour water supply while the population increase trend is almost as expected as at the time of planning. Therefore, the degree of achievement of the effect and qualitative indicators of the Project is low. Water leakage from the distribution pipe is the assumed reason for this situation, which is taken into consideration regarding the degree of effectiveness and impact at this evaluation.

3.3.2 Impacts

3.3.2.1 Intended Impacts

1) Quantitative impact indicators

Table 11. Comparison of the target and actual of the quantitative impact indicators

	Baseline	Target	Actual		
	2009	2015	2014	2016	2017
	At planning	2 years after completion	Year of completion	2 years after completion	As of ex-post evaluation
Indicator 1. The number of connections (households)	15,700	29,800	No data	No data	24,453

Indicator 2. Service population (people)	113,900	216,400	No data	No data	157,331
Indicator 3. Water service coverage ratio (%)	57	92	No data	No data	63

Source: Materials were provided by JICA for the baseline and target, and by the executing agency for the actual at the time of ex-post evaluation (answer to the questionnaire and interview)

(1) The number of connections in the project area

It was assumed that users of public faucets would wish to newly register for tap water, thereby increasing the number of water connections as an effect of the improvement of water service such as increase of water supply volume, stabilization of water supply, and improvement of water quality which was expected to be realized due to the enhancement of water supply facilities through the Project. The number of water connections in the project area at the time of the ex-post evaluation was 24,453 households[19], which is only a 56% increase compared to the targeted 90% increase from the baseline of 15,700 households to the target of 29,800 households (62% of the targeted rate of increase). Based on the above, there is considered to have been improvement to some extent in the effectiveness with respect to this indicator.

Table 12. The number of connections in the project area

(Unit: Households)

Water supply area*1	Baseline (2009)	Actual at the time of ex-post evaluation (2017)	Increase	
			No. of households	%
Abbottabad city	5,800	8,010	2,210	38%
Nawanshehr area	3,603	5,002	1,399	39%
Sheikhuk Bandi	1,129	2,380	1,251	111%
Salhad	1,052	1,707	655	62%
Mirpur	887	2,766	1,879	212%
Jhangi	3,229	4,588	1,359	42%
Total	15,700	24,453	8,753	56%

Source: Materials provided by the executing agency

*1 As stated in the note to table 1, there was a change in the administrative divisions in the water supply area. Therefore, whereas the total of the entire water supply areas compares the number of connections at the time of planning and ex-post evaluation, its breakdown is treated as reference information.

(2) Service population in the project area

The population in the project area in 2017 was 249,732 people (as described in the section

[19] As of the beginning of June 2018, it has increased to 26,010 households (from the interview at the time of feedback of provisional evaluation result to the executing agency).

on “Relevance”). Based on this population, the estimated water service population is 157,331, calculated by multiplying the following water supply coverage ratio of 63%. The increase rate from the baseline of 113,900 to the targeted 216,400 is 90%, while the actual increase was only 38% (42% of the target increase rate). Therefore, the achievement rate of this indicator was low.

(3) Water service coverage ratio

The water service coverage ratio is calculated as 63%, based on 39,102 households in the project area in 2017 (as described in the section on “Relevance”) and 24,453 of the households with connection indicated above. The increase rate from the baseline of 57% to the targeted 92% is 61%, while the actual increase was only 11% (18% of the target increase rate). Therefore, the achievement rate of this indicator was low.

2) Qualitative impact indicators

(1) Improvement of public health

According to the executing agency, there is no statistical data but overall health problems caused by lack of safety of drinking water are recognized to be decreasing. Regarding the improvement of public health, local residents do not recognize significant improvements in the quality of tap water. Drinking water is obtained mainly from the public faucets [20] installed adjacent to the tube well of the groundwater supply system, whereas tap water through the water distribution pipe is not drunk or drunk after boiled. The spread of the practice of boiling tap water for drinking since the implementation of the Project is considered a main factor in the decrease of health problems due to water use.

(2) Improvement of the quality of living

Reduction of the water-fetching from public faucets: It was assumed that local residents enjoying improved water service and improved water service coverage ratio would lead to the reduction of water-fetching from public faucets. However, the water supply coverage ratio is around 60%, which has not reached the targeted 90% level. According to the local residents, households with a connection use tap water for their living needs, but many households still obtain drinking water from public faucets. In addition, if the amount of supply of tap water is small and the necessary amount of water for their living needs cannot be obtained, people go to tube wells nearby or the public facilities such as state hospital headquarters, and carry water with jerry can bottles by car.

[20] The public faucets were installed in the water distribution tank before the project, but now these are installed adjacent to the tube wells with a filter for water purification.

Improvement in cooking and washing (convenience of in-house water use): It was assumed that improvement in both quantity and quality of water service would improve the convenience of people's water use for their living. However, according to the local residents, use of tap water is avoided not only for drinking but also for cooking because of water quality concerns. Also, since the amount of water supply is not sufficient, it has to be used carefully and stored in a water storage tank installed in the house; therefore, housework using water such as cooking and laundry has still been inconvenient.

Based on the above, improvement in the quality of living of the residents as an effect of the Project is limited.

3.3.2.2 Other Positive and Negative Impacts

(1) Impact on the natural environment

According to the executing agency, there has been no negative impact on the natural environment by the Project. However, an environmental monitoring report was not provided although it was requested to the executing agency.

(2) Resettlement and/or land acquisitions

The owners of the land were initially not receptive to providing their land during the land acquisition for the Project, and were not convinced regarding the method of compensation. The water right interest at the construction site of water intake facilities was also an issue. Therefore, the executing agency solved these issues through discussion with the community and the land acquisition was completed. According to the executing agency, there are 3 to 4 lawsuits by the residents who claim the compensation amount is insufficient, although compensation[21] was made in accordance with the local legislation[22]. The executing agency also stated that there was no resettlement of residents in the acquired land, and no negative effects on the livelihood of affected people have been recognized in particular, while the access road is used for daily living purposes by neighboring villagers.

(3) Other impacts

Other positive impacts

Economic effects: It was assumed that improvement of public health and quality of life as an effect of water service improvement would lead to revitalization of economic activities and improvement of value as a tourist site[23]. Although the degree of water service

[21] As a general procedure, it is calculated with the average market price over the past three years.

[22] Payments for the compensation were made in accordance with the decision of Deputy Commissioner of Abbottabad district. (Website of Abbottabad district government for information about Deputy Commissioner: http://dga.com.pk/district-administration/ / Access: July 20, 2018)

[23] Abbottabad urban area is located at altitude of 1,200 m and is known as a summer resort because of its comfortable summer climate.

improvement by the Project is not high, the access road to water intake facilities contributes to the increase of tourists to scenic sites as a side effect of the Project.

Other negative impacts
None in particular.

As described in the summary of the section on "3.3.1 Effectiveness," while the amount of water distributed from the supply side is at the targeted level set at the time of planning, the amount and quality of water to the demand side that the local residents receive from tap water has been far below the target. Leakage from the water distribution network is considered a major cause of this situation based on the following considerations:

- More than 800 leak points have been identified[24]. It seems that there is a possibility of considerable leakage including underground leakage, as there are more than 800 identifiable ground water leaks.
- There are many customer complaints about water quality of tap water thought to be caused by sewage infiltration from the sewer pipe and it can be seen from interviews with the residents that the situation is worsening than before.
- There are many illegal connections. About 400 illegal connections have been removed since January 2018, from the start of removing. The large number of illegal connections also affects the water supply to the subscribers.

Although water leakage rate cannot be calculated accurately as most of the water supply facilities are not equipped with water meters, it is assumed that leakage is a major cause of the supply-demand gap of the water supply volume. Therefore, renewal/repair of the distribution pipe network is considered the top priority for water supply improvement (see the recommendation on water leakage reduction in water distribution network). Based on this analysis, the sub-rating of the effectiveness/impact of the ex-post evaluation of the Project reflects the fact that the surface water supply system, the main part of the Project, has greatly increased the water distribution volume of the target area and thereby supports the local water supply, although the water leakage from the water distribution network is considered the main cause of not achieving the expected effect.

This project has achieved its objectives to some extent. Therefore effectiveness and impacts of the Project are fair.

[24] Source: WSSCA annual report (as of March 2018)

3.4 Sustainability (Rating: ②)

3.4.1 Organizational Aspect of Operation and Maintenance (O&M)

(1) Establishment of a wide range water supplier

At the time of the planning of the Project, there was no wide water supply area utility in the project area, and the water supply service was operated by the following independent three water supply utilities in the Abbottabad district.

Ÿ PHED

Ÿ Abbottabad municipal water service (water supply division)

Ÿ Nawanshehr area service unit of the Abbottabad municipal

At the time of ex-post evaluation, the water service in the urban area of Abbottabad district is managed by WSSCA, except for facility management of surface water supply system. WSSCA has jurisdiction over the area covered by the target area of the Project and Dhamtor and Kakuru water supply areas (the approximate population within the jurisdiction is 280,000 as of 2017).

(2) Organizational aspect of O&M of the surface water supply system

As mentioned earlier in the section on Output of Efficiency, the existing three waterworks entities stated above had no experience in operating the water purification plant. Therefore, a surface water supply unit under PHED was newly established by the soft component outcome 2 of the Project, which still operates and maintains the surface water supply system. Currently, the number of staff of the surface water supply unit is 28 (23 from PHED, 5 from Abbottabad city water supply. Although it was initially 30 people, two PHED engineers moved outside the WSSCA jurisdiction). Among them, 21 staff members centering around 8 operators operate and maintain the surface water supply system, and 3 engineers and 4 administrative staff perform water quality management and accounting work.

It has been decided that the operation and maintenance of the surface water supply system will be transferred to WSSCA in the future, and official notification was issued by the Khyber Pakhtunkhwa province government on September 6, 2017. At the time of the ex-post evaluation, there was ongoing discussion regarding the operation and maintenance budget of the facility and the change of staff (including budget for personnel expenses) between PHED, the financial department of the state government and WSSCA. After conclusion, the surface water supply system will be officially transferred to WSSCA in the near future. According to PHED, there are some staff who do not want to transfer as they will no longer be government officials. WSSCA will employ new staff in response to the shortage of personnel.

(3) Organizational aspect of O&M of the groundwater supply system

WSSCA is currently operating and maintaining the groundwater supply system. It was established in 2015 by the Khyber Pakhtunkhwa province and began providing services in April 2017 after the transfer of the staff of PHED and Abbottabad municipal water service and the handover of the facilities and operations of the groundwater supply system. The total number of WSSCA staff is currently 468 (full-time 413, part-time 55), of which the number of staff in the water supply department is 199 (full-time 197, part-time 2). According to WSSCA, although there is no problem in organizational structure, the number of staff of the water supply department is insufficient. From the viewpoint of the number of connections per employee, the number of staff members themselves is not considered particularly low as it is relatively low as calculated at 135 based on the number of water connections of about 27,000.

Based on the above, it was confirmed that there are no particular problems in the organizational aspect of O&M of both water supply systems.

3.4.2 Technical Aspect of Operation and Maintenance

(1) Technical aspect of O&M of the surface water supply system

In the surface water supply unit, a training system on the surface water supply system and operation manual, etc. were established through the soft components of the Project, and the transferred technology has been shared and utilized within the organization. However, PHED considers further training to be necessary especially for safe and reliable operation and maintenance of water treatment plant.

The water quality inspection of the water treatment plant had previously been conducted at the facility of Abbottabad municipal water service. Before the transfer of the surface water system to WSSCA, inspection equipment materials are being prepared in the water treatment plant.

(2) Technical aspect of O&M of the groundwater supply system

According to WSSCA, a large number of new employment and high turnover rate are the factors that affect the technical level of its staff. In addition, training system and operation and maintenance manuals etc. were not handed over from PHED. WSSCA recognizes the lack of technical skills of its staff regarding the operation and maintenance of the groundwater supply system as one important issue to be addressed. For this reason, WSSCA is going to improve training and programs for strengthening technical skills of its staff, which has not been realized so far due to insufficient funds. Given these circumstances, WSSCA will accept ADB's support mainly on technical cooperation, which is to be implemented in the near future.

WSSCA's water quality management is done at the laboratory of WSSCA twice a month. In addition, when complaints about water quality are received from the residents, water in the area is inspected and measures are taken based on the inspection results.

Status of response to the recommendations on problems related to technical aspects of groundwater supply system:

In the course of the technical assistance aimed at proper operation and maintenance of the groundwater system, it was pointed out that in order to grasp a breakdown of water pumps in advance, there were issues on recording operation, measurement and maintenance of the equipment and acquisition of data such as groundwater pumping data. Although flow meters are not installed yet in most tube wells, WSSCA is working on procurement of flow meters, well cameras for monitoring and spare parts for the purpose of improving well management by systematizing data acquisition in response to the recommendation.

Despite its effort, Dobathar No. 3, out of the newly constructed tube wells, has not been in operation for about a year since the breakdown of the water pump due to the drop in pumped water volume, and similar water pump failures occurred in many existing tube wells. Excessive pumping in existing tube wells was also pointed out during planning of the Project. Therefore, it is necessary that WSSCA acquires technical skills regarding appropriate operation and shares them within the organization for the purpose of avoiding failure in the water pumps. (Refer to recommendations for preventing damage in groundwater supply system).

Photo 4. Intake facility of new tube well not used due to breakdown (Dobathar No. 3)

Based on the above, there are considered to be some problems in the technical aspect of O&M of groundwater supply system.

3.4.3 Financial Aspect of Operation and Maintenance

(1) Financial aspect of O&M of the surface water supply system

According to PHED, as to the condition before transfer of the system to WSSCA, there is no financial problem with the budget for the daily operation and maintenance of the surface water supply system as it is allocated by the provincial government. However, budget for the replacement of facilities is not secured. Regarding the budget for operation and maintenance expenses after transfer of the system to WSSCA in the near future, discussion

with the provincial government is ongoing as described above.

(2) Financial aspect of O&M of the groundwater supply system

WSSCA recognizes the lack of operation and maintenance budget as an important issue. At the time of planning of the Project, budget from the local government had been allocated to the water service operation of PHED, for the amount of financial shortfall with water tariff collection. The financial situation has continued since the commencement of water supply service by WSSCA in 2017. The allocation of budget from the provincial government to WSSCA is only committed to for the next few years; therefore, financial improvement is necessary for subsequent water service operations. Meanwhile, cost recovery ratio for water tariff is only about 37%, and the tariff collection rate is also low[25]. Low fixed water tariff collection has not been improved from the situation that was reported at the completion of the Project, which is assumed as a factor that led to the shortage of the operation and maintenance budget. Although the Project supported shifting to a metered water tariff system through technical assistance based on awareness of this issue, there has been no progress so far. As such, WSSCA is required to improve its financial base as a provider of water service, which is a public service operated based on the users-pay principle (Refer to the recommendation on increasing the billings collection of water tariff).

Based on the above, there are considered to be some problems in the financial aspect of O&M of groundwater supply system.

3.4.4 Status of Operation and Maintenance

(1) Status of O&M of the surface water supply system

Currently, no particular problems are pointed out in the operation and maintenance by the surface water supply unit under PHED. Periodic removal of accumulated sediments from the water intake facilities, which is necessary maintenance for these facilities as instructed by experts in the technical assistance of the Project, has been carried out by PHED through outsourcing.

[25] For the year ended March 2018, the collection rate was 14%, the ratio of the number of invoices issued to the number of connections was as low as 65%, and the percentage of delinquent loans that can be withdrawn was as low as 19% (WSSCA 2017 annual report).

The protective cover of the transmission mains has been damaged at Namly Mira intake facility due to flooding during the rainy season. JICA has implemented a follow-up study since March 2018, and necessary response measures for emergency construction and repairmen after emergency measures etc. are under consideration. According to the executing agency, it is necessary to re-arrange the route of the transmission mains where the foundation is damaged.

Photo 5. Damage to protective cover of transmission mains at Namly Mira intake facility due to flooding

(2) Status of O&M of the groundwater supply system

Regarding the operation and maintenance of the tube well intake facilities, wells and other equipment that are inoperative due to aging are repaired and/or replaced according to secured budget. According to WSSCA, the main problem in the maintenance of facilities is not due to the facilities constructed and/or improved by the Project but water leakage from water pipes. WSSCA addresses this by responding to reports from the residents.

It was confirmed that while there are restrictions on the operation and maintenance of facilities in terms of technical and financial aspects of WSSCA, both water supply systems undergo necessary measures such repairs in case of problems.

Some minor problems have been observed in terms of the technical and financial aspects. Therefore sustainability of the effects of the Project is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to provide safe and stable water supply services in Abbottabad city and 4 neighboring areas, a medium-scale urban area located in Abbottabad district of Khyber Pakhtunkhwa province in the northern part of Pakistan, by newly developing a gravity-flow surface water supply system and the renewal and enhancement of the groundwater system. The Project thereby contributed to increasing the water supply coverage ratio and access to safe water of the residents in the project area, where water supply capacity was insufficient despite an expected population increase due to expansion of the urban area.

This project was highly relevant as it was consistent with the development plan and

development needs of Pakistan, as well as Japan's ODA policy. The efficiency of the Project is fair as the project period exceeded the plan, although project outputs were almost as planned and the project cost was within the plan. As an effect of the Project, the amount of water distributed from the supply side is almost as planned; however, the quantity and quality of water received by the local residents from tap water in their house has been far below the target, which seems likely due to leakage from the water distribution network. Therefore, improvement of access to safe water for the residents has not been fully achieved yet. The effectiveness and impacts of the Project are concluded as fair considering that the surface water supply system, the main part of the Project, supports the local water supply. The sustainability of the effects of the Project is fair as there are some minor problems to be improved in the technical and financial aspect of the newly established wide water supply area utility. 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 to WSSCA

- Reduction of water leakage from distribution pipes: Because the population increase trend is almost as expected at the time of planning, the amount of water supplied to the demand side has been far below the target whereas the amount of water distributed from the supply side (water supply utility) is at the targeted level which was set at the time of planning. Because leakage from the water distribution network is considered a major cause of the gap in volume of water between the supply side and demand side, it is recommended that WSSCA makes efforts on the renewal/repair of the distribution pipe network as one of its most important issues.

  In addition, reduction of water leakage is also necessary for improving the quality of tap water. In terms of finance, it is important not only to control the wasted power cost of tube well pumps but also a matter to consider as an alternative to new water source development from cost aspect. From an environmental point of view, it is important to conserve the groundwater source as there are concerns about decreasing water levels due to excessive pumping.

- Measures to prevent damages in groundwater supply system: It is assumed that excessive pumping has caused water pump failures that have occurred in many tube wells including Dobatar No. 3, one of the newly constructed tube wells, which has not been in operation for about 1 year due to breakdown of water pump due to a drop in pumped water volume. Regarding excessive pumping, technical suggestions concerning the appropriate amount pumped up were also made during the project implementation, and WSSCA is currently working on data acquisition. It is recommended that technical

considerations on appropriate operation of the groundwater system are shared within the organization and implemented by WSSCA.

- Increase of the billings collection of water tariff: The rate of billing and collection of water tariff has been very low even in consideration of the fact that there is much room for improvement in both quantity and quality of water supply service. The low tariff collection is a factor in the lack of budget for proper water business management, and the insufficient budget causes a vicious cycle of unimproved water service. Therefore, it is necessary to improve the tariff collection rate through the improvement of billing and collection such as creation of a route map, training of visitors, etc.

4.2.2 Recommendations to JICA

- Technical assistance for the measures to deal with leakage: It is recommended to JICA that it supports the renewal/repair of the distribution pipe network by WSSCA, which is recommended above as one of its most important issues. Possible support from JICA includes technical assistance on the planning of facility improvement and water service operation and management, based on an appropriate balance of water demand and supply calculation considering leakage from the distribution pipe network.
- Technical assistance on the measures to prevent damages in groundwater supply system: According to WSSCA, it needs a systematic method for data management and operation techniques, including the control of appropriate pumping volume by which breakdown of water pumps is prevented as stated in recommendation to WASSCA above. It is recommended to JICA that it supports the above response measures by WSSCA with technical assistance.

4.3 Lessons Learned

- <u>Importance of water source preservation</u>

  According to the executing agency, Bandi intake facility has suspended its operation since around 2014, right after its completion due to the effects of migrants in the upstream after the earthquake in 2005. Based on this situation, especially the importance of grasping residents' trend should be taken into consideration in future water supply projects mainly using mountain streams from the viewpoint of water source conservation. Specifically, response measures might include that the executing agency or JICA study team thoroughly study and grasp residents in the water source area from the earliest stage of the planning, then consider policies and technical aspects such as creating rules for conservation of water sources. As for the monitoring for water source conservation, technical assistance for periodic monitoring methods, etc. might be conducted by JICA study team.

Ÿ Importance of the participation of a river engineering expert during the planning of a project

A river engineer participated in the follow-up survey mentioned in "Status of O&M of the groundwater supply system" above. There is a possibility that more appropriate design and maintenance methods would be planned if a river engineer participated at the planning stage of a project, through a precise consideration on the effects of flooding in the rainy season to the water facilities installed in river channel when laying transmission mains along the mountain stream.

People's Republic of Bangladesh

FY2017 Ex-Post Evaluation of Japanese Grant Aid Project

"The Programme for Improvement of Solid Waste Management in Dhaka City toward the Low Carbon Society"

External Evaluator: Tokiko Ito, Octavia Japan Co., Ltd.

0. Summary

This project aims to strengthen the capacity of solid waste collection and transportation and to reduce the daily emission of greenhouse gas of the waste[1] collection vehicles in capital of Bangladesh, South Dhaka City and North Dhaka City (hereafter referred to as "North and South Dhaka Cities")[2] by procurement of waste collection vehicles, construction of maintenance workshop, and implementation of technical assistance through seminars etc. regarding greenhouse gas reduction and improvement of vehicle maintenance, thereby contributing to the sustainable implementation of waste management service, the improvement of hygiene environment and the promotion of recycling society in the city and the reduction of green gas emission in North and South Dhaka Cities. This project that aimed at increasing the amount of waste collection by procurement of the waste collection vehicles with low emissions of carbon dioxide is consistent with the development policies such as *the Seventh Five-Year Plan (2016)* that states the necessity of environmental sustainability, the development needs for waste collection equipment, Japan's ODA policy, and thus, its relevance is high. Although the project cost was as planned, the project period exceeded the plan, and the efficiency is fair. The operation rate of vehicles procured in this project is high, and the amount of collected waste has achieved the target value. However, it is judged that the target has been achieved by the increase in the number of collected vehicles in North and South Dhaka Cities and by the synergistic effect with other projects. Furthermore, regarding carbon dioxide emissions, although it is highly likely that North and South Dhaka Cities as a whole have not achieved the reduction target, the emissions by new vehicles by this project has decreased. On the other hand, because it is confirmed that the beautification of the city had been promoted due to an increase in waste collection amount, it is judged that the effectiveness and impacts are high. As for the workshop facilities that operate and maintain the vehicles procured by this project, there are plans to

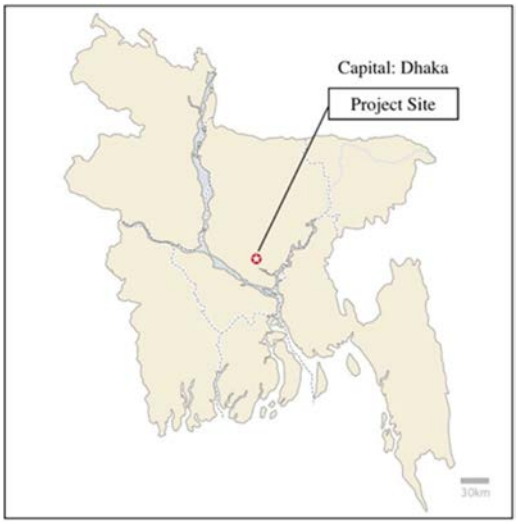
[1] "Waste" defined in this project means home garbage, business garbage, and road cleaning garbage. (Data provided by JICA).

[2] During the project was underway in April 2012, Dhaka City was divided into North and South Dhaka Cities. The administrative district of Bangladesh has Zone and Ward under City. During the project planning, there were 10 zones in the City of Dhaka. It was split into South and North Dhaka Cities, and the zone number was changed by the time of ex-post evaluation (Supplementary document ①).

relocate both in Dhaka North City Corporation (hereafter referred to as “DNCC”), the executing agency, and Dhaka South City Corporation (hereafter referred to as “DSCC”). Although there is a concern about securing functions of operation and maintenance of equipment, there is no particular problem at the time of ex-post evaluation. As no particular problems have been observed in the institutional, technical, financial aspects and the operation and maintenance system of DNCC and DSCC, the sustainability of this project effect is high.

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

1. Project Description



Project location

Procured compactor vehicle

1.1 Background

In former Dhaka City, due to the rapid population growth and economic development, the management of increasing quantities of solid waste is the considerable social issue. However, many of the waste collection vehicles owned by the former Dhaka City Corporation (hereafter referred to as “DCC”) were too old, their operation rates have declined due to repair and maintenance, and it was expected that many of the vehicles would no longer be used around 2010 to 2011. The City was aware of the necessity of strengthening solid waste management and has therefore raised related budget for the solid waste management in the current expenditure of general fund. However, there was no prospect of raising funds to purchase equipment like waste collection vehicles etc. necessary to properly manage the waste along the Master Plan of the waste management formulated by JICA technical cooperation projects,

"Solid Waste Management Study in Dhaka City" and the follow up study (October. 2003 – March. 2006). Therefore, the Bangladesh Government requested support from the grant aid project of the Japanese Government.

1.2 Project Outline

The objective of this project is to strengthen the capacity of solid waste collection and transportation and to reduce the daily emission of greenhouse gas of the waste collection vehicles in North and South Dhaka Cities by procurement of waste collection vehicles, construction of maintenance workshop, and implementation of technical assistance through seminars etc. regarding greenhouse gas reduction and improvement of vehicle maintenance, thereby contributing to the sustainable implementation of waste management service, the improvement of hygiene environment and the promotion of recycling society in the cities and the reduction of green gas emission in North and South Dhaka Cities.

Grant Limit / Actual Grant Amount	1,215 million yen / 1,215 million yen
Exchange of Notes Date/ Grant Agreement Date	February 2009 / February 2009
Executing Agencies	Responsible Agency: Rural Development and Cooperative, Ministry of Local Government Executing Agency: Waste Management Department, former Dhaka City Cooperation (As of Ex-Post Evaluation: Waste Management Department, North Dhaka City Cooperation)
Project Completion	May 2014
Main Contractors	M/A Abul & Brothers (Construction) Toyota Tsusho Cooperation (Equipment)
Main Consultant	Yachiyo Engineering Co., Ltd.
Procurement Agency	Japan International Cooperation System
Outline Design	July 2008 – February 2009
Related Projects	【Technical Cooperation】 "Solid Waste Management Study in Dhaka City" and its follow up study (October. 2003 – March. 2006) "Project for Strengthening of Solid Waste Management in Dhaka City" (February. 2007 – February. 2013) "The Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City and Chittagong City" (May. 2015 - April. 2021)

	【Grant Aid Project】 "The Project for Improvement of Solid Waste Management Equipment in the People's Republic of Bangladesh" (GA May.2015)

2. Outline of the Evaluation Study

2.1 External Evaluator

Tokiko Ito, Octavia Japan Co., Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: November 2017 – November 2018

Duration of the Field Study: March to mid-April 2018, June to July. 2018.

2.3 Constraints during the Evaluation Study

In this study, the external evaluator was unable to enter the project target country for security reasons, so the field survey (the information and data collection and the interview survey) was conducted mainly by the contracted local survey assistant. The evaluation analysis and judgment are done after the external evaluator has scrutinized the obtained information and data etc.

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

3.1 Relevance (Rating: ③[4])

3.1.1 Consistency with the Development Plan of Bangladesh

Before the start of the project, the Bangladesh Government considered the environmental pollution as an obstacle to improve people's health and production capacity, considered its improvement as one of its main goals and stated the improvement of environmental situation and "conversion to the clean fuel (CNG/LPG/LNG[5])" in order to reduce air pollution from vehicles and the like in the strategy for environment and sustainable development in the *Poverty Reduction Strategy Paper (2005-2006)* approved in 2005.

At the time of ex-post evaluation, the Bangladesh Government formulates *the Seventh Five*

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[4] ③: High, ②: Fair, ①: Low
[5] CNG stands for Natural Gas Car, LPG stands for Liquefied Petroleum Gas and LNG stands for Liquefied Natural Gas.

Year Plan (2016-2020) and states the necessity for the environmental strategy and environmental sustainability in harmony with economic growth for the country's sustainable development. Moreover, the environmental management based on the implementation of air and waste management strategies etc. is emphasized and solving waste problems is pointed out as one of the urban environmental issues. Furthermore, the necessity to work on improving the urban air pollution through vehicle improvement, to practice 4R[6] through the dissemination of waste management regulations etc., to raise awareness of the community, and to manage waste through strengthening public and private partnerships etc. are stated.

Based on the above, the Bangladesh Government continues to place importance on the environmental management including air pollution at the time of ex-post evaluation. Therefore, it can be said that the implementation of this project is consistent with the country's development policy at the time of planning and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Bangladesh

Prior to the start of the project, the management of increasing waste has become a major social issue in former Dhaka City due to the rapid population growth and economic development. Former DCC's waste collection vehicles were in short and have not been able to collect all the waste generated in the target collection area. As many were aging vehicles purchased before 1999, the operation and maintenance expenses piled up. The repair was also frequently required and their operation rate was decreasing, and it was expected that many could not be used around 2010 to 2011. The uncollected garbage was discarded in rivers etc. and had an adverse effect on the living environment. The city recognized the necessity of strengthening waste management, and the budget related to the countermeasure in the current expenditure of general fund was also increased year by year. However, there was no prospect of raising large funds to purchase the collection vehicles necessary for appropriate waste management.

On the other hand, at the time of ex-post evaluation, the Ministry of Local Government, Rural Development and Cooperative (hereafter referred to as "MLGRD&C"), which is the responsible agency of this project, and the relevant administrative organizations, mainly the Waste Management Departments of DNCC and DSCC, continue to recognize that it is necessary to provide appropriate and high quality public service of waste management. However, even at the time of ex-post evaluation in DNCC and DSCC, it is inevitable to operate aging waste

[6] 4R consists of Reduce, Reuse, Recycle, and Reclaim according to Bangladesh's *Seventh Five Year Plan (2016 - 2020)*. In the materials provided by JICA, 3R is defined as Reduce, Reuse, and Recycle.

collection vehicles. Furthermore, due to the restricted financial resources, the procurement of new waste collection vehicles is also hindered. Both city corporations have entrusted private companies to collect the waste supplementary. However, continuous improvement of the collection is necessary as the collection rate in 2014 is 65%[7] against the increased waste generation volume and 35% is uncollected.

As a result of the above, the improvement of waste collection in North and South Dhaka Cities is required even at the time of ex-post evaluation, and the necessity of further procurement of waste collection vehicles is high. Thus, the consistency with development needs is recognized both at the time of planning and at the time of ex-post evaluation.

3.1.3 Consistency with the Japan's ODA Policy

In the *Country Assistance Plan for Bangladesh (May 2006)* of the Japanese Government, the environment is one of the priority sectors in the social development and human security sectors, and the emphasis was placed on cooperation to improve the urban environment including response to air pollution. In addition, in 2008, the Japanese Government expressed its commitment to actively cooperate on the greenhouse gas reduction efforts as a part of support to the measures for climate change and introduced the *Grant Aid of Environmental Program*[8]. This project supports the improvement of the urban environment and the mitigation measures of greenhouse gas related to the country's assistance plan mentioned above through the improvement of waste disposal and transportation by the procurement of waste collection vehicles to DNCC and DSCC. Thus, it can be said that consistency with Japan's aid policy and this project is recognized.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The contents and actual results of this project are as shown in Table 1.

[7] Actual value in 2014. The details of the calculation basis are stated in "Effectiveness".
[8] Sub scheme of Grant Aid Project established in 2008 for assisting the greenhouse gas reduction efforts and the measures to climate change issues in developing countries etc.

Table 1: Outputs of the Project Plan/Actual

	Plan (2009: Before the project starts)	Actual (2018: Ex-Post Evaluation)
【Japanese Side】		
1	Package 1: Waste Collection Vehicles: Total 100 (15 3t-CNG Container carriers, 30 5t-CNG Container carriers, 20 7t-Diesel detachable container trucks (hook haul), 15 2t-Diesel compactor trucks, 20 5t-Diesel compactor trucks), Spare parts.	As Planned Additional Package 4: Waste Collection Vehicles Total 12 (6 7t-Diesel compactor trucks, 6 7t-Diesel dump trucks)
2	Package 2: Construction of workshop facilities and equipment (Vehicle maintenance and machine section: 8 Work bays, 3 Equipment storerooms, 1 Machine room , Tools and equipment. Administration section: 4 Office rooms, 1 Data room, Entrance, Toilets. Total 625 ㎡ and Washing and inspection platform)	As Planned
3	Soft Component (technical assistance): Public information and residents' education on environment, workshop, technical support for operation and maintenance of vehicle equipment, guidance on safety and operation and maintenance of CNG	As Planned Addition: Training of mechanic and training of trainers for facility management
4		Additional Package 3: Construction of storeroom and training facilities and equipment (storeroom, training space, office for training, store staff room, and toilets. Total area 600 ㎡, attached facilities)
【Bangladesh】		
1	Securing of land for facility construction site	As Planned
2	Leveling, clearing and relocation of obstacles of the facility construction site	As Planned
3	Construction of gates and fences	As Planned
4	Construction of road: Access road	As Planned
5	Electricity work: Electricity distribution work	As Planned
6	Water distribution work: City water (water supply) work	As Planned
7	Drainage work: Sewage pipe construction (Sewage & Rain water)	As Planned
8	Furniture: General furniture and equipment (office desks and chairs, cabinet)	As Planned
9	To bear commissions to opening the account at the bank based on the banking arrangement	As Planned
10	Transportation and customs clearance procedure and handling of various taxes (To bear tax in Bangladesh, customs clearance procedures and transportation of procured equipment etc., tax exemption of value added tax and bearing tax)	As Planned
11	Maintenance of the facilities and procured equipment	As Planned
12	Other expenses not included in grant aid	As Planned
13	Space necessary for technical assistance	As Planned

Source: JICA documents, Answers to the questionnaire from the executing agency

The output of Japanese side was implemented as planned[9]. Differences in plan and actual results are as follows. ①During the project implementation, there was change in design that the foundation form of the workshop facility was changed from the mat foundation form to the pile foundation form based on the result of the geological survey of the detailed design. The reason is that a soft ground in the upper ground layer of the site was found (it was found that the ground tolerance could not be obtained). In addition, minor design change was made twice concerning the attached equipment of the storeroom facilities[10] based on the request of the executing agency. As a result of bidding for the contractor of Package 2, there was the remaining amount because the proposed price was lower than the estimated price. In response to the request of the Bangladesh Government, the additional procurement policy was decided at the Japanese Ministry of Foreign Affairs in October 2011 after confirming the delivery and operation status of the originally procured vehicles and studying the storeroom and training facilities. As stated above, a total of 12 waste collection vehicles, construction of storeroom and training facilities and a set of equipment, and training as a soft component were added. Based on consultation with the Bangladesh side, additional policy was decided after confirming the utilization status of the initial plan. These changes were approved after consultation with JICA Headquarters. The output of Bangladesh side was also implemented as planned.

Photo 1: DNCC workshop (Front)

Photo 2: Container carrier of DNCC on a truck scale of the final disposal site

3.2.2 Project Inputs

3.2.2.1 Project Cost

Regarding the total project cost of this project, the initial plan was approximately 1,216

[9] In the detailed design, there was no change from the outline design.
[10] No change occurred in the contract amount of cost due to the two design changes.

million yen (Japan's share was 1,215 million yen, Bangladesh's share was approximately 0.9 million yen). Japan's actual cost was 1,215 million yen as planned (100% of the plan). The actual cost of Bangladesh was not available. This is because during the project implementation, additional procurement was implemented because of the design changes due to the generation of remaining amount, and "the reimbursement"[11] of the remaining amount was implemented after that. According to the construction supervisory consultant (hereafter referred to as "the Consultant") of this project, compared with the time of calculating reference price of the project (around August 2008), after the project began (2009), it is considered that price decline is realized because of the various price declines due to the global financial crisis etc., the trend of yen appreciation, and then, the result of competitive bidding among vehicle companies.

3.2.2.2 Project Period

Table 2: The plan and actual result of the project period

	Plan	Actual
Initial Plan	14 months (April 2009 – May 2010[12])	23 months (April 2009 – February 2011)
Consultation for usage of remaining amount		9 months (March – November 2011)
Additional Procurement	28 months (December 2011 – March 2014[13])	30 months (December 2011 – May 2014)

Source: Documents provided by JICA

As shown in Table 2, regarding the initial plan, it was planned to be completed in 14 months, while the actual result was 23 months and exceeded the plan (164% compared to the plan). According to the procurement agency of this project, the factors behind the delays of the initial plan are thought to be ① the delay due to engine remodeling work after importing CNG vehicles that necessity was not grasped at the time of Outline Design (about 6 months), ② the delay of the shipping due to delays in import procedures for vehicles on Bangladesh side (about 3 months), and ③ the delay in construction of workshop by the construction company (about 10 months), etc.[14]. After that, concerning the use of remaining amount, the contract

[11] Since the final amount of remaining amount (4.7 million yen) was less than 3% of the total amount of the loan and the interest, in accordance with the grant agreement, after confirming full payment from the recipient government to the contractors, etc., reimbursement payment, payment of the remaining amount to the recipient country, was implemented.

[12] The start of the period is at the time of contract with the procurement agency and includes the period of bidding main construction and the period of implementing soft component according to the project implementation schedule chart provided by JICA.

[13] The start of the additional procurement period is December 2011, the next month of agreeing the additional procurement content in Bangladesh. The project completion is May 2014 when additional output was completed (Completion Ceremony for Package 3 and Delivery Ceremony for Package 4).

[14] These delays are occurring in parallel due to the delay of each output compared to the original plan. The overall

change was made, and the output increased. At this time, it was necessary to confirm the operational status of the equipment procured based on the initial plan, and it took nine months outside the plan as a period of consultation for use. It is judged that this was the period necessary for judging the executing agency's operation capability of the procurement equipment. Moreover, after the contract change, the project period is extended based on the plan. By taking these factors into consideration and setting the project period again, total project period due to plan changes are considered to be 51 months (14 months (initially planned period) + 9 months (period for consultation of the use of remaining amount) + 28 months (planned period for additional procurement)) [15], and the actual result of the project period (62 months) exceeded the plan (122% compared to the plan).

From the above, although the project cost was as planned, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[16] (Rating:③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

1) Operation Indicator: Total amount of average waste collection per day in North and South Dhaka Cities

In this project, waste collection vehicles, workshop facilities, storeroom and training facilities, and sets of equipment were developed. Table 3 shows the trends of the total amount of average waste collection per day in North and South Dhaka Cities (baseline value, target value and actual value) which is a quantitative operation indicator. Incidentally, at the time of the project planning, the target value of waste collection amount of this project was set based on the target value of waste collection rate of the Master Plan. Therefore, in this evaluation, it was decided that the target value after the design change was set based on the Master Plan and the judgement to be made. The calculation rationale for the target value in Table 3 is shown in the supplementary document ② at the end.

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delay of the project is nine months.

[15] As for the actual period of the Bangladesh side, the executing agency did not grasp information and could not grasp the starting and ending of the period. However, the completion of implementation was confirmed by the defect inspection report of this project (March 2012 and June 2015).

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

Table 3: Total amount of average waste collection per day in North and South Dhaka Cities*

(Unit: t/day)

Base line	Target		Actual					
	2012	2015	2012	2013	2014	2015	2016	2017
2008	2 years after Package 1&2	1 year after Project Com-pletion	1 year after Package 1&2 Com-pletion	2 years after Package 1&2 Com-pletion	3 years after Package 1&2 Com-pletion	1 year after Project Com-pletion	2 years after Project Com-pletion	3 years after Project Com-pletion
1,619	2,429 (2,121)	3,052** (2,665)	2,374	2,769	3,338	3,636	4,332	5,257

Source: 2012: Documents provided by JICA, 2013: Document provided by the Consultant, 2014-2017: Documents provided by DNCC & DSCC[17]

* Note: The target value at the time of project planning was calculated based on the target value of the total waste collection amount excluding the collection amount of private consignment in the Master Plan. At the time of ex-post evaluation, the waste collection amount by private consignment was not confirmed, so the target values and actual values are calculated based on the total waste collection amount. The figures in parenthesis are the target value set at the time of the project planning.

** Note: In the Master Plan, target value after 2016 was not set. Therefore, although it is not two years after the completion of the project, year 2015 is set as the target year, and thus, the actual result of that year is indicated by bold line.

As shown in Table 3, the total amount of average waste collection per day in North and South Dhaka Cities exceeded the target value of the output of the initial plan and the target value after the design change. Since it is said that 10-20% of vehicles are not being measured on the track scale[18] of the final disposal site, actual collection capacity is considered to exceed the actual value in the table.

On the other hand, it is considered that the improvement of the primary collection amount[19] also contributes to the increase of the secondary collection amount. According to an interview with the Executive Engineer of the Waste Management Department of DNCC (hereinafter referred to as "DNCC Officer"), and Assistant Engineer of the Waste Management Department of DSCC (hereinafter referred to as "DSCC Officer") etc., because of JICA's technical cooperation project, "Project for Strengthening of Solid Waste Management in Dhaka City" (February 2007 - February 2013) that was started in advance to this project and also worked on improving primary collection (collection method, collection stations, etc.) and the fact that

[17] At the time of ex-post evaluation, data of actual amount in 2012 and 2013 are not directly available from DNCC and DSCC due to the problem of data management situation at the final disposal site, etc., so the sources differ from that of the actual amount from 2014 to 2017.

[18] Truck scale is a device that calculates weight of cargo while loading cargo on truck.

[19] Transporting garbage from households to waste collection stations is called primary collection. Collection and transport of waste from collection station to final disposal site is called secondary collection. The place to collect garbage by primary collection is called a secondary collection station.

nearly 80% of households were covered by the collection of the private waste collectors of the primary collection, the amount and rate of primary collection of waste increased after the project started[20]. Furthermore, compared with the time prior to the project implementation, container vehicles increased due to this project, DNCC and DSCC increased containers, and drastically reduced dustbins[21]. As a result, waste transshipment work at the secondary collection stations is becoming prompt[22]. Additionally, the number of new vehicles is also increasing[23], and the number of daily trips of the collection vehicles on average has increased substantially[24]. It is considered that these increases are also boosting the amount of secondary collection.

2) Effect indicator: Average waste collection rate per day for total of North and South Dhaka Cities

The Table 4 shows the transition of average waste collection rate per day for the total of North and South Dhaka Cities (standard value, target value, and actual value). As mentioned above, the target value of this project was set based on the target value of the waste collection rate of the Master Plan. Therefore, in this evaluation, it is decided to make a judgement about the target value after the design change based on the target value of the Master Plan. Furthermore, calculation rationale for the collection rate in Table 4 is shown in the supplementary document ② at the end.

[20] At the time of preparing the Master Plan for waste management, regular fixed-point collection by the introduction of compactor vehicles included in this project was considered to be premature due to the systematic issues of equipment maintenance of the executing agency. However, in line with the progress of the technical cooperation project, the stakeholders confirmed the direction to carry out regular fixed-point collection by compactor vehicles, and by such a background, it has been reached that the implementation of grant aid for introducing vehicles. On the other hand, in the technical cooperation project, on the premise of the start of regular fixed-point collection by introducing the vehicle, further improvement of the primary collection has been worked out.

[21] About 380 containers in former Dhaka City before the project have been increased to 513 in total in North and South Dhaka Cities by the time of the ex-post evaluation. 688 dustbins in former Dhaka City before the project was eliminated in North Dhaka City by the time of the ex-post evaluation. About 100 dustbins are used in South Dhaka City which has a lot of narrow alleys but have been decreased significantly.

[22] From the time when the city was former Dhaka City, residents or contractors are supposed to carry waste to a secondary collection stations (dustbin or container) in the North and South of Dhaka Cities. Since garbage is put in dustbins directly without using bags, etc., it faces the problems of unsanitary, garbage scattering and odor. Furthermore, at the secondary collection stage, although containers can be piled directly on container carrier vehicles, it is necessary for waste in the dustbin to be manually reloaded. Therefore, it is said that efficiency of dustbin is particularly poor.

[23] Additional procurement of new vehicles has been started also by "The Project for Improvement of Solid Waste Management Equipment in the People's Republic of Bangladesh" of JICA.

[24] The average number of daily trips for each existing DCC vehicle at the time of project planning is 1.5 times (open track 3t) to 2.8 times (container carriers 3t and 5t). At the time of ex-post evaluation, measured data of average number of trips per DSCC-owned operating vehicle at a final disposal site for a given day was 4.0 times (container carrier (collection capacity unknown)) to about 5.0 (dump truck (collecting capacity unknown)), and between 1.5 and 2.5 times for compactor (collection capacity unknown).

Table 4: Average waste collection rate per day for total of North and South Dhaka Cities*

(Unit: %)

Base line	Target		Actual					
	2012	2015	2012	2013	2014	2015	2016	2017
2008	2 years after Package 1&2	1 year after Project Com-pletion	1 year after Package 1&2 Com-pletion	2 years after Package 1&2 Com-pletion	3 years after Package 1&2 Com-pletion	1 year after Project Com-pletion	2 years after Project Com-pletion	3 years after Project Com-pletion
58	67	77**	66	No Data	No Data	91	No Data	No Data

Source: 2012: Documents provided by JICA, 2013: Document provided by the Consultant, 2014-2015: Documents provided by DNCC & DSCC

* Note: The target value at the time of project planning is calculated by the amount of discharged waste based on the Master Plan (the expected discharged amount, excluding the amount of waste for recycling, etc. from the amount of generated waste) as the denominator. Furthermore, it excluded collection amount of private consignment. At the time of ex-post evaluation, when calculating the target value and the actual value after the design change, the waste collection amount including the amount by private consignment and the discharged amount calculated based on the Master Plan (acquired only for 2012 and 2015) are adopted.

** Note: In the Master Plan, target value after 2016 was not set. Therefore, although it is not two years after the completion of the project, year 2015 is set as the target year, and thus, the result of that year is indicated by bold line.

As shown in Table 4, the average daily waste collection rate for the total of North and South Dhaka Cities is significantly higher than the target value of the initial plan of output and the target value after design change. However, the actual amount of waste generated in the project completion year (2014) was 5,100 t/day, exceeding the estimate of the Master Plan by 14%. Therefore, when the collection rate for 2015 was calculated using this increase rate for reference, the estimated amount of generated waste was still 5,271 t/day, the estimated collection rate was 80%, and they achieved the target value. It is also a reference, and in reality, there is a possibility that the target value has not been achieved. However, this is due to a sudden increase in the amount of generated waste compared to the estimated value in the Master Plan, and it is considered that a certain contribution to the increase of the collection rate from this project can be confirmed.

Regarding the daily operation rate of the waste collection vehicles of DNCC and DSCC, 297 vehicles out of 366 vehicles owned by former DCC were in operation at the time of project planning according to the document provided by JICA. Many vehicles were aging which required frequent repairs even among operating vehicles, and the operation rate was 88.4% in order to repair frequently (operation rate of owned entire vehicles including non-operating vehicles was 72%). According to the Consultant, based on the experiences of vehicle

procurement, “Sometimes vehicles that cannot be used normally range from 30% to 40%”, and it is considered that the situation was close to such a state. 112 vehicles procured through this project were distributed to DNCC and DSCC, and at the time of the ex-post evaluation, 111 vehicles were operating[25] as shown in Table 5. Therefore, the vehicles of this project are largely in operation. Furthermore, at the time of the ex-post evaluation, although actual data on the operation status of each vehicle could not be obtained, according to an interview with the procured vehicle’s drivers etc. of this project, the operation rate of procured vehicles by this project is thought to be about 95%[26]. And it exceeds the operation rate of the existing vehicle at the time of project planning. In other words, it is considered that the waste collection vehicles of this project can operate more stably with a high operation rate and contribute to an increase in the amount of waste collection.

Table 5: Management status of waste collection vehicles procured by this project (for vehicles owned by DNCC & DSCC)

(Unit: Vehicle)

Fuel Type	Vehicle Type	DNCC	DSCC	Total
CNG	Container Carrier 3t	3	12	15
	Container Carrier 5t	11	19	30
Diesel	Detachable container truck 7t	8	12	20
	Compactor 2t	4	10	14
	Compactor 5t	15	5	20
	Compactor 5t (additional procurement)	4	2	6
	Dump Truck 7t (additional procurement)	4	2	6
Total		49	62	111

Source: Document by Waste Management Department of DNCC and DSCC

3) Effect indicator: Greenhouse gas (carbon dioxide) emissions per day

Table 6 shows the transition of greenhouse gas (carbon dioxide) emissions of waste collection vehicles of DNCC and DSCC per day (standard value, target value, and actual value).

[25] Among the vehicles procured in Package 1, one diesel compactor 2t to DSCC became a scrapped vehicle by an accident by March 2012 (Before division of former Dhaka City).

[26] The rate for totally 99 vehicles was calculated under the following conditions. At the time of ex-post evaluation, ① The repair of the fault of custom engine which was remodeled to CNG specification occurs once a month taking a day, ② the repair of diesel vehicles occurs less frequently than ①, ③ the periodic inspection is conducted once every two months in DNCC and once a quarter in DSCC, and ④ repairs are conducted simultaneously at the time of the periodic inspection.

Table 6: Greenhouse gas (carbon dioxide) emissions of waste collection vehicles of DNCC & DSCC per day (As of October 2017)

Vehicle Type	Baseline	Target	Actual			
	2008	2016	2017[27]			
		2 years after the project completion	3 years after the project completion			
			Vehicles			Carbon dioxide(kg) *
			DNCC	DSCC	Total	
Diesel vehicle at the time of planning	297 vehicles (45.20kg/ vehicles/day)	93 vehicles (45.20kg/ vehicles/day)	21	82	103	4,655.60
New Diesel vehicle by this project	-	55 vehicles (18.75kg/ vehicles/day)	35	31	66	1,237.50
New CNG vehicle by this project	-	45 vehicles (16.91kg/ vehicles/day)	14	31	45	760.95
Other new vehicle	-	– (18.75kg/ vehicles/day)	60	62	122	2,287.50
Total of above	297 vehicles	193 vehicles	130	206	336	8,941.55
Carbon dioxide emissions per day (kg/day)	13,424.40	5,995.80				8,941.55
Carbon dioxide emissions per vehicle (kg/vehicle/day)	45.20	30.97				26.61

Source: Documents provided by Waste Management Department of DNCC & DSCC and the Consultant

*Note: It is not actually measured data but was calculated based on the amount of carbon dioxide emissions (in parentheses) for each type of vehicle set at the time of project planning. At the time of project planning, it was assumed that new vehicles were made in developed countries, and travel distance was calculated assuming to increase by 25% from the distance traveled at that time.

As shown in Table 6, the daily carbon dioxide emissions for waste collection vehicles of DNCC and DSCC at the time of ex-post evaluation have not achieved the reduction target. In DNCC and DSCC, old vehicles are still in operation. While other new vehicles are also introduced, and the total number of vehicles has increased, the number of collection trip is also increasing as mentioned above. Therefore, the total carbon dioxide emissions per day may be higher than the values in Table 6. Concerning only the vehicles procured by this project, both diesel vehicles and CNG vehicles contribute to the reduction of carbon dioxide emissions merely by introducing them because the amount of carbon dioxide per unit is smaller than the existing vehicles at the time of planning. However, since the indicator is set for the entire waste collection vehicles of DNCC and DSCC, there are influences of other vehicles which could not be estimated at the time of designing. Thus, it is considered that the indicator is not necessarily

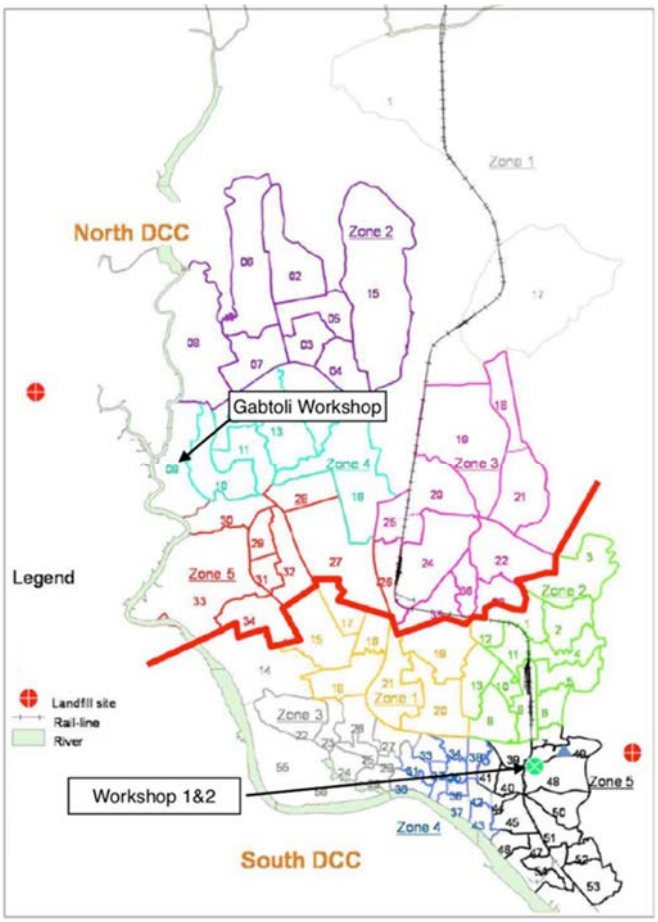
[27] Data before 2017 could not be obtained.

appropriate for judging the direct effect of this project. Judging from the amount of carbon dioxide emissions per vehicle, as shown in Table 6, it is considered to be highly possible that carbon dioxide emissions per waste collection vehicle of DNCC and DSCC have reached the target value at the time of ex-post evaluation[28]. Furthermore, DNCC and DSCC are pursuing replacement of old vehicles and new vehicles, and that is considered to contribute further to the reduction of carbon dioxide emissions from now on.

Photo 3: Container of DNCC

Photo 4: Building for storeroom and training of DNCC

[28] Among "other new vehicles", 84 (48 in DNCC and 36 in DSCC) vehicles are made in India and China. If the carbon dioxide emissions per day of vehicles manufactured by both countries exceed 35.96 kg/day, the target value of carbon dioxide emissions per day per vehicle in DNCC and DSCC cannot be achieved. However, it is considered to be unlikely that the carbon dioxide emissions of vehicles made in both countries against one made in developed countries are nearly double for new vehicles with almost the same load capacity.



Source: Information added by the evaluator based on the document provided by JICA

Chart 1: Location of Project Site

3.3.1.2 Qualitative Effects (Other Effects)

1) Appropriate operation and maintenance of vehicles by vehicle managers, mechanics and drivers

At the time of ex-post evaluation, the periodic inspections of waste collection vehicles are carried out once every two months at DNCC and once a quarter at DSCC. According to the DNCC and DSCC Officers etc., operation and maintenance are more sincerely and reliably carried out than before, and the reputation for inspection done by mechanics of the Waste Management Department is high. It is said that the drivers conduct the pre-operation inspection almost every day and implement idling off for mainly compactor vehicles and stopping engine at the secondary collection stations. According to the DNCC and DSCC Officers, etc., although it cannot be concluded that consideration for the environment is the main motivation, changes in the knowledge and behavior of vehicle management and operation of concerned parties are considered to have appeared.

Based on the above, it is considered that this project contributes to the reduction of greenhouse gas emissions as the appropriate operation and maintenance and the improvement of operation method of waste collection vehicles are seen.

2) Recognition of importance of waste and necessity of reduction of greenhouse gas by general residents

According to the DNCC and DSCC Officers and representatives of the residents, the residents of North and South Dhaka Cities are increasingly aware of the waste collection compared with the previous time because of the decrease in vacant lands due to urbanization and the change of consciousness to living environment. However, in North and South Dhaka Cities, which have a population over 10 million people, it is hard to consider that only the seminar on the countermeasures of climate change and the publicity campaign activities on reducing greenhouse gas emissions and methods of disposing waste conducted by this project are directly changing residents' consciousness. Meanwhile, the waste collection vehicles of this project impress the residents favorably[29], such as the request for the operation has also been submitted from residents outside the area subject to the vehicle operation. Thus, it is also considered that the residents' concern for waste collection has increased. From the above, although the direct change to the residents' awareness by this project is not confirmed, the residents recognize the difference between waste collection vehicles of others and of this project's. Given that fact, this project is considered to support the improvement of the general residents' awareness towards improvement of waste collection.

3.3.2 Impacts

3.3.2.1 Intended Impacts

1) Improvement of costs for the waste collection and transportation and the equipment operation and maintenance

Regarding the waste collection and transportation and the equipment operation and maintenance costs, the actual data on details was not obtained as both DNCC and DSCC did not compiled the data because the operation and maintenance were carried out by several departments, etc. According to the DNCC and DSCC Officers, there is a possibility that the maintenance and management cost is being kept low as there is still few defect of the vehicles

[29] According to the DNCC Officer, "The vehicles of this project are noticeable by the decoration of two colors of pink and green. The residents welcome because the compactor vehicle particularly is odorless, and the new vehicle does not spur black smoke exhaust gas."

procured by this project[30]. On the other hand, regarding DSCC, the repair cost for waste collection vehicles other than this project are increasing (Supplementary document ③ of the end). As mentioned before (3.3.1.1 Quantitative Effect), is it is considered that both DNCC and DSCC may have increased the cost of the waste collection and transportation and the equipment operation and maintenance as a whole because of the facts that the number of the waste collection vehicles and the collection trips increase, and that ageing vehicles are still in operation. As same as "effectiveness", although the cost of waste collection and transportation per trip per vehicle may have improved, from the above, it could not be judged whether improvement was made in the cost of the equipment operation and maintenance of DNCC and DSCC as a whole through introduction of vehicles of this project.

2) Reduction of generation of greenhouse gases in North and South Dhaka Cities

The situation of the generation of greenhouse gases in North and South Dhaka Cities was not obtained because the figures were not summarized. As mentioned in "3.3.1.1 Quantitative Effect 3", the total amount of carbon dioxide generated by the waste collection vehicles is likely to increase in North and South Dhaka Cities as a whole. Furthermore, at the improvement stage of waste management, it is considered that the carbon dioxide emissions from waste collection vehicles and the amount of waste collection are inversely proportional. Meanwhile, the DNCC and DSCC Officers show opinions that the amount of discharged waste in North and South Dhaka Cities continues to increase and that it is still required to increase vehicles. Although consideration is given by the introduction of new vehicles with low carbon dioxide emissions and by the vehicle operation through appropriate maintenance and operation methods, it is considered that the increase of emission of carbon dioxide for waste collection is an unavoidable to some extent. Meanwhile, according to the DNCC and DSCC Officers, it is possible that the increase in primary collection of waste might have the effect of decreasing the frequency of burning garbage independently and might reduce the greenhouse gas generation. That is, it is considered that there is a possibility that this project supports the reduction of greenhouse gas.

3) Beautification and sanitation improvement of the city

According to an interview with the DNCC and DSCC Officers and the representative of residents', before the start of this project, residents had dumped waste on vacant lands and roads,

[30] When the diesel and CNG vehicles of this project are compared, CNG vehicles has more frequent occurrence of engine repair, the fuel efficiency is also worse, but the fuel price is lower.

but during the project, they began to ask for handling waste regularly to the paid private primary collectors of waste etc. It is thought that these are because ① residents' standard of living has been improved and environmental consciousness also increased due to the economic development, thus, between neighbors the problems about handling garbage increased, ② the private primary collectors of waste have become more organized and gather waste more extensively and more effectively, and ③ with the introduction of new vehicles, etc., the cities have begun to collect regularly efficiently during this period. Therefore, it is considered that the cooperation for collection is also progressing because as the awareness about the hygiene environment by residents improves, the improvement of waste collection service is recognized. According to the DNCC Officer, "The residents welcome the improvement of waste collection services by the administration. The results of improvement of primary collection and secondary collection can be seen. This is considered that the effect of the "Project for Strengthening of Solid Waste Management in Dhaka City" is also compatible.[31]" In other words, based on the recognition of the DNCC and DSCC Officers, it is considered that the increase of the amount of waste collection by improvement of primary collection and secondary collection is related to the effect of technical cooperation project in addition to this project, and it is presumed to have a certain synergistic effect with this project.

Furthermore, according to the Consultant, such improvements were observed that at the secondary collection station facing the park where the containers were removed following the start of the operation of the compactor vehicles of this project, a cafe has been opened at the park side by the time of ex-post evaluation, and that at the secondary collection station where the dustbin was removed due to the regular fixed-point collection, the flowerbed was made by the residents. These are thought to be examples of improvement of waste collection contributing to the beautification of the city. As described above, it is confirmed that the improvement of the secondary collection method and collection station including the introduction of vehicles by this project contributes to the beautification of the city.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

In this study, through interview with the DNCC and DSCC Officers, it is confirmed that there was no negative influence on the environment, as noise, vibration and waste generation during

[31] According to the supervisory staff of the Zone Waste Management Office in DNCC, "Primary collection has been improved as they received multiple training by the project together with the community and primary collectors and created the community action plan for each ward (also at the time of ex-post evaluation)".

the project were in the usual range, and the waste was properly handled. In addition, because the vehicles including CNG vehicles procured through this project were provided with consideration for air pollution on the premise of replacement with aged vehicles owned by former DCC before the project, it is considered that the possibility of a negative environmental impact is low after the project completion.

2) Resettlement and Land Acquisition

It is confirmed through interview with the DNCC Officer that this project was to construct a workshop using the existing site of former DCC, and there was no acquisition of new land and resettlement of residents relating to the acquisition.

Regarding the waste collection in North and South Dhaka Cities, the average daily collection amount after the completion of this project was exceeded the target value of initial and after design change because of the increase in the amount of primary collection, the improvement in efficiency of secondary collection through the increase in containers and the increase in the number of other vehicles. On the other hand, the average daily collection rate may not have been reached the target value. It is considered as a factor that the amount of generated waste increased beyond the initial estimation during the extension of the project period. Therefore, although there is a high possibility that the increase in waste collection amount is not due to this project alone, it is considered that this project contributes to improve the amount of waste collected in North and South Dhaka Cities to a certain extent through a synergistic effect with other initiatives. It is also possible that the amount of greenhouse gas emissions of waste collection vehicles per day and the amount of greenhouse gas generated in the North and South of Dhaka Cities may not have achieved their targets due to same factors as the collection amount. However, as far as the vehicles of this project are concerned, carbon dioxide emissions are reduced[32]. On the other hand, there is a possibility that this project supports the reduction of greenhouse gas emissions such as decrease of general garbage incineration by the increase of waste collection.

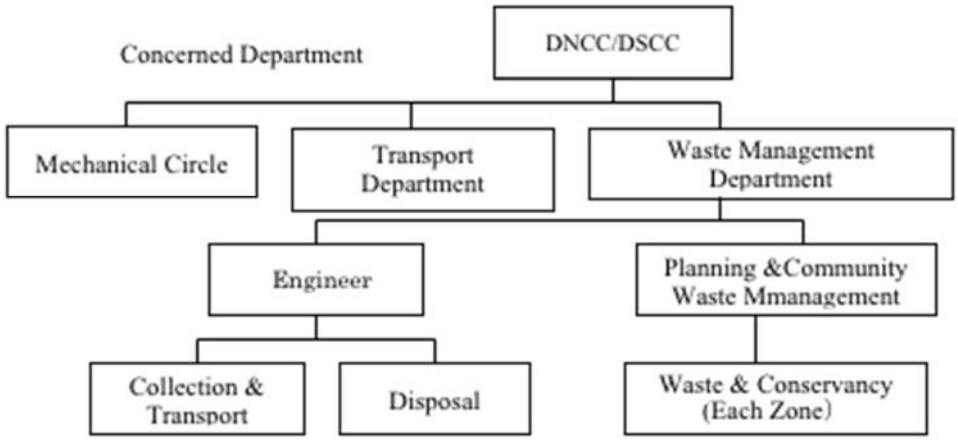
Based on the above, it is considered that effectiveness and impacts of this project are high.

[32] In other words, it does not mean that this project has no effect. It is considered that in order to increase the amount of waste collection that does not reach 100% yet, the increase of emission of carbon dioxide is unavoidable to some extent. If this project was not implemented, it is obvious that the emission of carbon dioxide would have increased further.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The responsible authority of this project is MLGRD&C. MLGRD&C has appointed DNCC as the executing agency when former Dhaka City was divided into the north and south and approved the establishment of the Waste Management Department in DNCC and DSCC with the Ministry of Finance and the Ministry of Public Administration. The institutions of operation and maintenance of the vehicles by this project are DNCC and DSCC. The organization of DNCC and DSCC is shown in Figure 2.



Source: Documents provided by JICA "the Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City and Chittagong City"

Figure 2: Organization Chart of Waste Management related sections in DNCC and DSCC

Both DNCC and DSCC are in the process of establishing a waste management system by the integrated management of the Waste Management Department. Although the Engineer department is responsible for carrying out collection, transportation (secondary collection) and final disposal in the Waste Management Department, some responsibilities are shared with the mechanical circle and the transport department as concerned departments as shown in Table 7, and the personnel are also arranged from those two departments. It is planned by the integration to the Waste Management Department to enable effective and efficient management by the department overseeing and managing all the processes related to the waste management. However, there are some points which have not been achieved because it is still necessary to share the responsibilities with several concerned departments.

Table 7: Items assigned to each department in operation and maintenance of the waste collection vehicles

Items in charge	Vehicle	DNCC	DSCC
Own vehicles	This project	Waste Management Department	Waste Management Department
	Others	-	Mechanical Circle
Periodic Inspection	This Project	Waste Management Department	Waste Management Department
	Others	Mechanical Circle	Waste Management Department & Mechanical Circle
Repair	This Project	Mechanical Circle	Waste Management Department
	Others	Mechanical Circle	Mechanical Circle
Driver	This Project	Waste Management Department (23people) & Transport Department	Waste Management Department (26people) & Transport Department
	Others	Transport Department	Transport Department
Allocation of vehicle & driver, Distribution of fuel costs & Placement of container		Transport Department	Transport Department
Container Manufacturing		Waste Management Department	Waste Management Department

Source: Interviews to Waste Management Department, Mechanical Circle and Transport Department of DNCC and DSCC

DNCC and DSCC distributed the maintenance spare parts and furnishings procured through this project between them, and as for the spare parts that can be procured in the market, strive to procure good quality supplies (oils and filters, etc.). Through the interviews with the DNCC and DSCC Officers, the division of roles within the organization and the distribution of procured vehicles and facilities etc. are confirmed, and it is also confirmed that there is no shortage of personnel by sharing responsibilities with the concerned departments. It is confirmed that there are no major problems in terms of maintenance. In the future, both the North and South Dhaka Cities will further pursue the integrated management system according to the overall budget allocation etc. From the above, it is judged that there are no particularly serious problems for realization of the project effect with regard to the institutional and organizational aspect of operation and maintenance at the time of ex-post evaluation.

3.4.2 Technical Aspect of Operation and Maintenance

Through interviews with the Waste Management Department, Mechanical Circle, and Transport Department of DNCC and DSCC each, it is confirmed that both DNCC and DSCC allocate the designated vehicles for regular collection at each secondary collection station, record the amount of collected waste, and there are no particular problems with technical matter of the waste collection and transportation and the vehicle operation and transport management[33].

[33] Regarding monitoring skills, both DNCC and DSCC measure the amount of collected waste (= load capacity) on the track scale of the final disposal site and submit the record to the Chief Waste Management Officer as a monthly

Regarding daily and periodic inspections of vehicles, at DNCC, both mechanics and drivers are equipped with skills through participating trainings of this project and of its own budget. Although DSCC does not have participants of trainings of this project, and some manuals are not shared by DNCC, some people received training from the vehicle manager of DNCC, and it is said that they have skills based on their experience. Regarding repair of the vehicles, the contractor is responsible for the CNG vehicles and the affiliated mechanics are in charge of the others. Based on the regulation, such work as parts replacement is supposed to outsource as necessary. From the above, it is considered that there is no particularly serious problem for realization of the project effect on the technical aspect of operation and maintenance of this project at the time of ex-post evaluation.

3.4.3 Financial Aspect of Operation and Maintenance

Tables 8-1 and 8-2 show the budget related to the waste management of DNCC and DSCC.

Table 8-1: Annual budget allocation of DNCC waste management

(Unit: million BDT)

Financial Year (Jul – June)		2012/13	2013/14	2014/15	2015/16	2016/17
Regular Expenditure	Fuel	228.4	244.8	259.0	266.6	251.6
	Workshop of Mechanical Circle	15.2	24.1	25.3	33.6	26.0
	Workshop of Waste Management Department	0.2	9.6	2.1	0.8	5.5
	Operation and Maintenance	14.0	38.4	22.5	24.1	29.6
	Sub-total	1,307.0	1,611.0	1,769.0	2,175.0	2,850.0
Development Budget		2,706.0	2,661.0	2,505.0	2,499.0	3,821.0
Others		-	92.0	213.0	8.0	3.0
Total		4,013.0	4,364.0	4,487.0	4,682.0	6,674.0

Source: DNCC Accounting Department

Table 8-2: Annual budget allocation of DSCC waste management (Modified Budget)

(Unit: million BDT)

Financial Year (Jul – June)		2012/13	2013/14	2014/15	2015/16	2016/17
Regular Expenditure	Fuel	340.0	350.1	399.0	450.0	420.0
	Workshop of Mechanical Circle	27.5	42.1	65.0	100.0	150.0
	Workshop of Waste Management Department	12.0	2.1	10.0	12.5	30.0
	Operation and Maintenance	60.0	24.6	72.0	82.5	76.4
	Sub-total	2,030.0	1,838.0	2,606.0	3,246.0	4,301.0
Development Budget		10,123.0	4,198.0	3,044.0	6,133.0	11,772.0
Others		86.0	57.0	276.0	367.0	450.0
Total		12,239.0	6,093.0	5,925.0	9,746.0	16,523.0

Source: DSCC Accounting Department

* For both DNCC and DSCC, the items related to the waste collection vehicles are stated for the breakdown of the regular expenditure. The total amount is the amount including other items. Regarding financial year 2016/2017 of DSCC, it is assumed that the modified budget amount is higher than the past due to an increase in the development budget amount which was not confirmed.

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report.

As shown in Tables 8-1 and 8-2, the budget for regular expenditure of waste management in DNCC and DSCC are on an increasing trend. According to the DNCC and DSCC Officers, "The budget related to vehicle operation and maintenance is allocated without problems. There is no problem with the prospect of future allocation". Therefore, it is judged that there is no particular shortage of the operation and maintenance budget of this project, and it is judged that no major problem regarding financial aspects can be seen.

3.4.4 Status of Operation and Maintenance

At the time of ex-post evaluation, it is confirmed that the vehicles by this project are largely operated without problems in operation status with maintenance such as periodic inspections and repairs through the observation and interviews at the field survey. Some spare parts related to compactor vehicles cannot be procured domestically, and the imitations are manufactured and procured in the county although they do not work like a perfect genuine product. Furthermore, as mentioned above, according to the Consultant, "Because vehicles that cannot be used may occupy 30-40%, the maintenance status up to the time of ex-post evaluation can be highly appreciated." The storeroom and training facilities and equipment by this project are managed, and procurement also has no special problem at the time of ex-post evaluation. However, regarding the training facility owned by DNCC, the usage is very limited. It is said that the mechanics and drivers who received the training of this project continue to work in DNCC and there has been no necessity for new training by the time of ex-post evaluation. According to the DNCC Officer, ways to utilize the storeroom and training building will be considered in the future.

【About Workshop Facilities】

At the time of this project planning, former DCC had two adjacent workshops (Workshop 1 and Workshop 2)[34] which were used by the Mechanical Circle and the Transport Department. In this project, the workshop facilities for operation and maintenance of the vehicles belong to the Waste Management Department and the storeroom and training facilities were built in the premises of Workshop 1. After former Dhaka City's division, the position of the Workshops became the area of South Dhaka City, the Workshop 1 (hereafter referred to as "DNCC Workshop") was allotted to DNCC, and the Workshop 2 (hereafter referred to as "DSCC

[34] At the time of former DCC, at the Workshop 1, operation and maintenance of vehicles, mainly waste collection vehicles, were carried out, and at the Workshop 2, heavy equipment necessary for road operation and maintenance etc. was operated and maintained.

Workshop") was allotted to DSCC. It was also considered to jointly use these facilities by the Waste Management Department of DNCC and DSCC each, but only the Waste Management Department of DNCC is using at the time of ex-post evaluation.

Moreover, in late 2017, the Mechanical Circle and the Transport Department of DNCC relocated the workshop function to a DNCC's temporary facility located in Gabtoli in the area of DNCC. The main reason is that drivers have got tired of the periodic inspections due to the distance[35] to the DNCC workshop in the area of South Dhaka City. In the Waste Management Department, the mechanics move the necessary equipment to Gabtoli and regularly inspect the waste collection vehicles owned by the Department. The facilities developed by this project in the DNCC Workshop are used for operation and maintenance of parts and heavy equipment of waste management. DNCC is planning to develop formal facilities for the vehicle operation and maintenance including the one for the Waste Management Department in Gabtoli, and the budget is also planned to be accounted. On the other hand, the Waste Management Department of DSCC shares the DSCC Workshop with the mechanical circle and the transport department at the time of ex-post evaluation, but there is no facility for vehicle inspection and repair. However, there is a plan for the development of workshop of the Waste Management Department, and it is said that contractors are entering the bidding stage. There is concerns about ensuring appropriate functions of workshop as the Waste Management Department after relocation for both DNCC and DSCC, but in both of them, there has been no problem arising in the maintenance of the vehicles at the time of ex-post evaluation.

Based on the above, there are no particularly serious problems in the status of operation and maintenance concerning the effects of the project at the time of ex-post evaluation.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aims to strengthen the capacity of solid waste collection and transportation and to reduce the daily emission of greenhouse gas of the waste collection vehicles in North and

[35] The distance from the northern end zone in the North Dhaka City to the DNCC workshop is considered to be around 25 km, and it takes about 2 hours to move in a traffic jam.

South Dhaka Cities by procurement of waste collection vehicles, construction of maintenance workshop, and implementation of technical assistance through seminars etc. regarding greenhouse gas reduction and improvement of vehicle maintenance, thereby contributing to the sustainable implementation of waste management service, the improvement of hygiene environment and the promotion of recycling society in the city and the reduction of green gas emission in North and South Dhaka Cities. This project that aimed at increasing the amount of waste collection by procurement of the waste collection vehicles with low emissions of carbon dioxide is consistent with the development policies such as *the Seventh Five-Year Plan (2016)* that states the necessity of environmental sustainability, the development needs for waste collection equipment, Japan's ODA policy, and thus, its relevance is high. Although the project cost was as planned, the project period exceeded the plan, and the efficiency is fair. The operation rate of vehicles procured in this project is high, and the amount of collected waste has achieved the target value. However, it is judged that the target has been achieved by the increase in the number of collected vehicles in North and South Dhaka Cities and by the synergistic effect with other projects. Furthermore, regarding carbon dioxide emissions, although it is highly likely that North and South Dhaka Cities have not achieved the reduction target, the emissions by new vehicles by this project has decreased. On the other hand, because it is confirmed that the beautification of the city had been promoted due to an increase in waste collection amount, it is judged that the effectiveness and impacts are high. As for the workshop facilities that operate and maintain the vehicles procured by this project, there are plans to relocate both in DNCC and DSCC. Although there is a concern about securing functions of operation and maintenance of equipment, there is no particular problem at the time of ex-post evaluation. As no particular problems have been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system of DNCC and DSCC, the sustainability of this project effect is 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

It is recommended for DNCC and DSCC each to proceed the development of environment of the workshops in the Waste Management Departments for the operation and maintenance of vehicles procured by this project. This is because the operation and maintenance workshop of the waste collection vehicles is a necessary facility to utilize the vehicles in good condition in

the long term. At the time of ex-post evaluation, both cities are in the process of improvement, but it is recommended to promote the development of the workshop environment as soon as possible so as not to hinder the operation and maintenance of the vehicles.

4.2.2 Recommendation to JICA

None

4.3 Lesson Learned

Synergistic effects between schemes and timing of implementation

It is considered that the amount of primary waste collection increased, the loading efficiency at the secondary collection station improved, and the number of trips of waste collection vehicles increased because of the improvement of collection undertaken by the JICA Technical Cooperation Project, “Project for Strengthening of Solid Waste Management in Dhaka City”, that has been implemented prior to this project. It is considered that the awareness of residents about environment which had been potentially improving has further improved due to the beautification of the city by the regular collection and the increase of collection amount of the secondary collection, and that the primary collection has been further promoted. These are thought to be a synergistic effect because in the projects of waste management measures, the timing and contents of the relevant activities were matched even though the schemes are different. Furthermore, the implementation of this project was not planned at the beginning of the preceding technical cooperation project. Along with the progress of the technical cooperation project, the fact that the direction of vehicle procurement centered on the compactor vehicles was confirmed among the stakeholders is also the background of this project. In similar projects in the future, it is considered to be meaningful to explore the possibility of the synergistic effect by utilizing the features of different schemes at the project formulation and planning stage. Moreover, based on a timing and details of the activities of the project, it is considered to be meaningful to carefully and flexibly incorporate efforts that take advantage of the features of different schemes when examining methods of promoting realization of effects and methods of solving problems during the project implementation.

Supplementary Documents:

① Zones under DNCC and DSCC

Division of local government	Zones at the time of planning	Zones at the time of ex-post evaluation
North Dhaka City	Zone10	Zone 1
	Zone 8	Zone 2
	Zone 9	Zone 3
	Zone 7	Zone 4
	Zone 6	Zone 5
South Dhaka City	Zone 5	Zone 1
	Zone 4	Zone 2
	Zone 3	Zone 3
	Zone 2	Zone 4
	Zone 1	Zone 5

Source: Documents provided by Waste Management Department of DNCC and DSCC

② Calculation basis concerning trends in the total amount and rate of waste collection per day in DNCC and DSCC *

(Unit: t/day)

Item		2008	2012	2013	2014	2015	2016	2017
Waste generation	Master Plan	3,670	4,196	4,323	4,471	4,624	n.a.	n.a.
	Actual**	n.a.	n.a	n.a.	5,100	5,271	n.a.	n.a.
Waste discharge	Plan (a)	3,186	3,621	n.a.	n.a.	3,977	n.a.	n.a.
	Actual (b)	n.a.	n.a.	n.a.	n.a.	4,533	n.a.	n.a.
Waste collection	Plan (Target)	1,718	2,429	n.a.	n.a.	3,052	n.a.	n.a.
	Actual (c) ***	n.a.	2,374	2,769	3,338	3,636	4,332	5,257
Waste collection rate	Plan (Target)	58%	67%			77%		
	(c) / (a)	n.a.	66%	n.a.	n.a.	91%	n.a.	n.a.
	(c) / (b)	n.a.	n.a.	n.a.	n.a.	80%	n.a.	n.a.

Source: Documents provided by JICA, the Consultant, DNCC and DSCC
*Note: All amount of waste generation, discharge, collection include amount of the private consignment
**Note: 2014: Document provided by JICA, 2015: Approximate amount calculated based on the document provided by JICA.
***Note: 2008, 2012: Document provided by JICA, 2013: Document provided by the Consultant, 2014-2017: document provided by DNCC and DSCC.

③ Repair cost of DSCC waste collection vehicle (excluding vehicle of this project)

(Unit: Million BDT)

Financial Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Repair cost of vehicles	13.9	13.2	18.6	24.7	30.3

Source: Document provided by Mechanical Circle of DSCC

People's Republic of Bangladesh

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project

"Small Scale Water Resources Development Project"

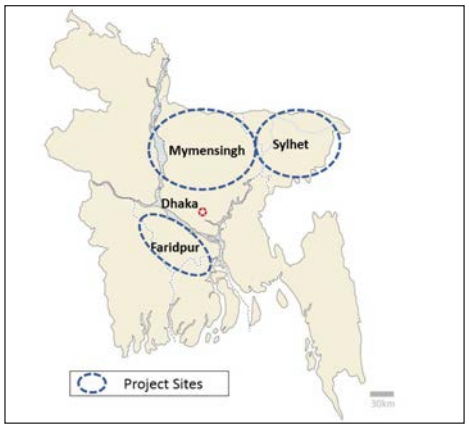
External Evaluator: Hisae Takahashi, Ernst & Young ShinNihon LLC

0. Summary

This project was implemented in the north-eastern and central parts of Bangladesh, aiming to increase agriculture and fishery production and efficiency by utilizing water resources effectively through the development of small infrastructure for water-resource management. Implementing this project was consistent with Bangladesh's development strategy that emphasizes the role of agriculture and fishery sector in helping reduce poverty, a sector plan showing the need to use irrigation and fishery water resources efficiently, development needs following frequent damage inflicted by floods, which hinder agricultural and fishery activities and the need to mitigate damage from water logging as well as Japan's ODA Policy. Therefore, its relevance is high. Though the project cost was within the plan, the project period exceeded the plan due to the increase in the number of sub-projects (hereinafter referred to as "SPs") and commencing the project was delayed due to delays in concluding the contract with a consultant, so the efficiency is fair. Improvement of irrigation facilities and various kinds of training enabled agricultural and fishery activities that were restricted by floods and droughts, and boosted crop and fish production in the SP area as well as employment opportunities for workers and agricultural and fishery income. While implementing project, working opportunities were offered to women through minor construction work. It was also confirmed that women who participated in training of income-generation activities and so on have started small businesses such as poultry farming and tailoring, helping generate income after completion of the project. Through these changes, the poverty rate of the area declined, thus the effectiveness and impact of this project are high. No major problems have been observed in the institutional, technical, financial aspects of the maintenance system and the small infrastructure facilities developed by this project are operating almost without problems. Therefore, the sustainability of the project effects is high.

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

1. Project Description



Project Locations

Constructed sluice gate
(Binna Kandi SP：Sylhet)

1.1 Background

In Bangladesh, where 77% of all people and 85% of the poor live in rural areas and poverty reduction is a development policy priority, efforts in rural areas with particularly high poverty rates were considered critical issues[1]. The country is prone to frequent floods in the rainy season due to the impact of outflow water equivalent to four time and more the domestic rainfall of neighboring countries; seriously damaging agricultural activities and people's lives in rural areas. The river erosion caused by these floods ravaged land and houses, especially of poor people and caused agricultural land to drain. Conversely, there is hardly any rainfall in the dry season and drought caused a decline of up to 30% in agricultural production and a shortage of drinking water. Accordingly, measures to prevent enormous damage in agricultural areas while securing and effectively utilizing water resources proved a major challenge when promoting regional development nationwide.

Under such circumstances, in response to the flood and water shortages during the dry season, it was decided to support efforts to develop small-scale infrastructure for flood control, drainage improvement, surface water storage, irrigation, etc., which will promote effective use of water resources through this project, to improve agriculture and fishery production in the three deprived areas (Sylhet, Mymensingh, Faridpur) where the per-capita GDP level was below the national average.

1.2 Project Outline

The objective of this project is to increase agriculture and fishery production through effective use of water resources by providing infrastructure for the small scale water resources development and management in north eastern and central zone of Bangladesh, thereby contributing to economic and social development and the poverty reduction in the target area.

[1] The poverty rate in rural areas was 43.8%, far exceeding that of 28.4% in urban areas (as of 2005)
(Source: document provided by JICA)

Loan Approved Amount/ Disbursed Amount	5,313 million yen / 5,311 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	December 2007 / December 2007	
Terms and Conditions	Interest Rate Repayment Period (Grace Period Conditions for Procurement	0.01% 40 years 10 years) General untied
Borrower / Executing Agency	The Government of the People's Republic of Bangladesh/ Local Government Engineering Department (LGED)	
Project Completion	June 2016	
Main Contractor(s) (Over 1 billion yen)	-	
Main Consultant(s) (Over 100 million yen)	Resource Planning and Management Consultants(PVT)ltd. (Bangladesh)/Northwest Hydraulic Consultants (Canada) / Nippon Koei Co., Ltd. (Japan)(JV)	
Related Studies (Feasibility Studies, etc.)	-	
Related Projects	【Technical Cooperation Projects】 ・"The Master Plan Study on Small Scale Water Resources Development for Poverty Alleviation through Effective Use of Surface Water in Greater Mymensingh of Bangladesh" (2004-2005) 【ODA Loan Projects】 ・"Small Scale Water Resources Development Project (Phase 2)"(June, 2017) 【Asian Development Bank (ADB)・Dutch government】 ・"Small Scale Water Resources Development Project Phase I" (1996),"Small Scale Water Resources Development Project Phase II" (2001)	

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: November, 2017 – January, 2019

Third-country meeting: February 18 – 21 and May 6 – 9, 2018

Field survey: March 17 – April 30, 2018 (A local consultant carried out the field study.)

2.3 Constraints during the Evaluation Study

Based on instructions from the JICA Evaluation Department, the evaluator did not enter Bangladesh for security reasons and a local consultant carried out the entire process of the field study under the direction of the evaluator. The evaluator and the local consultant had a preliminary meeting in the third country (Thailand) before the field study to share information on the evaluation policy of the project and the method of the field study. In the meeting, in order for the local consultant to accurately understand and be able to collect information necessary for the five evaluation and analysis items, materials prepared by the evaluator such as a questionnaire to the executing agency and an information collection checklist to be used in the site survey were used, so as to ensure the completeness of the collection of information and the quality of information collection used in analysis.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Bangladesh

At the time of appraisal, *Unlocking: National Strategy for Accelerated Poverty Reduction (2005)* was taken as the basic document of the government's development strategy, equivalent to *the Poverty Reduction Strategy Paper* (hereinafter referred to as "PRSP") in Bangladesh. This strategy aimed to accelerate poverty reduction by effectively linking agricultural and irrigation policies, which were summarized as follows: (1) establish effective ways of utilizing water resources nationwide, (2) improve access to safe water and 3) realize a stable water supply[4]. In the development plan for the water sector at that time, *National Water Policy (1999)*, the six items including (1) promotion of small-scale irrigation, (2) promotion of private sector participation in groundwater irrigation, (3) use of both surface and underground bodies of water, (4) promotion of crop diversification toward the efficient use of water resources, (5) regulation of chemical substance use and (6) strengthening monitoring institutions for water quality, quantity and specifications, were cited concerning agricultural irrigation. In (1), the goal targeted was to consolidate the system for collecting maintenance fees of small-scale irrigation facilities, mainly by the executing agency, the Local Government Engineering Department (hereinafter referred to as "LGED") in the Ministry of Local Government, Rural Development and Co-operatives[5]. In addition, the *National Water Management Plan (2004)* focused on improving small-scale infrastructure for using water resources for agricultural land and disseminating agricultural and fishery technology to use such infrastructural elements as a means of boosting the agricultural and fishery sectors, and

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low
[4] Source: document provided by JICA
[5] Source: document provided by JICA

on promoting cooperative network with related authorities. Furthermore, *the Guidelines for Participatory Water Management (2000)* were also prepared to promote the participation of local people in improving the utilization of water resources[6].

At the time of ex-post evaluation, the country's development plan, *Seventh Five-Year Plan 2016-2020 (2015)*, which consolidated the role of PRSP, shows the role to be played by the agricultural sector and cited the utilization of efficient and balanced land and water resources as one of the goals of the agricultural field, since about half the labor force was intensified in the agricultural sector, in which most of the poor were engaged. In addition, improving the infrastructure for water-resource management is also specified as an issue, given the propensity for flooding and circumstances where 11% of rural laborers are engaged in fisheries, more than half of whom are domestic fishery[7]. Regarding the sector plans, *National Water Policy*, *National Water Management Plan*, the G*uidelines for Participatory Water Management* etc. at the time of appraisal remained effective as of the time of ex-post evaluation.

As mentioned above, in the development plan and the plan of the water-resource management sector of Bangladesh, the effective use of water resources in agriculture and fishery and improving infrastructure for water-resource management have been emphasized both at the time of appraisal and ex-post evaluation. This project was conducted to assist the plan and its consistency with the development policy was confirmed.

3.1.2 Consistency with the Development Needs of Bangladesh

Bangladesh is a low plain where over 90% of the land area is 9m or less above sea level and frequent flooding during the rainy season has damaged people's lives to a huge extent. Drainage conditions remain poor even after flooding, with prolonged clogging in agricultural land affected by such flooding, which affected agricultural production. Conversely, during the dry season, droughts cause agricultural production to decline by up to 30% or so. Accordingly, while coexisting with natural conditions and helping reduce poverty by spearheading rural development, the need emerged to reduce flood damage and shorten the flooding period by using water resources effectively through improvement of small-scale reservoir and irrigation facilities. At the time of ex-post evaluation, rice, the country's main agricultural product, is produced in over 80% of the total cultivated area during the rainy season and 58% of the same during the dry season. Rice production in the rainy season is about 18% lower on average than during the dry season, with yields of 15.8 and 18.9 million tons during the rainy and dry seasons respectively in 2016. The main reasons are still the damage caused by the flood, the

[6] Source: document provided by JICA
[7] Source: *Seventh Five-Year Plan 2016-2020 (2015)*
http://www.plancomm.gov.bd/wp-content/uploads/2015/10/7th_FYP_18_02_2016.pdf
(accessed as of July 26, 2018)

delay in cultivation following such damage and the lack of drainage facilities. The effects of drought in the dry season and the supply of insufficient irrigation water are also cited.

In this project, the three deprived regions (Sylhet, Mymensingh and Faridpur areas), each with per-capita GDP below the national average at the time of appraisal, were selected for the project areas (see Table 1). Although the poverty ranking[8] of the target area in Bangladesh subsequently improved after the appraisal, as shown in the poverty map of Figure 1, a sizeable number of households in the target area were still confirmed as in absolute poverty[9].

Table 1 Poverty ranking of target areas

Area	District	Poverty ranking	
		2000	2010
Sylhet	Habiganji	29	20
	Maulvibazar	40	21
	Sunamganj	53	21
	Sylhet	31	20
Faridpur	Faridpur	48	20
	Gopalganj	51	27
	Madaripur	64	34
	Rajbari	45	26
	Shariatpur	59	34
Mymensingh	Jamalpur	50	34
	Kishoreganj	43	16
	Mymensingh	33	32
	Netrakona	30	20
	Sherpur	55	30
	Tangail	56	18

Source: document provided by JICA and executing agency
Note: Ranking in 64 districts nationwide

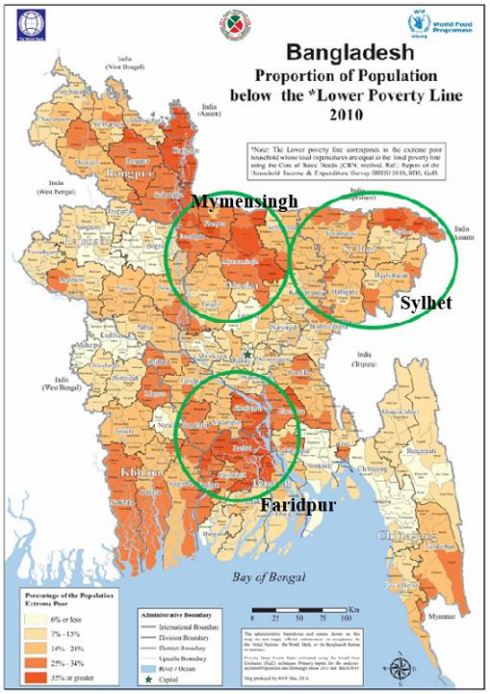


Figure 1 Poverty map

Source: WB, Bangladesh Bureau of Statistics and WFP, Lower poverty line, Poverty of Bangladesh 2010

3.1.3 Consistency with Japan's ODA Policy

Country Assistance Program for Bangladesh (May 2006) and *Medium-Term Strategy for Overseas Economic Cooperation Operations* (FY2005-2007) specified the need to strengthen support for rural areas as a more direct poverty-reduction measure. Rural development was regarded as a priority area also in FY2006 Country Assistance Strategy for Bangladesh[10]. This project developed small-scale infrastructure for flood control, drainage improvement, surface water storage and irrigation and helped improving agricultural and fishery production through water-resource management, led to the contribution of the poverty reduction in the three areas with poverty levels below the national average. Accordingly, it is consistent with areas of

[8] The latest available data is 2010.
[9] The map shows the proportion of households in absolute poverty in each district in color. The darker the color, the higher the proportion of poor households.
[10] Source: document provided by JICA

priority support given by Japan to Bangladesh.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The major output of this project comprises the construction of small infrastructure for water-resource management, procurement of construction materials, Survey Investigation and Design (hereinafter referred to as "SID"), arrangement of facilitators, capacity-building training and consulting services. The plan and actual output are shown in Tables 2 to 5.

Table 2 Planned and actual major output (Civil works, procurement of construction materials)

Plan	Actual
【Civil works】 1) Flood management (FM) 65 SP 2) Drainage improvement (DR) 80 SP 3) Surface water storage 50 SP 4) Irrigation facility (IRR) 5 SP Total 200 SP ＊Since SP would be selected based on the executing agency's criteria (more than 70% of residents are willing to become members of the water management cooperative association (WMCA)), the actual number may differ from the number above.	1) CAD 8 SP 2) Water conservation (WC) ・CAD 1 SP 3) FM & DR and WC 45 SP 4) WC 31 SP 5) DR・WC 44 SP 6) FM ・WC 8 SP 7) FM 4 SP 8) FM &DR 40 SP 9) FM&DR・ IRR 2 SP 10)DR and IRR 47 SP 11)DR 12 SP Total 242 SP
【Procurement of construction material】 Construction material, vehicles for site management /trainings and monitoring and office equipment	Nine 4WD vehicles, six pickups, 185 motor bicycles
【Construction of WMCA offices】 No information	225 offices for WMCA were constructed.

Source: documents provided by JICA and questionnaire

Note 1：CAD is an abbreviation for Command Area Development, which mainly refers to facilities such as header tank (pressure adjustment), pumping and distribution pipe to farm. In addition, small-scale infrastructure, where WC is mainly a control gate for water flow, FM for repairing banks and water flow control facilities, DR for drainage canals, IRR for irrigation canals and so on, was developed.

Changes of output and reasons

【Civil works: Increase in the number of SPs】

It was pointed out at the time of appraisal that the number of SPs after the selection may

differ from the plan due to the nature of the project developing small infrastructure facilities over a wide area. In fact, the SP number was actually 121% of the planned total. It was explained that the increase was mainly attributed to the project steering committee putting forward a proposal to increase the number of SPs due to the unused loan caused by fluctuations in the foreign exchange rate. Although the descriptions of the facility content differ from that at the time of planning, it can be explained that the contents of classifications 1) to 4) at the time of appraisal were conducted by combining each of the items and all the planned contents were covered as follows: 1) flood management = water conservation・CAD, 2) drainage improvement = drainage, 3) surface water storage = water conservation・CAD, 4) Irrigation facility = irrigation.

【Construction of WMCA offices】

The preceding project, supported by ADB and the Dutch government, included plans to construct the WMCA offices and made them the base for WMCA activities. Though it was not included in the plan at the time of appraisal, to ensure consistency with the proceeding project and to have its needs recognized, construction of WMCA offices was decided on for this project in the same way when formulating the revised project plan. Since land was available in 225 of the 242 actual SPs, the number of SPs where the office was built was 225. Regarding the remaining 17 offices, the land was secured after completion of this project and it was decided that they would be constructed using an ODA loan "Small-Scale Water-Resources Development Project (Phase 2)" as the successor to this project.

Table 3 Planned and actual major output (SID and community facilitators)

	Plan	Actual
【SID】		
1) Participatory Rural Appraisal	Approx. 260 SP	335 SP
2) Feasibility Survey; F/S	Approx. 240 SP	331 SP
3) Detail Design	Approx. 220 SP	258 SP
4) Baseline Survey	Approx. 10 SP	20 SP
【Facilitator】 Allocation of facilitators (each district) for technical assistance and dissemination activities including training sessions and so on, Allocation of community assistants for institutional establishment support for WMCA		242 community assistants Five general facilitators

Source: documents provided by JICA and questionnaire

Changes of output and reasons

【SID】

Various surveys related to the design survey were also carried out according to the needs of the sites at the implementation stage, which meant a difference from the plan emerged, however, it

can be said that each of the surveys constituted a necessary process to select the appropriate SP.

【Facilitator】

The community assistants, named as facilitators during the appraisal, did not finalize the number to be placed at the time of appraisal. However, since the same number as the actual SP number was scheduled for placement, it can be said that the number of community assistants was placed as planned. The community assistants instructed each SP on to smoothly establish WMCA and the daily operation, while as for general facilitators, five were selected for all target areas of this project; supported for SPs whose community activities did not proceed steadily.

Table 4 Planned and actual major output
(Total number of trainees for capacity-building training)

	Plan	Actual	Plan/actual
1) Orientation & Management	20,045	24,915	124%
2) Plan, design and construction	33,767	14,567	43%
3) Establishment and management of WMCA	157,061	126,572	81%
4) Operation & management	28,773	1,993	7%
5) Agriculture	23,720	28,823	121%
6) Fishery	21,481	4,128	20%
7) Environment	11,230	10,145	90%
8) Gender and development	8,455	14,384	170%
9) Overseas trainings	112	44	40%
Total	**304,644**	**225,571**	**74%**

Source: documents provided by JICA and questionnaire

Changes of output and reasons

【Trainings to strengthen capacity】

Training was also expected to change to a certain extent from the beginning, given the need to make a plan by considering site circumstances as appropriate following the SP selection. Consequently, the total number of training participants was lower than the plan (74% of the plan). The number of participants in “Operation & Management” and “Fisheries” training (technical guidance) largely decreased, while that for “Gender and development” largely increased.

It was not possible to conduct “Operation & Management” training by the end of project period in 50 SPs where the facility constructions were completed in the later stage of the project period. Furthermore, there were WMCA with only one training session, despite multiple such sessions planned originally in the abovementioned SPs. Accordingly, the number of training sessions was significantly lower than planned. The contract with consultants, having already extended for two and a half years, finally terminated half year before the

project completion without further extension. It is because thanks to training conducted by then, LGED could conduct training on behalf of the consultants. LGED provided follow-up training for the above 50 SPs which could not receive the trainings by the end of June 2016. It was confirmed that all WMCA, which were visited by site surveys, had received "Operation & Management" training. Number of trainees of Fishery training was significantly lower than planned because it was limited only to SPs expected to have potential for fishing activities, out of the overall SPs. In addition, the reason for the increased number of participants in "Gender and development" training included holding multiple training sessions within a short period responding the needs and convenience of participants.

More importantly, training sessions were conducted for WMCA members; not only to strengthen capacity but also to promote understanding, cooperation and motivation to participate, underline their roles and responsibilities and promote continued participation in future. With this in mind, it is considered that the training sessions were planned and implemented properly, since all areas of this project were covered (except for some "Operation & Management" and "Fishery"). It was also confirmed that assistance had been obtained from the relevant ministries and agencies such as the Ministry of Agriculture and Ministry of Fisheries, when planning, implementing and monitoring training sessions[11] to improve technical capacity.

Table 5 Planned and actual major output (Consulting services)

Plan	Actual
1) Plan, design, pre-examination, quality management and monitoring 2) Support for participation of community 3) Support for tendering and planning 4) Capacity strengthen of executing agency, WMCA and related institutions 5) Supervising supports to related institutions and collaboration	While service was conducted as planned, the contract period was extended due to the increase of SP. (Original contract: 51months, additional re-contract : 30 months)

Source: documents provided by JICA and questionnaire

【Consulting services】

The consulting services was implemented as planned and the period of re-contracting with the increase in SP was considered appropriate, since it was realistically extended according to real circumstances at the time.

3.2.2 Project Inputs

3.2.2.1 Project Cost

While the total project cost was planned to be 7,538 million yen (of which yen loan

[11] It indicates training sessions for 5) Agriculture and 6) Fishery in Table 4.

portion was 5,313 million yen), the actual cost was 7,428 million yen (of which yen loan portion was 5,311 million yen) and within the plan (99% of the plan). Cost covered by Bangladesh side exceeded the plan in local currency as the number of SP increased, however, the amount converted into yen was reduced to within the plan due to the fluctuation of the exchange rate[12] (95% of the plan).

3.2.2.2 Project Period

Though the planned project period of this project was 77 months in total from October 2007 to February 2014[13], the actual period was 103 months in total from December 2007 to June 2016, exceeding the plan (134% of the plan). This was mainly due to delays in starting the project due to delays in procuring consultants and extension of the period with the increase in SPs. In this project, while the loan became effective in March 2008, given the delay in selecting consultants, the commencement was postponed to April 2009. Delays in selecting and concluding contracts with consultants were exacerbated by the situation, while the internal procedures also took longer than expected due to the temporarily increased workload in ministries given the election of December 2008 and the subsequent launch of the new administration[14]. In addition, the detailed design, tendering period and consulting services period were also extended due to an increase of around 20% in the number of SPs at the time of appraisal. The extension of surveys and consulting services accompanying the increase in SP was indispensable for implementing the project and can thus be considered reasonable.

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

（1） Financial Internal Rate of Return(FIRR)

Since it was not calculated at appraisal, no recalculation was carried out.

（2） Economic Internal Rate of Return (EIRR)

The economic internal rate of return (EIRR) at the time of appraisal was estimated at 36% as the average rate of various SPs[15]. EIRR at the time of project completion was calculated 12%[16]. This is because the EIRR at the time of appraisal included both agricultural and fishery production increases in benefits, whereas benefits at the time of project completion

[12] At the time of appraisal; 1 taka＝1.66 yen, At the time of project completion, 1 taka＝1.38 yen and as an average during project implementation: 1 taka＝1.34yen

[13] The project period is defined from the Loan Agreement signing month (starting point) to the civil engineering completion month (completion).

[14] Source: questionnaire

[15] 36% is the average EIRR for four types of SPs. The EIRR of each SP is as follows: flood control = 24.8%, drainage improvement = 48.6%, surface water storage = 17.4%, irrigation = 45%. Cost of integration at the time of calculation was cost = project cost (excluding tax) + operation and maintenance expenses, benefit = increase in agriculture · fishery production, project life = 30 years.

[16] Source: document provided by JICA. EIRR at the time of project completion was data recalculated by the executing agency not by this ex-post evaluation survey.

included only agricultural production but none from fishery production[17]. Furthermore, it is because there was limited benefit from agricultural production in most areas of the SPs. Since most SPs that completed at the last year of project period experienced only one or two times of harvesting in most SPs by the project completion, even though some of these SPs can perform three times of harvesting year-round. Given that data on agricultural and fishery production by areas after project completion needed for quantitative analysis could not be obtained from the executing agency, EIRR could not be recalculated at the time of ex-post evaluation.

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[18] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

At the time of appraisal, the provisional indicators, namely "benefited area", "number of benefitting households", "number of WMCAs", "collection rate of irrigation water charge", "production of rice" and "production of fish" and their targets were set based on the SP selected samples as shown in Table 6, whereupon it was decided that both baseline data and target would again be revised after the SPs were selected after the project commencement.

Table 6 Baseline and target for indicators which were set at the time of appraisal

Indicator	Baseline (2005)	Target (Two years after completion)
Benefited area (ha)	—	167,000
Number of benefitting household(no.)	—	259,000
Number of WMCA (no.)	—	200
Collection rate of irrigation water charge (%)	—	100
Production of rice (ton/year)	778,396	1,000,000
Production of fish (ton/year)	10,000	27,000

Source: document provided by JICA

242 SPs were selected in 2010 after the project commencement and the target was again set as shown in Table 7. SP construction proceeded in phases and the effect indicators of each SP were monitored during the project. Meanwhile, though LGED continues to monitor efforts to maintain and manage the infrastructure related to rural development, data after the project completion was not collected since information on production was outside LGED

[17] According to LGED, for fisheries, there were many cases where it was made for consumption by themselves and the catch was smaller than the agricultural harvest, so it was not included in the benefit.

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

jurisdiction. Accordingly, the actual data shown in Table 7 was that obtained from the SP completed during the project period until project completion[19].

Table 7 Target and actual operation and effect indicators set after the project commencement

Indicator	Target[Note1]	Actual			
		2012/13	2013/14	2014/15	2015/16
	2 Years After Completion	A part of SP completed			Completion year
		27 SP	83 SP	143 SP	242 SP
Benefited area (ha.)	130,000	14,438	44,920	73,676	127,863
Number of benefitting household (no.)	150,000	15,486	38,058	71,923	115,125
Number of WMCA (no.)	235-250	27	83	143	242
Production of serial (ton/year)	184,000	10,714	34,536	67,918	n.a.
Production of no serial (ton/year)	145,000	4,567	14,432	31,637	n.a.
Production of fish (ton/year)	10,000	28	95[Note2]	156[Note3]	717[Note4]

Source: documents provided by executing agency

Note 1: Target set as of 2010

Note 2: Production of fish for 48 SPs, Note 3: Production of fish for 92 SPs, Note 4: Production of fish for 217 SPs

(1) Benefited area, number of benefitting household, number of WMCA formed

Although there is no baseline for these indicators[20], the actual benefited area at the time of project completion reached 98% of the target and thus almost achieved the target. It can be said that the number of benefitting households also largely attained the target, despite being slightly lower than 80% of the figure. Since the benefited area achieved 98% of the target, it can be assumed that benefited area per benefitting household increased and that the target number of benefitting households was largely attained. The number of WMCA formed was also equivalent to the number of SPs, so it can be said that the number of WMCA largely reached their target. It is possible to say that even in areas where sufficient water could not be obtained, due to the development of reservoirs and irrigation facilities, scope to utilize water resources more widely and more effectively and efficiently emerged.

(2) Increase of crop production

As mentioned above, the latest data obtained at the ex-post evaluation was that for 2014/2015. At the time, 143 out of 242 SPs were completed, namely 59% of the total SPs. Therefore, although it is impossible to measure the achievement situation accurately, considering the number of SPs completed in 2014/2015 and confirmed if the target value is 60%, the achievement rate for crop production in 2014/15 is about 62%.

According to the executing agency, triple cropping is common in Bangladesh. Conversely, there were also many SPs which did not cover the planned three cultivation periods, since the

[19] According to LGED, it is assumed that the impact assessment will be conducted five years after completing all SPs, as with the preceding project.

[20] The baseline of the number of benefitting households and WMCA formed can be said as zero.

monitored data gathers data from the following month after the completion of the facility. For example, while 83 SPs was completed in 2013/2014, many SPs obtained data from the second cultivation period because the completed timing of each SP was different resulting only 27 SPs, completed in 2011/2012, could monitor the actual data of three cultivation periods. Moreover, according to the executing agency, when confirming the agricultural production as the project effect, it is desirable to check the production at least two years after completing the facility constructions since one year after completion of the facility includes cases not covering multiple cultivation periods as described above and approximately one year would be needed to correct and adjust defects occurring in the facility. Therefore, for targeting the production of 27 SPs, the incremental production of 27 SPs and incremental yield per hectare are shown in Table 8 and the estimated effects of 242 SPs based on information of 27 SPs are shown in Table 9 to determine the effect more accurately. Consequently, it was considered that the estimated production of 242 SPs achieved 80% or more of the target though the same cultivation conditions may not apply to all 242 SPs.

Table 8 Comparison on incremental crop production of 27 SPs immediately after project completion and two years after project completion

	Cropped area (ha)	Incremental production (t)	Incremental yield per ha (t)
Immediately after SP completion (2012/2013)	14,438	15,280	1.058
2 years after SP completion (2014/2015)	14,438	30,340	2.101

Source: document provided by executing agency

Table 9 Comparison of incremental crop production of 242 SP immediately after project completion and 2 years after project completion (estimate)

	Cropped area (ha)	Incremental yield per ha (t)	Incremental production (t)	Target (t)	Achievement rate (%)
Immediately after SP completion (2012/2013)	127,863	1.058	135,320	―	―
2 years after SP completion (2014/2015)		2.101	268,691	329,000[Note]	82

Source: document provided by executing agency

Note: Data include the total crop production of cereal and non-cereal. Therefore, the target was also set as the sum of the cereal production (184,000 t) and non-cereal production (145,000 t).

(3) Increase in fish catch

The catch shown in Table 7 was less than 10% of the target. Conversely, when measuring the effectiveness of fishing activities, it is necessary to consider the fact that fishery activities did not commence immediately after completion of the facilities at each SP. After completion of the facilities, fishery activities have started followed by the establishment of a carp farm, implementation of an aquaculture demonstration utilizing the pond and various training related to fishery, etc. through cooperation of the Ministry of Fisheries and Livestock. It is

expected that the facilities developed under this project will facilitate management of wetlands and floodplains and so on in the target area, to prepare an environment suitable for fish ecology over several years, whereupon fish production will gradually increase by utilizing members' experiences gained through training. Therefore, although catches may not increase rapidly after the SP completion year, it is expected that productivity will gradually increase over the next few years. Accordingly, it had not reached the target as of completion of the project, despite commencing the new fishery activities. Conversely, according to the results of the questionnaire conducted on completion of the project, 95% of the 142 SPs who responded answered that the catch volume had increased. As the majority of the areas did not originally carry out fishing activities except for the purpose of domestic consumption in the target area, it can be said that the result of the questionnaire shows scope to boost the catch volume by starting new fishery activities after the project was implemented (see Table 10).

Table 10 Result of questionnaire about fish catch amount

Increase	No change	Decrease
95%	1%	4%

Source: documents provided by executing agency
Note: Questionnaire survey was conducted for 142 SPs at the project completion.

3.3.1.2 Qualitative Effects (Other Effects)

To collect information to supplement the qualitative effects and those described above, Focus Group Interviews (hereinafter referred to as "FGIs") were conducted for WMCA members during the site visit by the local consultant[21], the results of which are shown below.

(1) Strengthening the local community's organizations and raising awareness through WMCA activities

According to the executing agency, members of committees and WMCAs participated in the facility construction, monitoring and quality management activities while implementing this project, helping foster a sense of ownership among beneficiaries toward the completion of works. A system was also established to perform maintenance and sustainable management under the WMCA initiative.

[21] During this evaluation, site visits were conducted by local consultant at 16 SP sites and FGIs were also conducted at all sites. Sites visited included 4 SPs in Mymensingh area, 6 SPs in the Faridpur area and 6 SPs in the Sylhet area. FGI was implemented for 12 WMCA members at each SP. As one third of WMCA committee members were to be composed of women, around 30% of all interviewees were women.

Also, in FGI, it was explained that the members, mainly WMCA committee members, participated in the capacity-building training implemented in this project and utilized the knowledge gained thereby for agricultural and fishery activities. Since WMCA did not exist before the project, most members responding were unable to provide feedback on changes in terms of strengthening WMCA and raising awareness. However, it is confirmed that respondents have been involved in organized WMCA as members and cooperated in providing a workload and a member fee (water charge) for maintenance works. Accordingly, it can be said that awareness of the importance of maintaining and managing facilities was raised by participating in this project. Moreover, it was decided that one third of the WMCA committee members would be women. In Bangladesh, where very few women participate in social activities, having women elected to a committee initiated changes in terms of awareness of women's participation in WMCA and encouraged women to participate in regional and social activities.

WMCA members maintaining river bank
(Kalagang Roar Haor SP Sylhet)

(2) Increase in crop and fish production
(supplementary information on quantitative effects)

In the answers to the questionnaire from the executing agency and the result of FGI, flood damage decreased during the monsoon period and more irrigation water could be used during the dry season, thanks to improvements in facilities such as irrigation, drainage, water storage and adjustment gates. Consequently, harvesting and fishery areas thrived, the cultivatable period extended and scope emerged to obtain water for irrigation and aquaculture ponds promptly, timely and as required. Accordingly, increases in the production of rice, jute and vegetables etc. and fishery catches were confirmed in areas where fishing activities were carried out (see Table 11).

Pre-harvest Boro rice
(Binnakandi Chara SP in Sylhet)

Fish culture in artificial pond
(Sutiar Khal SP in Mymensingh)

Table 11 Change of crop and fish production (Answers in FGI)

Area	SP	Crop production	Fish production
Mymensingh	Dogachi	Boro rice [Note1] production increased approximately 2-3 times. 60kg/1khara[Note 2] à 120-160kg/1khara.	Culture fishery started at 20 ponds as a new activity after the project.
	Foliar Khal	Production increased approximately 4 times for Boro rice and 3 times for Aman rice [Note 1], Cultivation of vegetable and Robi [Note 1] were also started after the project completion.	Due to increased water volume, the fishery catch increased about 3-4 times in canals and fish culture ponds.
	Morahashi	Both Boro and Aman rice production increased by 2 to 3 times.	The fishery catch increased 2-3 times compared with the figure before implementing the project.
	Sutiar Khal	Cultivation became possible on 100% of the land and crop production increased 1.6 times.	The fishery catch increased 2-3 times compared with the figure before implementing the project.
Faridpur	Baneswardi	Significantly increased. Approximately 200kg/acre for jute and 400kg/acre increased. Harvesting of Robi and onions and so on also become possible.	N.A.
	Satgavia	Increased. Rice production pattern increased from double- to triple-cropping.	Fishery catch by members who participated in fishery training sessions increased 3 to 4 times.
	Rotandia-Balughat	Production of Aman, Robi and Onion doubled and using higher quality water also boosted the quality of jute.	Almost tripled.
	Bangdubi Beel	Production of Boro rice and jute approximately doubled. Production of onions started.	Largely increased.
	Auliar Char	Production of Aus and Aman rice as well as jute increased 2-3 times. Production of Boro rice, which was not possible before the project, emerged at 1200kg/acre.	Due to the use of canals and starting to use fish culture ponds, the fishery catch roughly tripled.
	Palordi-Alinagar	Production of all crops increased, 1.7 times for Jute and approximately doubling for Boro and Aman rice.	Due to the use of canals and starting to use fish culture ponds, the fishery catch roughly tripled.
Sylhet	Binnakandi	Production of Boro rice increased 2-3 times and significantly for vegetables, which could not be produced due to the shortage of water.	N.A.
	Bawa-Chamurakandi Bora Haor	Rice production increased about 4-5 times.	N.A.
	Kalagang Roar Haor	Production of Boro rice increased about 2-4 times.	N.A.
	Bongaon Chhara	Production of Boro rice roughly tripled.	Increased.
	Moti Khal	Production of Boro rice roughly doubled. 600-640kg à 800-1200kg /cultivation area	Fish production doubled.
	Bara Chhara	Production of Boro rice has increased from 40-60kg/bigha to 80-100kg /bigha (1Bigha=1500- 6771m^2)	Approximately tripled.

Source: prepared based on the record of FGI

Note 1: Boro rice is a type of rice cultivated from October to April (dry season), Aman rice is cultivated from May to August and September (monsoon season), Aus rice is from January to April and May (pre-monsoon season). Robi refers to crops other than rice. It includes wheat, vegetables, spices, etc. and cultivation requires considerable water.

Note 2: 1 Khara＝7decimal=0.07 acre

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Contribution to poverty reduction (increase in farmer's income)

As mentioned in effectiveness, beneficiaries answered that the production of crops and fish had increased and women's participation in economic activities such as poultry, tailoring, making baskets and so on had been promoted through participation in training to develop small-scale infrastructure facilities and activities related to agriculture, fisheries, income-generation, etc. Consequently, it can be said that incomes have increased, which has helped reduce poverty in each region. As seen in the answer in FGI for Table 12, it was confirmed that the poverty rate was reduced across the board after completion of this project.

Table 12 Situation of poverty reduction based on information confirmed at FGI

Area	SP	
Mymensingh	Dogachi	Due to the stimulation of agricultural and fishery activities in the area, no families categorized as poor were confirmed at the time of ex-post evaluation.
	Foliar Khal	Thank to implementing this project, the poverty rate of this area has been considered lowered by about 60%.
	Morahashi	The poverty rate declined with the activation of agricultural and fishery activities and is currently considered to be about 10%.
	Sutiar Khal	Although about 20% of residents can still be considered in poverty, it can be said that the poverty rate in the SP area has declined drastically due to the revitalization of agriculture and women's economic activities.
Faridpur	Baneswardi	Since income-generation activities were implemented after this project, incomes have increased, which has helped reduce poverty, despite the lack of figures.
	Satgavia	Along with the increase in individual agricultural activities and incomes, it helps reduce the poverty rate in the area.
	Rotandia-Balughat	It was answered that the poverty rate among WMCA members was almost zero.
	Bangdubi Beel	On completion of this project, the poverty rate of this area had decreased by 10 - 15%.
	Auliar Char	The poverty rate dropped by 40%, 10% of which was considered thanks to this project.
	Palordi-Alinagar	The poverty rate of the target area decreased by 30 - 40%. About 10% is thought attributable to the impact of developing irrigation facilities.
Sylhet	Binnakandi	The poor in the SP area has decreased. Despite the lack of official data, 80% of population were considered poor, which decreased to about 20% after the project.
	Bawa-Chamurakandi Bora Haor	Despite the lack of data, through SP income-generation activities, incomes have increased, which has also helped reduce poverty.
	Kalagang Roar Haor	It can be said that the proportion of poor has been reduced by about 10 - 15%.
	Bongaon Chhara	About 70% of poverty has been reduced. As things stand, the proportion of poor has fallen to about 10%.
	Moti Khal	At the time of ex-post evaluation, the poor households were only limited.
	Bara Chhara	Poor families have declined by about 20% and the current situation is about 10% of the total.

Source: prepared based on the record of FGI

Note: Respondents do not set criteria for defining poverty and explained the poverty situation as judged by the living conditions of local people.

(2) Increased employment opportunities

According to the executing agency, it was analyzed that implementing this project has stimulated agricultural and fishery production, generating employment opportunities of 3.1 million man/day[22]. Local consultant on site visits for field investigations confirmed that employment opportunities had been generated and boosted in all 16 areas visited as a result of FGI. Given the limited opportunities for labor before this project, one or two people from each household had been working in neighboring cities. However, since most of the areas had expanded agricultural and fishery activities after the project, migrant work was no longer needed. In reverse, certain areas short of labor during the harvesting season were also confirmed. At the same time, it was also mentioned that employment opportunities for women had increased. As well as employing workers, employment of women involved in poultry farming, vegetable cultivation, tailoring and basket-making etc. was also confirmed by using the knowledge and experience of income-generation activities learned through capacity-building training, which played a key role in boosting household income. Cases of expanding the agricultural activities and income-generation activities of women after this project are shown in the following box.

BOX 1: Women's income generation activities: departure from poverty

Mrs. A, a member of Baneswardi SP in Faridpur, received poultry farming training in this project. On completion of the project, she took out a loan of 5,000 Taka (about 6,500 yen) from WMCA and started poultry farming by utilizing her training knowledge and experience. Although it used to be difficult for families to eat enough meals each day, the income she now earns varies from about 20,000 to 30,000 Taka (approximately 26,000 – 39,000 yen) per month. Moreover, her children can now attend school and eat three meals a day. She is also involved in vegetable cultivation in her small yard alongside poultry farming and harvesting became possible. She is delighted with the WMCA activities, since they allowed her to escape poverty by utilizing the fruit gained from capacity building training.

BOX 2: Expansion of agricultural activity

Mr. B, a WMCA member of Binnakandi SP in Sylhet, used to cultivate rice in this area before the project. On completion of this project, annual rice production tripled. With the support of WMCA, he purchased a rice crushing machine and can also earn 500 to 700 taka per day from a crushing mill. With the increased income, currently he has started new activities to cultivate a demonstration plot in a portion of farmland for high-grade seed for rice cultivation.

[22] Source: questionnaire. This is an estimated figure by the executing agency based on the survey for 142 SPs. Man/day is one of the units to express workload and shows how many people need to work for how many days to complete works. It is indicated as the "number of persons × number of days".

BOX 3: Purchasing land through income generation activity

Mrs. C, a WMCA member of Kalagang Roar Haor SP in Sylhet, engages in duck farming for a living. Before the project, since she did not own land, she needed to work as a labourer on landowners' land to earn income. She became a WMCA member after WMCA was formed, and participated in training on duck farming. Receiving support from WMCA, she started duck farming activity. She currently earns 150,000 taka (about 200,000 yen) per year. With these earnings, she could purchase 60 decimal (0.6 acres) of land, which makes it possible to cultivate rice.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

Based on the *Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations*, it was considered that the undesirable effects on the environment of the project is not likely to be serious and the project was categorized as B. The environmental impact assessment report was not required under the domestic laws of the country[23]. According to the executing agency, the construction monitoring committee of the Contractor / WMCA monitored the impact of air, soil, water quality and noise in the 242 SP areas, details of which were periodically reported to LGED and no issues was confirmed. The WMCA members also explained that no negative impact was imposed on the environment, even in the interviews conducted during the site surveys. Therefore, it is judged that no negative impact was imposed on the natural environment by this project.

(2) Resettlement and Land Acquisition

At the time of appraisal, land acquisition of 300 hectares was assumed. However, the fact that the majority of the necessary land was state-owned land, the land of the WMCA office was provided free of charge from the WMCA, thus land acquisition actually limited only 0.46 hectares, which was significantly lower than the plan. According to the executing agency, all land acquisition was carried out without problems according to domestic procedures. It was also confirmed with the executing agency that there was no resettlement.

As mentioned above, it is confirmed that the crop production and catch volume had increased in SP area since agricultural and fishery activities previously restricted during rainy and dry seasons became possible thanks to improved small infrastructure facilities for water management such as irrigation and drainage as well as various training. In addition, income has increased and employment opportunities for workers in agricultural and fishery activities have proliferated. While implementing the project, women were given opportunities to engage in labor through minor construction work, while females participating in training such

[23] Source: document provided by JICA and questionnaire

as income-generation activities became involved in activities to boost income after completion of the project. It was also confirmed in FGI that such efforts could help expand employment opportunities and reduce the rate of poverty in the area.

In light of the above, this project has largely achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

Daily maintenance of the infrastructure facilities constructed in this project is handled by the WMCA formed by each SP. Each WMCA has established a WMCA committee comprising about 12 persons[24] on average and the maintenance subcommittee is selected under the committee. The subcommittee is responsible for understanding the cultivation area and water usage of members, formulating a maintenance plan based on said usage, collecting water charges or member fees from members and also conducting the necessary activities for management and maintenance of the same.

While WMCAs perform daily Operation and Maintenance (hereinafter referred to as "O&M"), handling breakage due to natural disasters, replacement due to aging and large-scale repairs are supported by LGED, including financial aspects. Integrated Water-Resource Management (hereinafter referred to as "IWRM"), an LGED unit, has continuously monitored facilities, the collection rate of member fees, etc. and provided technical advice as necessary. They oversee training to the O&M subcommittee as well as support the emergency response.

At the time of ex-post evaluation, a total of 11,184 staff members are assigned to LGED nationwide and among the 204 head office staff members, 17 staff of the maintenance team controlled the O&M of small-scale infrastructure facilities. In actual fact, the headquarters of LGED help supervise/manage and provide technical support to regional offices such as district and Upazila (sub-units of districts) offices, while the regional offices provide WMCA administrative and technical support. Specifically, the scope includes O&M guidance to the O&M subcommittee, assistance to assess the necessary maintenance activities, advice to prepare the O&M annual plan, support for urgently needed maintenance and so on. According to LGED, in each regional office, about four to five engineers and seven to nine technical staff members are assigned and the lack of any staff shortages, including in the target area of this project, was confirmed.

[24] It was decided by a contract between the WMCA and LGED that one third of the committee members would be women and the term of office is three years.

3.4.2 Technical Aspect of Operation and Maintenance

In this project, a total of 1,245 O&M training sessions were conducted for WMCA members. Further, a detailed follow-up on SP's O&M emerged through follow-up training after handing over of the facilities maintained by the SP[25]. At the time of the ex-post evaluation, LGED answered to questionnaires that almost all WMCA carried out the O&M activities without problems and even on the site where the local consultant visited for the field survey, the WMCA members basically understood the required activities based on the O&M manual and tried to implement them. In particular, it was confirmed through a questionnaire and interview survey to LGED and WMCA, for using water, maintenance fees had been collected and accumulated in the account opened in the bank and a mechanism to make it as a fund for maintenance and management had also been implemented according to the manual.

According to WMCA, however, changes of the committee members every three years and new members joining the WMCA underlines the need for ongoing training sessions. Although the WMCA also has the opportunity to participate in a range of training conducted by the IWRM unit and the LGED region (Upazila) office, the IWRM unit lacks funds to continue providing organizational management and O&M training to the WMCA, so ongoing WMCA training needs still apply. Since the development of infrastructure facilities for this project was completed in 2016, no maintenance work requiring high technical skill occurred at the time of ex-post evaluation and even if it occurs, LGEDs are supposed to support WMCA as needed so the lack of any issues from a technical perspective can be confirmed.

3.4.3 Financial Aspect of Operation and Maintenance

Expenses related to the O&M of small scale infrastructure facilities constructed in this project are borne by each WMCA and LGED. In this project, to secure future sustainability, only the WMCA having opened a bank account and capable of preparing the funds in the WMCA, although the amount varies in each union, were selected as target SPs at the time of SP selection. Therefore, all WMCAs have a certain level of O&M budget. In the WMCA, fees are collected from all members for labor and irrigation water, etc. even after facility development and deposited in the WMCA bank account. According to the executing agency, the total amount collected from 242 WMCAs as member fees amounted to 59,394,655 taka (data as of 2015/2016) and the annual average collected amount was 716 taka / year per member. The average collection rate of the member fee was also generally high, as shown below. It was also confirmed that there were some WMCA which had started fish farming, then hired workers locally and part of the income obtained from them was used for O&M expenses.

[25] Source: documents provided by JICA

Table 13 Collection rate of a member fee of 242 WMCAs

	2012/13	2013/14	2014/15	2015/16 Note
Average rate of collection fee	100%	99.5%	99%	94%

Source: document provided by executing agency
Note: Data of 2015/2016 is the one as of May 2016.

The following table shows the development budget of LGED and the amount of subsidy from LGED to WMCA in the recent year. The LGED development budget comprises about 12 to 14% of the development budget of the Bangladesh government and according to LGED, more than half is budgeted for rural development projects. Furthermore, LGED has secured a budget to support the WMCA, the amount of which is confirmed as having increased substantially over the past three years.

Table 14 Development budget of LGED

(Unit: million Taka)

	2014/2015	2015/2016	2016/2017
Development budget of LGED	108,145	117,763	141,286
Ratio of Bangladesh's total development budget	13.6%	12.3%	12.4%

Source: document provided by LGED

Table 15 The amount of subsidy from LGED to WMCA

(Unit: thousand Taka)

	2015/2016	2016/2017	2017/2018
The amount of subsidy from LGED to WMCA	9,865	18,702	38,930 Note

Source: document provided by LGED
Note: Amount of 2017/2018 is provisional budget.

Since this project was completed in 2016 and given the very limited time to ex-post evaluation, no significant maintenance costs are assumed incurred, but according to the results of FGI conducted at site surveys, appropriate maintenance fees were collected, including a form of providing a labor force at the time of ex-post evaluation. In addition, all SPs had bank accounts for maintenance and management and a system usable for maintenance and management expenses, including interests, is in place. Based on the above analysis, it can be said that there is no problem in terms of O&M financial aspects.

3.4.4 Status of Operation and Maintenance

Although it is difficult to determine the situation of all SPs of 242, according to the executing agency, no serious damage precluding the use of facilities was reported. In addition, it was confirmed that the facilities were mostly well utilized even when visiting the site. Although some SPs were confirmed where the facilities could not be 100% utilized due to partial erosion caused by rain or water shortages during the dry season, this is a situation

where periodically and partial troubles occur, so no cases of non-operational facilities were confirmed. Though damage to embankments caused by rain, partial damage to river banks and clogging mud etc. were reported by members during FGI, cleaning and simple repair work of damaged parts utilizing O&M funds were carried out by the O&M subcommittee with the support of WMCA members.

At sites where the site survey was conducted, records were kept in line with the O&M manual and stored. It was also confirmed through records that controlling the opening and closing of the water gate, cleaning of the gate and mud and repairs to the embankment were all carried out. Consequently, as mentioned above, though it is assumed that a portion of the SP facilities are not operational periodically and partially, it can be said that they have been largely utilized without issues.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented in the north-eastern and central parts of Bangladesh, aiming to increase agriculture and fishery production and efficiency by utilizing water resources effectively through the development of small infrastructure for water-resource management. Implementing this project was consistent with Bangladesh's development strategy that emphasizes the role of agriculture and fishery sector in helping reduce poverty, a sector plan showing the need to use irrigation and fishery water resources efficiently, development needs following frequent damage inflicted by floods, which hinder agricultural and fishery activities and the need to mitigate damage from water logging as well as Japan's ODA Policy. Therefore, its relevance is high. Though the project cost was within the plan, the project period exceeded the plan due to the increase in the number of SPs and commencing the project was delayed due to delays in concluding the contract with a consultant, so the efficiency is fair. Improvement of irrigation facilities and various kinds of training enabled agricultural and fishery activities that were restricted by floods and droughts, and boosted crop and fish production in the SP area as well as employment opportunities for workers and agricultural and fishery income. While implementing project, working opportunities were offered to women through minor construction work. It was also confirmed that women who participated in training of income-generation activities and so on have started small businesses such as poultry farming and tailoring, helping generate income after completion of the project. Through these changes, the poverty rate of the area declined, thus the effectiveness and impact of this project are high.

No major problems have been observed in the institutional, technical, financial aspects of the maintenance system and the small infrastructure facilities developed by this project are operating almost without problems. Therefore, the sustainability of the project effects is 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 and WMCA

(1) Sharing of O&M knowledge within WMCAs considering sustainability

WMCAs have requested that LGED regularly conduct training sessions on an ongoing basis due to regular changes in the WMCA committee members and new members joining. Accordingly, LGED needs to examine continuing guidance on new technical aspects in future. Conversely, training sessions on capacity-building were implemented in this project for all WMCAs during and after implementation. With this in mind, when committee members change, there is a need to conduct take over and explain sufficiently from former to new members and when new members join, mainly the committee members need to set up briefing sessions. As such, there is also a need to strive to share basic O&M knowledge and experience learned to date within the WMCA. LGED can also instruct and encourage WMCA to share knowledge within the WMCA.

4.2.2 Recommendations to JICA

(1) Setting a mechanism for providing implications to the successor phase and understanding the area-wide effectiveness

Since many SPs completed construction in 2016, only limited periods have elapsed since the project completion. Accordingly, the effect and impact of this project will further clarify in future. Meanwhile, LGED have been monitoring O&M performance of all SP's facilities through the IWRM unit, but it is difficult to measure data showing the effectiveness / impact of this project such as crop and fishery production because LGED is the agency responsible for maintaining infrastructure facilities. In implementing Phase 2 of this project which has already started, the executing agency and JICA Bangladesh office should examine the mechanism of measurement of the project effect / impact on completion of the project, a few years after project completion and further after for a certain period so as to avoid the situation occurred in this project. The mechanism may include cooperation with the Ministries of Agriculture and Fisheries during project implementation.

4.3 Lessons Learned

(1) Systematic implementation of O&M training for maintenance organizations in supporting small-scale irrigation facilities

This project involved developing small-scale irrigation facilities and the details and numbers of SP were confirmed through a survey after the project started. With site needs and survey results in mind, the number of SPs increased and the period allowed to construct facilities was also extended. Consequently, some SPs completed in the later stage of the project period and those SPs could not receive trainings by the end of the project period. In most projects developing small irrigation facilities, community organizations are normally responsible for improving facilities, underlining the crucial need to improve the O&M capabilities of community organizations simultaneously ensure sustainability. Accordingly, in determining details of the target SP of similar types of project, the executing agency and JICA should examine project period considering not only infrastructure development needs but also capacity development support for an organization responsible for O&M (soft component), and formulate a realistic plan to ensure project sustainability.

(2) SP selection considering sustainability

In this project, opening a WMCA's bank account with funds for maintenance and management was set as a selecting condition of SP so that the WMCA could assure sustainability. Consequently, it can be said that SPs with WMCAs who have motivations to participate in this project and to become involved in O&M were selected. This is one of the reasons for securing high effectiveness and sustainability of this project. Where the entity responsible for maintenance is a facility user, it is desirable to examine factors to scale the motivation of the user / responsible entity of maintenance (in this project, opening an account by the WMCA for O&M), and add it to the selecting criteria at the time of project planning.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Civil works	Small scale infrastructure for water-resource management in farmland (Benefited area of 1,000ha or less) ・Flood management (FM) 65 SP ・Drainage improvement (DR) 80 SP ・Surface water storage 50 SP ・Irrigation facility (IRR) 5 SP Total approximately 200 SP	・CAD 8SP ・Water conservation (WC) ・CAD 1SP ・FM & DR and WC 45SP ・WC 31SP ・DR・WC 44 SP ・FM ・WC 8 SP ・FM 4 SP ・FM&DR 40 SP ・FM&DR・ IRR 2 SP ・DR and IRR 47 SP ・DR 12 SP Total 242 SP
Procurement of construction material	Construction material, vehicles for site management /trainings and monitoring and office equipment	・Construction material was procured as planned. Vehicles for site management, trainings and monitoring.
Construction of WMCA offices	No information	225 offices for WMCA were constructed.
Survey Investigation and Design	・Participatory Rural Appraisal approx.260SP ・Feasibility Survey approx.240SP ・Detail Design approx.220SP ・Baseline Survey approx. 10SP	・Participatory Rural Appraisal 335 SP ・Feasibility Survey 331 SP ・Detail Design 258 SP ・Baseline Survey 20SP
Facilitator	Allocation of facilitators in each district for technical assistance and dissemination activities including training sessions and so on, Allocation of community assistants for institutional establishment support for WMCA	242 community assistants Five general facilitators
Trainings to strengthen capacity	(Number of Participants) ・Orientation & Management 20,045 ・Plan, design and construction 33,767 ・Establishment and management of WMCA 157,061 ・Operation & management 28,773 ・Agriculture 23,720 ・Fishery 21,481 ・Environment 11,230 ・Gender and development 8,455 ・Overseas trainings 112 Total 304,644	(Number of Participants) ・Orientation & Management 24,915 ・Plan, design and construction 14,567 ・Establishment and management of WMCA 126,572 ・Operation & management 1,993 ・Agriculture 28,823 ・Fishery 4,128 ・Environment 10,145 ・Gender and development 14,384 ・Overseas trainings 44 Total 225,571
Consulting Service	・Plan, design, pre-examination, quality management and monitoring ・Support for participation of community ・Tendering and plan ・Capacity strengthen of executing agency, WMCA and related institutions ・Supervising supports to related institutions and collaboration	While service was conducted as planned, the contract period was extended due to the increase of SP. (Original contract: 51months, additional re-contract : 30 months)
2. Project Period	October 2007 – February 2014 (77 months)	December 2007 – June 2016 (103 months)
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total ODA Loan Portion Exchange Rate	 522 million yen 7,016million yen (4,227 million Bangladesh Taka) 7,538 million yen 5,313 million yen 1 Bangladesh Taka= 1.66 yen (As of September 2006)	 373 million yen 7,055 million yen (5,265 million Bangladesh Taka) 7,428 million yen 5,311 million yen 1 Bangladesh Taka =1.34 yen (Average between December 2007 and June 2016
4. Final Disbursement	March 2016	

People's Republic of Bangladesh

FY2017 Ex-Post Evaluation of Japanese ODA Loan

"Central Zone Power Distribution Project"

External Evaluator: Hisae Takahashi, Hideyuki Takagi

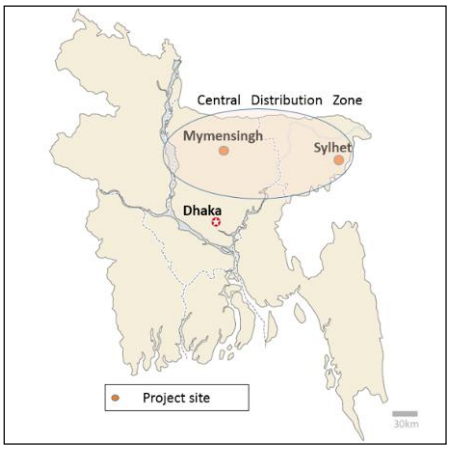
Ernst & Young ShinNihon LLC

0. Summary

This project was implemented with the aim of ensuring a stable power supply through improvement of the power distribution network in the central zone of Bangladesh and support for strengthening the institutional capacity of the executing agency which planned to be unbundled as a part of the power sector reform. Its objective was consistent with the development policy of Bangladesh, which aims for stable and reliable power supply, Bangladesh's development needs including development of a power distribution network that could withstand the ever-increasing demand accompanying economic growth, and Japan's ODA policy. As such, its relevance is high. While project cost was within the plan, project period exceeded the plan due to the increase of outputs and the delays in tendering and each step of facility development. Therefore, the efficiency of this project is judged as fair. Through the implementation of this project, the maximum demand served in the target area increased, the frequency and duration of system interruptions and distribution loss rate decreased, and the reliability of power supply improved. This means that the project goal, providing a stable power supply, has achieved. These effects have a positive impact on stimulating the regional economy, local residents' daily lives. Since the planned unbundling of the executing agency did not materialize, support for strengthening its institutional capacity was not implemented. However, there was confirmed improvement in commercial indicators such as sales, number of customers and billing collection rate through the increase of the power supply. Therefore, the effectiveness and impact of this project are high. Although the state of maintenance of the facilities developed in this project is largely good and there are no issues with financial conditions, some minor concerns with the O&M system and technical capacity of the executing agency have been confirmed. Therefore sustainability of the project effects is fair.

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

1. Project Description



Project Locations

Rehabilitated Substation (Tangail, Sylhet)

1.1 Background

At the time of appraisal, power demand was growing in Bangladesh along with steady economic growth of 5-6% annually. Meanwhile, power facilities could not keep up with demand growth – there was a supply-demand gap as of 2006 in which peak power demand was about 4,700 MW while the actual available capacity of power supply facilities was only about 3,800 MW. Maximum output of the power plants was significantly lower than the maximum demand served due to aging and other factors and the plans for new power plants were not carried out as planned because of delays in plant investment. In addition, there were concerns about the supply-demand gap widening since power plants in operation were planned to be shut down due to aging. Moreover, electrification rate in the country was low at 42% and the per capita electricity consumption of 140 kWh/year was one of the lowest in the world[1].

Furthermore, inefficiency was identified as an issue throughout the entire power sector. Electricity tariffs was set lower than cost recovery level due to political considerations. In addition, there were accumulated unpaid electricity bills from the government to distribution companies and outstanding debt of distribution companies to the government, impairing the financial soundness of the entire sector. Particularly, the power plants where Bangladesh Power Development Board (hereinafter referred to as "BPDB"), the executing agency of this project, performed maintenance and management achieved only 60% of the original power supply capacity due to inadequate maintenance and fuel supply caused by a lack of personnel and funds, aging of facilities and other factors, despite the power supply shortage.

These circumstances made development of power supply facilities to address the demand expansion an urgent issue, requiring capital investment as well as sector reform at each segment of power generation, transmission and distribution.

[1] document provided by JICA

In light of the situation discussed above, towards the provision of a stable power supply, this project was conducted to support developing power distribution facilities for the central zone as well as establishing the institutional setting of the new distribution company to be separated from the executing agency.

1.2 Project Outline

The objective of this project is to provide stable power supply in the target areas by developing/rehabilitating power distribution network facilities, and by strengthening the institutional capacity of new distribution company to be established, thereby contributing to stimulate regional economic activities and improvement of living standard, in the Central Zone.

Loan Approved Amount/ Disbursed Amount	9,715 million yen / 9,709 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	February 2009 / March 2009
Terms and Conditions	Interest Rate 0.01 % Repayment Period 40 years (Grace Period 10 years) Conditions for Procurement General untied
Borrower / Executing Agency	The Government of the People's Republic of Bangladesh (GOB) / Bangladesh Power Development Board (BPDB)
Project Completion	May 2016
Main Contractor(s) (Over 1 billion yen)	Siemens ltd.(India)
Main Consultant(s) (Over 100 million yen)	-
Related Studies (Feasibility Studies, etc.)	・Basic data management survey on distribution related facilities in central zone(2007) ・Special assistance for project formulation for Bangladesh Central Zone Power Distribution Project (2008)
Related Projects	【Technical Cooperation Projects】 ・Power Sector Advisor (Dispatch experts) (2013-2014), (2014-2016) ・Strengthening Management and Performance Standards in Power Sector of Bangladesh through Promotion of TQM (2006-2009) 【ODA Loan Projects】 ・National Power Transmission Network Development Project (February 2013) 【Asian Development Bank】 ・Power Sector Development Program I (2003), II (2004) 【World Bank】 ・Power Sector Financial Restructuring and Recovery Plan (2006) ・Power Sector Development Technical Assistance Project (2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Hideyuki Takagi, 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: November, 2017 – January, 2019

Third-country meeting: February 18 – 21 and May 6 – 9, 2018

2.3 Constraints during the Evaluation Study

Based on instructions from the JICA Evaluation Department, the evaluator did not enter Bangladesh for security reasons and a local consultant carried out the entire process of the field study. The evaluator and the local consultant had a preliminary meeting in the third country (Thailand) before the field study to share information on the evaluation policy of the project and the method of the field study. In the meeting, in order for the local consultant to accurately understand and be able to collect information necessary for the 5 evaluation and analysis items, materials prepared by the evaluator such as a questionnaire to the executing agency and an information collection checklist to be used in the site survey were used, so as to ensure the completeness of the collection of information and the quality of information collection used in analysis.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Bangladesh

At the time of appraisal of the project, the basic document of development strategy, *Unlocking: National Strategy for Accelerated Poverty Reduction*(2005), which was equivalent to the country's *Poverty Reduction Strategic Papers* (hereinafter referred to as "PRSP"), positioned the power sector as important infrastructure for economic growth leading to poverty reduction while addressing the need for power sector reform. The basic direction was also followed in the New PRSP formulated in 2008[4]. At that time, *Power Statement on Power Sector Reforms* (2000), which indicated the direction of the power sector, laid out a long-term vision through three points as follows: securing power supply capacity enabling all people to use electricity by 2020, provision of a high-quality and reliable power supply, and provision of a power supply with reasonable tariffs. Furthermore, sector reform to unbundle the vertically

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

[3] ③: High, ②: Fair, ①: Low

[4] Source: document provided by JICA

integrated BPDB into generation, transmission and distribution segments was promoted and the *Power Sector Road Map* formulated with the support of ADB planned to sequentially unbundle the generation segment and then distribution segment of BPDB. This Road Map also defined the action plan and schedule to change BPDB itself to a holding company[5].

7th Five Year Plan 2016-2020 (2015), as of the ex-post evaluation, indicates that an efficient and inexpensive power infrastructure is necessary in order to maintain the development of the country's international competitiveness. It also aims to reduce transmission and distribution losses and increase electrification rate in rural areas with the increase of the efficiency of power transmission and distribution[6]. *The Power System Master Plan 2016* formulated in 2016 also aims for Bangladesh to be a high-income country by 2041, and discusses the establishment of a high-quality electricity network to support its long-term economic development.

Meanwhile, in accordance with the power sector reforms planned at the time of appraisal, part of the plan to unbundle segments to each area has been implemented by the time of ex-post evaluation. However, it was pointed out that the effect of unbundling BPDB could not be sufficiently confirmed and progress stalled following discussion by management. At the time of ex-post evaluation, the plan to proceed on BPDB reform as a holding company is summarized anew as a report in December 2017[7], and there has been no major change in the direction of reform.

As stated above, the development plans of Bangladesh have positioned the infrastructure development of the power sector as an important area which contributes to economic growth since the time of appraisal through the time of ex-post evaluation. Moreover, they have aimed to promote a continuously highly reliable power supply, which is consistent with this project's aim of providing a stable power supply by developing power distribution facilities. Although progress of unbundling BPBD as a part of the power sector reform was stalled during the project implementation as its meaning was called into the questioned, future roadmap are being newly discussed at the time of ex-post evaluation, and it was also confirmed that there are no changes to its objective.

3.1.2 Consistency with the Development Needs of Bangladesh

In Bangladesh at the time of appraisal, peak power demand was increasing at about 8% per year along with steady economic growth, and was expected to increase to about 6,600 MW in 2010. Due to the supply-demand gap, power supply was already being restricted out of necessity mainly around the peak time in each area and 1,400 hours of planned power outages

[5] Source: documents provided by JICA
[6] Source: Website of *7th Five Year Plan 2015-2020* (http://www.plancomm.gov.bd/wp-content/uploads/2015/10/7th_FYP_18_02_2016.pdf), accessed on August 2, 2018.
[7] Source: documents provided by executing agency

were implemented in 2005. Accordingly, approximately 4,200 MW by 2012 and 11,400 MW by 2020 of new power source development and the associated power transmission facilities were required. However, the capital investment for the aforementioned forecast demand was delayed due to the delay in financing. Even in the distribution segment, the average distribution loss rate nationwide was high at 19.3%[8] due to deterioration of facilities, poor meter reading, power stealing, etc., thus it was a challenge to improve those problems. Furthermore, the distribution loss rate of BPDB (20%) and of Dhaka Power Supply Agency[9] (30%) were higher than the one of converted public companies such as Dhaka Power Supply Company (16.6%) and the Western Power Distribution Company (18.9%). As a result, the necessity of sector reform to improve efficiency through conversion to a public companies has been pointed out[10].

Table 1 shows the capacity of power supply and peak demand of Bangladesh and the target area, namely Mymensingh and Sylhet, after 2014. Both total power supply capacity and peak power demand are in an increasing trend, and it is expected that peak power demand will continue to increase with the country's economic growth in the future. The distribution loss rate has improved year by year (see Table 2), and efficiency seems to have been improved, however, the distribution loss rate of BPDB is still higher than other distribution companies. As such, even at the time of ex-post evaluation, development of the distribution network towards stable power supply in the target areas is still needed.

Table 1 Capacity of power supply and peak demand in Bangladesh

	2014	2015	2016	2017
Capacity of power supply (MW)				
Bangladesh	10,416	11,532	12,365	13,846
Mymensingh	376	441	706	706
Sylhet	175	260	385	405
Peak Demand (MW)				
Bangladesh	8,488	8,124	9,286	9,507
Mymensingh	N.A.	394	441	499
Sylhet	N.A.	156	204	231

Source: prepared based on questionnaire

Table 2 Average distribution loss rate

	2014	2015	2016	2017
BPDB	11.9%	11.2%	10.7%	9.0%
Dhaka Power Distribution Company Limited	9.0%	9.5%	9.2%	8.4%
Dhaka Electric Supply Co. Ltd	8.4%	8.3%	8.0%	7.2%
North-west Power Generation Company Ltd	11.0%	10.3%	10.0%	9.6%

Source: prepared based on questionnaire

[8] Transmission and distribution loss rate in South East and South Asian countries were as follows; 11.3% in Indonesia (2004), 13.1% in Philippine in 2005, 12.1% in Vietnam (2004), 8.2％ in Thailand (2004), 31% in India (2004). Source: document provided by JICA

[9] Dhaka Power Supply Agency was renamed to Dhaka Power Distribution Company Limited in October 2005 following the reorganization.

[10] Source: document provided by JICA, data shows the figures as of 2005.

3.1.3 Consistency with Japan’s ODA Policy

In Japan's *Bangladesh Country Assistance Program* (2006), in addition to the lack of capital investment in the power sector, issues such as inefficient management by government agencies, improper electricity tariff levels, and unpaid electricity charges were pointed out. In response to those issues, the program focused on areas including "support for policies, management, operating, financial improvement of the entire power sector", "support for expansion of power generation facilities to reduce the supply-demand gap" and "support of efforts to reform the power transmission and distribution sector". JICA also positioned the power sector as a priority area for "development of economic infrastructure" raised as a development issue under "economic growth", one of the priority objectives for assistance in Bangladesh. This project aimed at providing the stable power supply through the improvement of power distribution network, thus it is consistent with the priority items of Japan’s support to Bangladesh.

3.1.4 Appropriateness of the Project Plan and Approach

Considering the project effect of a stable power supply in the target area, output increased dramatically in this project (see “efficiency” for details). The increased cost caused with this increase of the output was covered by utilizing the remaining unused amount of the loan and was borne by the Bangladesh side. Moreover, while the project period exceeded the plan, the increased output was implemented as an additional portion of this project rather than being planned as a new project from scratch, preventing a loss of the time and manifesting the effects of this project. Therefore, this change in the scope was a result of due consideration of the appropriateness of the project plan and approach, and it does not affect the sub-rating of the Relevance.

As stated above, this project has been highly relevant to the Bangladesh’s development plan and development needs, as well as Japan’s ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

As the main outputs of this project, development of power distribution facilities and consulting service for strengthening institutional capacity were planned. The planned and actual outputs are shown in Table 3. Concerning the development of power distribution facilities, the scope of renovation/construction of distribution feeders and transformers, the number of substations and the number of transformers installed increased significantly. Conversion of 33kV lines which as not included in the plan was added. Consulting services for

strengthening institutional capacity was cancelled because BPDB was not spun off.

Table 3 The plan and actual outputs
(New construction and rehabilitation of core distribution facilities)

Item		Unit	Plan	Actual
Rehabilitation/construction facilities				
Distribution feeder				
33kV Line	Renovation	km	308	377
	Construction	km	98	386
11kV Line	Renovation	km	227	730
	Construction	km	183	565
11kV/0.4kV Line	Renovation	km	281	700
	Construction	km	244	752
0.4kV Line	Renovation	km	616	1,618
	Construction	km	525	1,024
33kV Line（Underground cable）	Construction	km	3	32
Conversion of 11 to 33kV Lines			―	46
Sub station				
33/11kV substation	Renovation	No.	16	26
33/11kV substation	Construction	No.	6	14
2 × 5MVA substation	Renovation	No.	―	12
Transformer (Renovation and construction)				
250kVA transformer	Renovation	No.	393	465
	Construction	No.	451	1,166
100kVA transformer	Renovation	No.	564	640
	Construction	No.	419	1,226
Condenser (Construction)				
3x100kVA, Auto SW		No.	122	As planned
3x 50kVA, Auto SW		No.	65	As planned
3x100kVA, Auto Fix		No.	115	As planned
3x 50kVA, Auto Fix		No.	7	As planned
Equipment and vehicle for maintenance works, others			No detail information	Equipment for maintenance work 100 Note 1, Vehicle 115 Note 2, Function building 2,069m^2

Source: documents provided by JICA and questionnaire
Note 1: 60 Hot stick tools, 40 feeder meters.
Note 2: Six Bucket cars, 83 Motorcycles, Three Jeeps, 23 Pickups.

Reasons for the changes and the details for measures are described as follows.

【Changes of Output from the Original Plan】

Increase of each power distribution facility by expansion of the target areas（12[11]⇒40 units）

Reason: Though the project cost at the time of appraisal was 8,868 million yen, the actual contract amount was only 5,055 million yen due to the effect of competitive bidding

[11] Units formally means Electric Supply Unit. It shows the power distribution areas and Mymensingh and Sylhet are comprised of 40 units in total.

and fluctuation of foreign exchange rate. Prior to the appraisal of this project, a plan was proposed by the executing agency for all 40 units covering Mymensingh and Sylhet. On the other hand, only 12 units with high priority were planned to be included in this project based on criteria such as urgency and investment efficiency as a result of the Special Assistance for Project Formation Survey. Even in the initial plan, the effect to satisfy the project purpose of this project was expected to be generated, however, in addition to the occurrence of unused loan during the project, demand further increased with the passage of time, thus the expansion of the number of units of facilities was considered in order to generate further effects. As a result, Bangladesh submitted a request to add 28 units which were out of scope of the original plan of the project. The amount required due to this increase was estimated to be 6,241 million yen, and the amount exceeding 4,373 million[12] yen of the unused loan was covered by the Bangladesh side with the consent of JICA, leading to the change.

Effects and appropriateness of the change: As stated above, covering all 40 units was proposed for stable power supply and reliability improvement in the target area, however only 12 units with high priority were targeted in this project. By changing the output, the power distribution network for all 40 units was developed, leading to the achievement of the expected effect as explained as below, and the change is therefore considered to have been appropriate.

Table 4 Planned and actual outputs
（Consulting services for strengthening institutional capacity）

Plan	Actual
Support for strengthening institutional capacity to Newly establish Central Zone Power Distribution Company ・Development of institution framework for each area: human resources, finance/accounting and legal/regulatory ・Formulate systems necessary for beginning institutional management ・Development of business plan ・Conduct baseline survey and assist implementation for development of universal service provision	Cancelled

Source: documents provided by JICA and questionnaire

【Changes of Output from the Original Plan】

Cancellation of consulting service for strengthening the institutional capacity

Reason: At the time of appraisal, as part of Bangladesh's power sector reform, unbundling the central region from BPDP was examined and the implementation of consulting services for new distribution companies to be newly established was planned. However, after the start of this project, the opinion that the effect of unbundling was not as great as

[12] This amount was the sum of contingency (449 million yen) that was recorded at the time of planning and the difference (3,924 million yen) between the project cost (8,868 million yen) at the time of appraisal and the contract amount (5,055 million yen).

expected was raised in the executing agency, and unbundling was temporarily suspended. In addition, following the reconsideration of the effects of unbundling by management and the labour union's approaches, efforts towards unbundling during the project discontinued. Following this, implementation of the consulting services was also cancelled.

Effects and appropriateness of the change: Given that efforts towards unbundling were stopped, implementation of this component is virtually impossible, thus this cancellation is judged to be appropriate. According to the executing agency, there is no effect on the project objectives, such as the provision of a stable power supply, or the project period, etc., due to this change. Part of the funds scheduled to be allocated to consulting services was reallocated to the construction and rehabilitation work of the 33 kV·11 kV line. This was arranged to proceed with the construction work caused by the increase in output without delay, thus it can be said that it was a reasonable change based on its necessity.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 17,559 million yen, exceeding the initial planned amount (12,737 million yen) (138% compared to the plan) (See table 5). The main reason for the increase was due to the increase in output. However, if the increased planned amount (6,241 million yen) due to the increase in output was added to the planned amount at appraisal, the planned amount after the change of output would be 18,978 million yen[13]. Therefore, the ratio of the planned amount including the increased output and the actual result was 92%, and it was within the plan. Incidentally, within the increased amount, the portion in excess of the unused balance of the ODA loan was borne by the Bangladesh side. As compared with the case where the construction of additional units is implemented as a new project, including additional units into the current project scope by utilizing the unused loan amount was judged to be more efficient in terms of time and cost, and moreover further project effect was expected. As stated above, this change was made by taking into consideration of not only the power situation of the specific area where this project provided the facilities, but also the power situation of the target area as a whole and the subsequent effects, therefore it can be said that there is no problem in its appropriateness.

[13] At the time of appraisal, the ODA Loan amount was 9,715 million yen, of which the equipment and construction cost was 8,979 million yen. On the other hand, the actual contract amount was 5,505 million yen due to competitive bidding price of tendering and fluctuation of the exchange rate. Hence, 3,924 million yen（planned equipment and construction cost (8,979 million yen) minus actual contract amount (5,505 million yen)) was unused. 4,373 million yen, the sum of 449 million yen (the planned contingency cost at the time of appraisal) and 3,924 million yen, was confirmed as unused loan. Among the amount (6,241 million yen) required for the increase in output, the amount exceeding the unused loan amount (4,373 million yen) was borne by Bangladeshi side (1,870 million yen).

Table 5　Planned and actual project cost

(unit: million yen)

	Plan			Actual		
	Foreign Currency portion	Local Currency portion	Total	Foreign Currency portion	Local Currency portion	Total
Material and construction	6,587	2,039	8,626	6,790	6,246	13,036
Consulting services	230	57	287	0	146	146
Price escalation	354	0	354	0	0	0
Interest during construction	2	0	2	0	1,095[Note1]	1,095
Contingency	347	102	449	0	1	1
Land acquisition	0	59	59	0	79	79
Administration cost	0	486	486	0	197	197
Duties and taxies	0	2,475	2,475	0	3,005	3,005
Total	7,520	5,217	12,737	6,790	10,769	17,559

Source: documents provided by JICA, questionnaire

Note 1: Interest during construction significantly exceeded the plan even when compared with other items. This is because the amount at the time of appraisal assumed the interest payment amount to JICA, while the actual result is the amount including the interest related to additional cost born by Bangladesh side. The amount paid (actual result) to JICA was 1.09 million yen, which was 55% of the plan.

Note 2: Exchange rate 1 Bangladesh Taka (BDT) = 1.56 yen (as of plan), 1 BDT = 1.26 yen (Actual) based on the IFC annual average rate of project implementation period

3.2.2.2 Project Period

The project period[14] of this project was planned to be 37 months, however, in fact it took 87 months from March 2009 to May 2016, which was significantly longer than the plan (235% of the originally planned project period). The table below shows the planned and actual schedule of this project (Table 6) and the increase in output of each facility and the resulting extended project period (Table 7).

The expansion of 33kV line and 11kV line as well as the number of substations (actual output) that were subject to increase and expansion exceeded the plan by more than 200%. Furthermore, installation of equipment and conversion of 33kV line, which were not included in the plan, were also performed. Considering this increase, it is thought that the implementation period of 235% of the plan was an extension according to the increase of output. The executing agency also explained that the increase of output was necessary to generate the effect in the target area, thus it is was a reasonable period of extension in line with this increase. Meanwhile, as shown in Table 6, the project had already been delayed before the detailed design of the additional component was started, and the construction period of the initial scope also took 34 months (189% of the planned time of 18 months). Hence, the delay has been confirmed, and it can be judged that the project period significantly exceeded the plan.

[14] Project period is defined as the period from loan agreement signing date to the completion month of construction works.

Table 6 Implementing period of this project (Planned and actual)

	Planned	Actual
Loan Agreement	June 2008	March 2009
Detailed design	May - December 2008 (8 months)	January - June 2010 (6 months)
Tendering	September 2008 - December 2009 (16 months)	June 2010 - March 2012 (22 months)
Civil works	January 2010 - June 2011 (18 months)	March 2012 - December 2014 (34 months)
Additional component		
Detailed design	—	June 2012 - February 2013 (9 months)
Tendering	—	January 2013 - February 2014 (14 months)
Civil works	—	December 2014 - May 2016 (18 months)

Source: responses to questionnaire

Table 7 Increase rate of each facility output and extension of project period

	Actual to plan	Extended period caused by increase of output
Extension of distribution feeder	Approximately 200%	20 months
Increase of the number of target substations	22 ⇒ 52 (236%)	24 months
Increase of feeder meter, etc.	Not planned ⇒ 40	12 months
Laying underground cable	Not planned ⇒ 30km	15 months

Source: responses to questionnaire

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

The result of recalculating the internal rate of return was significantly higher than that at appraisal. The reason for the difference between the calculations at the time of appraisal and the recalculation is mainly due to the considerable increase in output as mentioned in "Efficiency", namely that the number of outputs of this project was increased from 12 to 40 units[15]. The calculation at the time of appraisal was reviewed and amended as follows for recalculation:

ŸTo change the starting point of project life from the project completion to the start of the project

ŸTo include the Bangladesh side cost in the total project cost, which was not included in the original calculation

ŸTo change the basis of the calculation of operation and maintenance (O&M) cost from total project cost to construction cost

[15] Therefore, in recalculation, the baseline of benefits has also changed from 12 at the time of appraisal to 40 units.

Table 8 Elements for the recalculation of internal rate of return

Item	Explanation
Number of units	Increased due to the change of plan at implementation
Cost:	
Project cost	Construction cost and expenditures
O&M cost	3% of the construction cost per year
Transmission cost	Transmission cost based on the volume of distribution (cost of distributing electricity increased by new construction plus cost continued after renovation)
Benefit:	
Revenue from sales of electric power	Enhancement of distribution capacity by new construction
	Continued volume of electricity distribution by renewal
Reduction of loss on distribution of electricity	Increased volume of electricity distribution by the reduction of distribution loss
	Avoided cost for the new construction of generation plant (only EIRR)

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

(1) Financial Internal Rate of Return (FIRR)

The result of recalculation at the time of ex-post evaluation has risen to 2.5% compared to -0.3% in the result of calculation at the time of appraisal (after correction), however both calculation results are relatively low. This is affected by the policy of the Bangladesh government of keeping electricity usage fees low, which, as described in “financial aspect of sustainability”, is related to a prolonged deficit in BPDB’s financial results.

Table 9 Results of recalculation for FIRR

	At appraisal (corrected)	At ex-post evaluation
FIRR	- 0.3%	2.5%

Source: documents provided by JICA and recalculation by the evaluator

(2) Economic Internal Rate of Return (EIRR)

The result of calculation at the time of appraisal (after correction) was 13.9% and the result of recalculation at the time of ex-post evaluation was 18.1%, both of which are relatively high levels. Based on the calculations, it was confirmed that the project has consistently been cost-effective before and after the project.

Table 10 Results of recalculation for FIRR

	At appraisal (corrected)	At ex-post evaluation
EIRR	13.9%	18.1%

Source: documents provided by JICA and recalculation by the evaluator

Based on the above, although the project cost was within the plan when analysing the planned cost reflecting the increased output, the project period exceeded the plan. Therefore, efficiency of this project is fair.

3.3 Effectiveness and Impacts[16] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

(1) Maximum demand served, system interruption frequency/duration, distribution system loss rate

Baseline before the project implementation, target to be achieved after two years of project completion set at the time of appraisal and actual data after the project completion for each indicator are shown in the table 11.

Table 11 Maximum demand served, system interruption frequency/duration, distribution system loss rate

		Baseline	Target	Actual	
		2007	2 Years After Completion	2016 Completion Year	2017 1 Year After Completion
Maximum demand served (MW)[Note1]	Mymensingh	69	123 (174) [Note2]	441	449
	Sylhet	94	176 (154) [Note2]	204	231
Average system interruption more than 30 minutes (times/year)	Mymensingh	63	11	4	2
	Sylhet	120	50	4	4
Average system interruption more than 30 minutes (minutes/year)	Mymensingh	2,037	400	125	40
	Sylhet	11,481	700	44	47
Distribution system loss (%)	Mymensingh	20.7	11.6	13.1	13.2
	Sylhet	16.4	10.0	12.3	11.6

Source: documents provided by JICA, questionnaire

Note 1: Targets of maximum demand served were calculated based on the collected data in 2007 as the baseline data, with the assumption of power demand increase rate for 2007 to 2012 was 8.6%, and that for after 2013 was 7.8%.

Note 2: In this project, it was confirmed that the target value set at appraisal and the target value (indicated in parentheses) answered by the executing agency through questionnaire during this evaluation are different. However, in the ex-post evaluation, if such change is not confirmed through officially agreed-upon documents, the effectiveness is analysed based on the target value at the time of appraisal in principle. Therefore, analysis in this evaluation was performed based on the target value set at appraisal.

【Maximum demand served】

The maximum demand served in the target area, Mymensingh and Sylhet, has greatly increased and achieved the target value (see Table 11). However, when analysing the achievement status of the target value, it is necessary to consider two points as follows: 1) the output of the power distribution network facility increased to more than 200% of the

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

plan, and 2) two years from the project completion (set as the timeframe to confirm the target value) have not yet elapsed at the time of the ex-post evaluation due to the delay.

Upon confirmation with the executing agency about the increase of output, the target value was not re-examined when the project scope was increased, and it was accordingly not possible to perform an accurate analysis. Meanwhile, as described in "3.2.1 Output", the scope of distribution network facilities increased by approximately 200%. If the increase in the output is prorated to the target maximum demand served[17], the target value can be assumed to be about 325 MW for Mymensingh and 239 MW for Sylhet. As a result, it can be said that about 138% in Mymensingh and about 97% of the Sylhet of the target value were achieved one year after the completion of the project. Also, the target value was initially set to be confirmed two years after completion of the project, and one year has passed at the time of ex-post evaluation. Hence, while it cannot be concluded that the figure will necessarily increase for 2018, which is two years after the completion of the project, it can be judged that the target value has been largely achieved at the time of ex-post evaluation.

【System interruption (frequency / duration)】

Both the frequency and duration of system interruption in Mymensingh and Sylhet have decreased and achieved the target value. This can be a result of improving the reliability of the power supply of the system by newly constructing and extending the power distribution system, which was seriously aged and overloaded. Prior to this project, there was only one distribution system in each section, and when trouble occurred in one place, it led to immediate blackouts. However, backup facilities were additionally installed in each unit through the expansion of the distribution networks, enabling the provision of a stable power supply.

【Distribution system loss rate】

Both areas have improved compared with the baseline and reached 80% or more of the target value although they have not reached the target value. According to the executing agency, the entire power distribution network is not covered by this project alone, and additional facility investment is required to improve the distribution loss rate further. However, the effect of the distribution loss rate through this project is confirmed as shown in Table 11.

[17] The output increased by 28 units, of which 23 units are in Mymensingh and 5 units are included in Sylhet. Therefore, calculation was performed assuming that 82% of the output increased by 200% was allocated to Mymensingh and 18% to Sylhet.

(2) Improvement of commercial indicators

Improvement of commercial indicators was expected as an effect of consulting services for strengthening institutional capacity of the new company planned to be established by unbundling of BPDB. In actuality, however, the planned unbundling was not implemented and consulting services for strengthening institutional capacity was not carried out either. As such, the planned and actual commercial indicators are shown in table 12 for reference.

The average monthly billing collection rate is slightly worse than the baseline in Mymensingh, however it exceeds 90% and has been maintained at a high level. In Sylhet, as a result of appropriate handling, the average monthly billing collection rate has become the level not exceeding 100%. This rate used to exceed 100% because of collecting the uncollected portion of the previous year in the following year. According to the executing agency, the spread of electrification to rural areas and difficulties in collecting tariffs from poor areas are factors as to why both areas show lower rates than the target value. Meanwhile, average monthly billing, number of customers per employee, and sales per employee have improved both at the project completion year and at the ex-post evaluation. In this project, consulting services for strengthening institutional capacity were not implemented, however, improvement of commercial indicators has been confirmed due to increased sales following an improved electrification rate by expanding the power supply capacity.

Table 12 Commercial indicators (Only for reference)

		Baseline	Target	Actual	
		2007	2013	2016	2017
			2 Years After Completion	Completion Year	1 Year After Completion
Average monthly billing collection rate (%)	Mymensingh	97.5	100.0	87.4	90.8
	Sylhet	111.6[Note]	100.0	91.8	96.8
Average monthly billing (million BDT)	Mymensingh	134.0	248.0	734	800
	Sylhet	114.5	211.9	420	439
Customer/employee (no. of people)	Mymensingh	223	425	651	718
	Sylhet	295	550	689	752
Sales/employee (million BDT)	Mymensingh	1.64	3.1	7.0	8.0
	Sylhet	0.30	0.6	8.9	9.9

Source: document provided by JICA, questionnaire

Note: The baseline of Sylhet is 111.6% because it was calculated including the collection of the uncollected portion of the previous year in addition to the collection of the current year. It was expected to be no more than 100% when carrying out appropriate treatment (recovery or amortization of uncollectible amount) for uncollected cases in previous years.

(3) Increase in number of electrified households

As shown in table 13, the number of electrified households has significantly increased after implementation of this project. Since the target area expanded from the initial 12 units of the scope to 40 units covering all areas of Mymensingh and Sylhet, target values were

corrected to 2.9 times for Mymensingh and 1.5 times for Sylhet during project implementation from the target values set at the time of appraisal. Accordingly, the actual numbers at the time of ex-post evaluation achieved the target values, which were 1.6 times (Mymensingh) and 1.4 times (Sylhet) the target values respectively.

Table 13 Number of electrified households in the target area

		Baseline	Target	Revised target	Actual	
		2007	2013	2 Years After Completion	2016	2017
			2 Years After Completion		Completion Year	1 Year After Completion
Number of electrified households	Mymensingh	93,184	159,701	462,012	673,906	759,186
	Sylhet	97,833	167,669	245,799	314,114	339,438

Source: documents provided by JICA, questionnaire

3.3.1.2 Qualitative Effects (Other Effects)

(1) Improvement of stability and reliability of power supply

As mentioned above, it is quantitatively shown that the frequency and duration of system interruptions have decreased after implementation of this project, hence it was confirmed that power is supplied stably through the improvement of the power distribution network. With regard to these effects, power consumers of Mymensingh and Sylhet were interviewed for the purpose of gathering information to complement the above existing data, confirming the status of improvement of stable power supply through the number (frequency) of system interruptions, etc.[18].

The results of interview surveys reported reduction of the frequency and duration of system interruptions similarly as shown by the quantitative data. The information from the respondents was almost the same in each area. Answers obtained stated that before the project was implemented, system interruptions occurred on average four to five times per day in Mymensingh and five to seven times per day in Sylhet, while no planned or unplanned power failures occurred except for planned outages required for maintenance at the time of ex-post evaluation. Even if system interruptions occurred, time to restoration decreased to about 15 to 30 minutes at the time of ex-post evaluation, which used to take 1.5 to 2 hours in both areas before the project. Respondents explained that the stable supply of electricity and reliability[19] are synonymous, and all respondents said that reliability for

[18] Field surveys were conducted at two sites (units) in Mymensingh (S&D Div 2, DD Tangail) and two sites in Sylhet (S&D-1,DD Moulvibazar). Interviews were conducted for a total of 25 customers in 6 to 7 places at each site. The target customers were as follows. Mymensingh: three universities, two hospitals, one high school, two colleges, one mat factory, one flour mill factory, one chamber of commerce and two hotels. Sylhet: Two universities, two high schools, one hospital, one tea factory, one chamber of commerce, one rice mill factory, one food factory, two hotels and one supermarket.

[19] According to the respondents, reliability to power supply indicates, for example, to ease the anxiety or

power supply improved owing to stable supply of electric power. Moreover, according to staff at each substation where local consultant visited for the field surveys, complaints for system interruptions to substations/power plants, etc. have decreased, and the satisfaction of users is increasing in recent years.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Stimulation of the regional economy

Contributing to stimulation of the regional economy was expected as an impact of this project through establishing power distribution network facilities in the target area by constructing and rehabilitating the distribution network facilities of this project. An attempt was made to obtain economic statistics such as GDP data, manufacturing production and household income of the target area through the executing agency, however, data for each area could not be obtained. On the other hand, according to the executing agency, as a result of the improvement of the power distribution network, power has been supplied stably in the target area, leading to contribution to stimulation of the regional economy through promotion of industry in the target area and energization of agricultural activities. Specific effects of the reduction of the frequency and duration of system interruptions (i.e., the provision of a stable power supply) as stated during interviews with consumers in the target area included the following: “We are now able to provide operation, sales and services continuously and conduct business stably. Accordingly, sales and service have improved”, (factory and supermarket managers) “The number of customers has increased due to service improvements and employees are able to perform their work more efficiently due to the reduction in system interruptions” (hotel manager). Furthermore, almost all respondents answered that the number of times of generators use and the usage time decreased, which has made possible to increase the investment amount with the saved amount.

(2) Improvement of living standard of local residents

Many areas in rural areas of Mymensingh and Sylhet were not electrified before the project. The spread of electrification to households in rural areas can be said to have significantly improved the living environment in those areas. Specific examples of the impact of a stable supply of electricity mentioned in interviews at high schools and colleges in both target areas included increased at-home study time for students and being able to conduct classes using multimedia, thus deepening students’ understanding. The following effect was mentioned at a hospital in the target area: “Service has improved due to the reduction of equipment malfunctions through stabilized voltage and reduced time restrictions

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dissatisfaction occurred by unplanned or sudden system interruptions.

on conducting clinical consultation, medical treatment and surgeries thanks to a stable supply of electricity." According to the executing agency, although there is no data showing its impact, implementing this project has expanded home industries and irrigation areas through electrification in rural areas, resulting in the creation of jobs for the people in those areas. Therefore, it can be said that electrification indirectly contributes to improving living standards by providing convenience for people in rural areas as well as increasing employment opportunities.

Class using digital equipment (Public high school in Sylhet)

Reception at Hotel (Sylhet)

Milling factory where electricity is indispensable (Sylhet)

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

Environmental Impact Assessment Report of this project was approved by Department of Environment in the Ministry of Environment and Forest in July 2008. Based on the environment on *Guidelines for JBIC for Confirmation of Environmental and Social Considerations* (April 2002), it was considered that the undesirable impact on the environment of the project is not likely to be serious and the project was categorized as B. According to the executing agency, no undesired impacts on the natural environment accompanying the implementation of this project were confirmed. The executing agency also mentioned that since implementation of power distribution projects in general do not cause serious negative impact on the natural environment, monitoring was not carried out but no report has been made on negative impact including air pollution due to dust and so on, waste, noise, soil contamination, etc. during and after this project. In addition, during the interviews to users conducted at the site visit, they also explained that there was no negative environmental impact from implementing this project.

(2) Resettlement and Land Acquisition

At the time of appraisal, resettlement and land acquisition along with implementation of this project were not planned. However, land was acquired in each area when the scope was changed, although it was only 2.2 hectares in Mymensingh and 0.6 hectares in Sylhet. Land

acquisition was not made in the area affecting the commercial activities and people's living and was conducted in accordance with the regulations and plans of the administration in districts of each area, and it was confirmed with the executing agency that no particular problems occurred. There was no resettlement caused by the implementation of this project.

(3) Unintended Positive/Negative Impacts

・Promoting access to power by low-income people

Although data could not be obtained, the number of electrified households in the target area increased as a result of implementation of this project as described above in effectiveness. In particular, electrification has been extensive in rural areas because they were included in the target area of this project. According to the executing agency, since many low-income people live in rural areas, implementing this project has contributed to the promotion of access to the electricity by low-income people.

・ Creation of employment at target electric power stations

At the time of appraisal, it was assumed that employment opportunities for women would continue to be secured as an effect of this project, as 90% of all staff at the billing centre for electricity charges in the project area were women. At that time, the bill was prepared manually, and 80% of the workers were women. However, the executing agency explained that the work was computerized after the project completion, and employment opportunities and the number of employees for women decreased. Meanwhile, it was confirmed in an interview with the executing agency that new employment for workers, guards, etc. has been created due to the establishment and expansion of distribution stations and the change of unmanned power distribution stations to manned stations.

As mentioned above, the maximum demand served and duration/frequency of system interruptions in the target area have achieved the target, and a certain effect has also been confirmed in the power distribution loss rate through implementation of this project. Accordingly, stability and reliability of power supply are improved, thus it can be said that the expected effects have been generated. In addition, the stable power supply has promoted the stimulation of regional economies, and the increase in the number of electrified households, especially in rural areas, has also had a positive impact on the lives of local residents.

In light of the above, this project has largely achieved its objectives. Therefore effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

At the time of appraisal, Central Distribution Company, which was to be unbundled from the executing agency, was planning to maintain and manage the facilities. However, unbundling was not actually implemented, hence BPDB, the executing agency, is responsible for the Operation and Maintenance (O&M) of the facility, and each regional office of BPDB distribution divisions is in charge of the operation and maintenance activities at the time of ex-post evaluation. Therefore, there is no change in the O&M system prior to the project implementation, and there is no effect on the system, but the shortage of the number of personnel continues to be mentioned as a problem. The following table shows the actual and prescribed number of staff of the executing agency and regional office. The number of allocated staff is about 70% of prescribed number of staff in Mymensingh, and less than 50% in Sylhet. According to the executing agency, the shortage of the number of personnel is a problem occurring throughout the government sector. In BPDB, due to the personnel shortage, the work burden of several people falls upon one person, and it is necessary to outsource some work such as meter reading to the private sector.

Table 14 Prescribed and actual number of personnel in executing agency and regional offices

	Prescribed number of staff	Actual number of staff
Maintenance staff in BPDB	1,628	1,191
Mymensingh	1,705	1,258
Sylhet	1,032	504

Source: questionnaire

3.4.2 Technical Aspect of Operation and Maintenance

The executing agency is an institution which has been in charge of O&M for power distribution facilities up to now, thus there are basically no issues with technical aspects. During the site survey, it was also confirmed that O&M for the facilities and equipment are conducted in line with the instruction manuals and operation guides provided by this project. The executing agency reported the improvement of quality control and management capacity as well through a technical cooperation project for comprehensive quality management improvement. However, it has been confirmed that the partially damaged equipment at the distribution stations in Mymensingh and Sylhet has not been addressed sufficiently due to lack of technical capacity or knowledge. Thus, it can be said that the improvement of technical capacity to deal with equipment, especially in case of equipment failure, is an issue to be addressed.

3.4.3 Financial Aspect of Operation and Maintenance

(1) Financial condition of the distribution department of BPDB

The Bangladesh Government has adopted a policy to keep electricity rates low, while the government simultaneously subsidizes the negative balance of BPDB[20]. The results of business operations based on this national power policy are shown in the financial statements of BPDB. The concerns about financial situation remains unchanged since appraisal[21]. Table 15 shows the annual changes in the revenue and expenditure and deficit of the distribution department of BPDB.

Table 15 Annual changes in the revenue and expenditure and deficit of the distribution department of BPDB

(Unit: Million BDT)

Item	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Sales (Power distribution)	44,121	51,373	59,412	73,204	68,326
% of change from previous year	*38%*	*16%*	*16%*	*23%*	*-7%*
Cost of revenue (Power distribution costs)	50,016	56,715	61,834	73,669	68,513
% of change from previous year	*41%*	*13%*	*9%*	*19%*	*-7%*
(Repair and maintenance cost)	*1,064*	*1,247*	*1,290*	*1,189*	*977*
Loss from revenue	-5,895	-5,343	-2,422	-465	-188
General & admin. expenses	705	599	742	957	987
Operating loss	-6,600	-5,941	-3,164	-1,422	-1,174
Net loss	-6,774	-6,509	-3,770	-2,026	-2,191
Deficit	-17,672	-24,166	-27,678	-29,772	-31,693

Source: Annual reports of BPDB (fiscal year is from July to the end of June in the next year)

At the time of appraisal, financial indicators were set as quantitative effect indicators. (Boldfaces in Table 16). The following table shows the analyzed trends of financial sustainability by complementing the originally set indicators. Due to the national policy to keep the electricity rate low as mentioned above, the sales profit margin has been at nearly 0%, which is a major source of the financial difficulties.

[20] Source: Energy Regulatory Commission (ERC) *BPDB Bulk Electricity Price Rate Order, 23 November 2017*

[21] At the time of appraisal, the donors including the World Bank and ADB were implementing support for financial reform and reconstruction. Technical support for financial improvement was scheduled for this project as well. The Government has been considering the separation of the distribution business of Mymensingh and Sylhet area.

Table 16 Annual changes in the financial ratios of the distribution department of BPDB

Financial ratio	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Debt-servicing capability					
1. Current ratio	**No data**	**No data**	**0.86**	**0.83**	**0.61**
2. Debt equity ratio	No data	No data	1.04	1.01	0.97
3. Debt service coverage ratio [Note 1]	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Financial sustainability					
4. Equity ratio	No data	No data	0.27	0.26	0.29
Profitability					
5. Sales profit ratio (%)	-13.4	-10.4	-4.1	-0.6	-0.3
6. Operating profit ratio (%)	**-15.0**	**-11.6**	**-5.3**	**-1.9**	**-1.7**
7. Rate of return on assets (ROA) (%)	**No data**	**No data**	**-3.0**	**-1.5**	**-1.7**
8. Rate of return on equity (ROE) (%)	No data	No data	-11.3	-5.7	-5.7
Other					
9. Receivables turnover period (days)	No data	No data	131	123	100

Source: Calculated by the evaluator based on the figures in BPDB's annual reports

Note 1: DSCR (debt service coverage ratio) was not calculated (N/A) as the operating results were negative and operating cash flows were assumed to be negative.

As mentioned above, financial conditions so far have been harsh. However, efforts to improve the financial condition planned at the time of appraisal are underway: government subsidies currently treated as long-term debt are to be capitalized in the future. The debt related to the subsidies for the gap between selling and purchase price of power accounts for 396 billion BDT (69% of total long-term debt (as of 2017)). Excessive liabilities will be eliminated as a result of capitalization.

(2) Operation and maintenance costs of the project area

Table 17 shows operation and maintenance costs for both Mymensingh and Sylhet distribution areas over the past three years and the budget over the next two years. The 2017/2018 budget for personnel expenses and O&M costs is greater than the past year's. According to the breakdown of the budget, the main reasons for the change are that more overtime and severance payments are posted for personnel expenses, and more repair costs and stored items such as parts are posted for operation and maintenance expenses. The 2018/2019 budget for O&M costs is comparatively smaller than that in the past years, likely because the budget in 2017/2018 was larger and the amount accordingly needed to be adjusted. Although the answer to the questionnaire by BPDB mentions that the budget allocations for the O&M costs of both distribution areas are assumed to be insufficient, there seems to be no substantial reduction from that in the past years. Therefore, there is no particular problem in the budget allocation for O&M costs.

Table 17 Annual changes in personnel expenses and O&M costs in Mymensingh and Sylhet

(Unit: Million BDT)

Item / Distribution area	Actual			Budget	
	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019
Personnel expenses:					
Mymensingh	301	440	609	692	618
Sylhet	231	269	386	473	410
O&M costs:					
Mymensingh	70	69	91	197	62
Sylhet	52	55	91	145	46
Total	654	833	1,177	1,507	1,136

Source: Calculated by the evaluator based on the budget documents of BPDB

Based on the understanding that government subsidies are inseparable from the national policy, it is assumed that the subsidies will be secured as long as the policy continues. In addition, it is expected that the financial condition of BPDB will be improved by the capitalization of long-term debt related to the subsidies. Based on these observations, there is no concern regarding the financial sustainability of the project effects.

3.4.4 Status of Operation and Maintenance

Through questionnaire and site survey conducted by a local consultant, it was confirmed that O&M of the facilities is generally good. Cases in which the breaker at the substation was not operating due to the low gas pressure and the switch to cut 11kV breaker was not functioning correctly were observed during the site survey, however, it was reported that these defects posed no serious concern to fulfilment of their function as distribution stations. Lack of expertise and understanding of countermeasures were mentioned as reasons why these defects have not been repaired. This reveals trouble shooting method and process when failure and trouble occurs have not established and this would partly be an issue related to institutional aspect of the maintenance and management.

As stated above, some minor problems have been observed in terms of the institutional aspect, technical aspect and current status. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented with the aim of ensuring a stable power supply through improvement of the power distribution network in the central zone of Bangladesh and support for strengthening the institutional capacity of the executing agency which planned to be unbundled as a part of the power sector reform. Its objective was consistent with the development policy of Bangladesh, which aims for stable and reliable power supply,

Bangladesh's development needs including development of a power distribution network that could withstand the ever-increasing demand accompanying economic growth, and Japan's ODA policy. As such, its relevance is high. While project cost was within the plan, project period exceeded the plan due to the increase of outputs and the delays in tendering and each step of facility development. Therefore, the efficiency of this project is judged as fair. Through the implementation of this project, the maximum demand served in the target area increased, the frequency and duration of system interruptions and distribution loss rate decreased, and the reliability of power supply improved. This means that the project goal, providing a stable power supply, has achieved. These effects have a positive impact on stimulating the regional economy, local residents' daily lives. Since the planned unbundling of the executing agency did not materialize, support for strengthening its institutional capacity was not implemented. However, there was confirmed improvement in commercial indicators such as sales, number of customers and billing collection rate through the increase of the power supply. Therefore, the effectiveness and impact of this project are high. Although the state of maintenance of the facilities developed in this project is largely good and there are no issues with financial conditions, some minor concerns with the O&M system and technical capacity of the executing agency have been confirmed. Therefore sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- The executing agency reported a shortage of O&M staff. At the time of ex-post evaluation, the workload of each staff member increased, and some necessary O&M activities are accordingly performed by outsourced private companies. In the government sector of Bangladesh, staff shortage has been regarded as a common problem. Since excessive workload can hinder the implementation of appropriate O&M activities in the future, it is necessary for the executing agency to endeavour to increase the number of persons deployed as many as possible while considering the O&M workload required in each region.
- It has been confirmed that there are no staff at the regional distribution stations with the technical capacity to respond when problems arise with equipment. There is also a lack of understanding of not only the technical aspects, but also how to respond (who should deal with it or where to report it). The executing agency should clarify the process of how the distribution stations should respond when a problem occurs in the facility, notify each distribution station, and provide technical backup if needed.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Flexible response during implementing projects to realize effects

In this project, output was drastically increased by utilizing the remaining unused loan during project implementation. The occurrence of unused loan due to currency fluctuations and price competition cannot be predicted during appraisal. However, after confirming the occurrence of unused loans in this project, the scope of the project was reconsidered in terms of effectiveness and efficiency and significantly expanded from 12 unit as of the planning to 40 unit including 28 which was excluded in the course of formulating the plan based on the priority. Accordingly, though both project cost and period exceeded the plan and affected efficiency, it became possible to supply stable power to a wider area throughout the whole region. The use of unused loan can be examined only when the added scope is inseparable from the initial ODA loan project, necessity arises due to circumstances that cannot be predicted initially, and it is necessary to implement construction and procure service urgently. However, in cases when unused loan arise due to currency fluctuation or the reduced contract price during project implementation and when additional scope consistent with the purpose of use of unused loan is envisioned, the recipient government and Japanese stakeholder can respond promptly and flexibly to deal with the use of unused loan, thereby making it possible to further enhance the project effect.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Rehabilitation/construction facilities		
Distribution feeder		
33kV Line Rehabilitation	308 km	377 km
Construction	98 km	386 km
11kV Line Rehabilitation	227 km	730 km
Construction	183 km	565 km
11kV/0.4kV Line Rehabilitation	281 km	700 km
Construction	244 km	752 km
0.4kV Line Rehabilitation	616 km	1,618 km
Construction	525 km	1,024 km
33kV Line（Underground cable）		
Construction	3 km	32km
Conversion of 11 to 33kV Lines	-	46 km
Sub station		
33/11kV substation Renovation	16 no.	26 no.
33/11kV substation Construction	6 no.	14 no.
2 × 5MVA substation Renovation	-	12 no.
Transformer (Renovation and construction)		
250kVA transformer Renovation	393 no.	465 no.
Construction	451 no.	1,166 no.
100kVA transformer Renovation	564 no.	640 no.
Construction	419 no.	1,226 no.
Condenser (Construction)		
3x100kVA, Auto SW	122 no.	As planned
3x 50kVA, Auto SW	65 no.	As planned
3x100kVA, Auto Fix	115 no.	As planned
3x 50kVA, Auto Fix	7 no.	As planned
Equipment and vehicle for maintenance works, others	No detail information	Equipment for maintenance work 100 no., Vehicle 115 no., Function building 2,069m^2
Support for strengthening institutional capacity to newly establish Central Zone Power Distribution Company	・Development of institution framework for human resource, finance/accounting and legal/ regulatory ・Formulate systems necessary for beginning institutional management ・Development of business plan ・Conduct study and assist its implementation for development of universal service provision	Cancelled
2. Project Period	June 2008 – June 2011 (37 months)	March 2009 – May 2016 (87 months)
3. Project Cost		
Amount Paid in Foreign Currency	7,520 million yen	6,790 million yen
Amount Paid in Local Currency	5,217 million yen (3,344 million BDT)	10,769 million yen (8,549 million BDT)
Total	12,737 million yen	17,559 million yen
ODA Loan Portion	9,715 million yen	9,709 million yen
Exchange Rate	1 BDT = 1.56 yen (As of March 2008)	1 BDT = 1.26 yen (Average between March 2009 and March 2015)
4. Final Disbursement	March 2015	

People's Republic of Bangladesh

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project

"Grid Substations and Associated Transmission Lines Development Project"

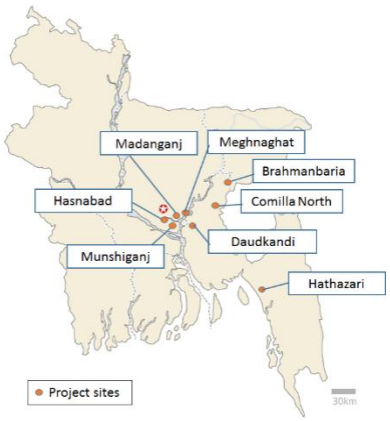
External Evaluator: Kaho Kumagai, Hideyuki Takagi, Ernst & Young ShinNihon LLC

0. Summary

The Project was implemented with the objective of stably providing high-quality electric power by constructing and expanding transmission lines and sub-stations in major cities such as Dhaka, Comilla and Chittagong and surrounding areas where rapid increase of electricity demand was expected.

The relevance of the project is high as it is consistent with the Bangladesh's development plan which places the promotion of the electric power infrastructure as an important field for the sustainable development of society and the economy, the need for development to establish a stable and reliable electric power supply, as well as Japan's ODA policy. Although the project cost was within the plan, the project period exceeded the plan due to the fact that it took time to prepare the bidding document and the delay occurred in the additional work to respond to the increase in regional power needs. Therefore, the efficiency of the project is fair. The implementation of the Project has enabled a continuous and steady supply of electric power even under the continuous increase in power demand. As an effect, the frequency of power failures and accidents has decreased, which has contributed to the enhancement of economic activity in the target area and the improvement of quality of social services such as hospitals and schools. Therefore, the effectiveness and impact of the project are high. With regard to the operation and maintenance of grid substations constructed and expanded during the Project, there were issues with securing technicians and parts in some instances. However, considering that a backup structure of the executing agency is in place and that the substations are in operation without issue, the sustainability of the transmission system overall has been secured. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location(s)
(Subject areas: The surrounding areas of Dhaka, Comilla and Chittagong)

Photo 1. Transformers and transmission facilities (Meghnaghat 132/33 kV substation)

1.1 Background

In Bangladesh, electricity demand was growing at an annualized rate of about 8% as of 2006 with peak electricity demand of approximately 4,000MW, but the generation capacity of approximately 3,600MW could not satisfy demand. Thus the gap between supply and demand was adjusted for using routine planned power outages. The gap between electricity supply and demand was expected to widen further due to the planned decommissioning of power plants in operation at the time due to dilapidation. Electricity shortages were especially critical in major cities such as Dhaka, Comilla and Chittagong and surrounding areas, which caused frequent power outages and dangerously low voltage. These issues posed a major obstacle to the economic activities of small to medium sized enterprises in particular, who do not have access to private power generators; therefore, a reliable and quality supply of electricity was required as the foundation for economic development. In the *Bangladesh Power Sector Development Plan and Strategy* (January 2004), the Government of Bangladesh stated three goals in its long-term vision for the energy sector: (a) to guarantee a supply of power which makes it possible for everyone to use electricity by the year 2020, (b) to supply high-quality and highly reliable electrical power, and (c) to supply electrical power at a reasonable price.

Under these circumstances, the “Grid substations and associated transmission lines development project” (hereinafter referred to as “the Project”) was implemented in major cities and surrounding areas where rapid growth of electricity demand was expected. The Project provided assistance with the construction and expansion of substations and transmission lines by Power Grid Company of Bangladesh Limited (hereinafter referred to as “PGCB”), which is in charge of electricity transmission.

1.2 Project Outline

The objective of this project is to improve stability and reliability of electric power supply by constructing and expanding transmission lines and sub-stations in major cities and surrounding areas where rapid increases in demand was expected, thereby contributing to the growth of the economy and society of Bangladesh.

Loan Approved Amount/ Disbursed Amount	4,642 million yen / 4,183 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	June 2006 / June 2006
Terms and Conditions	Interest Rate 0.01% Repayment Period 40 years (Grace Period 10 years) Conditions for Procurement General untied
Borrower / Executing Agency	Government of the People's Republic of Bangladesh (GOB) / Power Grid Company of Bangladesh Ltd. (PGCB)
Project Completion	October 2013
Main Contractor(s)	・ KEC International Ltd. (India) ・ Hyosung Corporation (South Korea) ・ M/S Jiangsu Etern (China) / China National Electric Wire & Cable Export Corp. (China) ・ Energypac Engineering Ltd. (Bangladesh) / ABB Ltd. (India) (JV)
Main Consultant(s)	―
Related Studies (Feasibility Studies, etc.)	・ Feasibility study (PGCB, 2004)
Related Projects	JICA (Technical Cooperation Project): ・ Strengthening Management and Performance Standards in Power Sector of Bangladesh through Promotion of TQM (2006 – 2009) JICA (ODA Loan Projects): ・ National Power Transmission Network Development Project (February 2013) ・ Dhaka-Chittagong Main Power Grid Strengthening Project (December 2015) World Bank:

	・ Power Sector Development Technical Assistance Project (2004 – 2014) Asian Development Bank (ADB): ・ Bangladesh Power Development Program (2003 – 2012)

2. Outline of the Evaluation Study

2.1 External Evaluator

Kaho Kumagai, Hideyuki Takagi, 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: November 2017 – November 2018

Third-Country Meeting: February 18 – 21 and May 6 – 9, 2018

Duration of the Field Study: February 27 – April 5 and June 27, 2018 (The field study was carried out by a local consultant.)

2.3 Constraints during the Evaluation Study

Based on instructions from the JICA Evaluation Department, the evaluator did not enter Bangladesh for security reasons and a local consultant carried out the entire process of the field study under the direction of the evaluator. The evaluator and the local consultant had a preliminary meeting in the third country (Thailand) before the field study to share information on the evaluation policy of the project and the method of the field study. In the meeting, in order for the local consultant to accurately understand and be able to collect information necessary for the analysis in accordance with 5 evaluation criteria, the evaluator explained the details of materials including a questionnaire to the executing agency and an information collection checklist to be used in the site survey. This process ensured the completeness of the collection of information and the quality of information collection used in analysis.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Bangladesh

Poverty Reduction Plan (2005), a national development plan of Bangladesh at the time of appraisal of the Project, regarded infrastructure as important in poverty reduction, economic growth and social development, as it directly affects socioeconomic consequences. Increasing

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

[2] ③: High, ②: Fair, ①: Low

access to electricity was stated as an issue given that about 1/3 (22% in rural areas) of the population had access to electricity as of 2005[3].

Policy Statement on Power Sector Reforms (2000), one of the sector development plans at the time of the appraisal of the Project, stated three goals in the long-term vision for the electric power sector: to ensure universal access to electricity by 2020, to ensure a high-quality and reliable electric power supply, and to provide electricity at reasonable rates[4]. In addition, the *Bangladesh Power Sector Development Plan and Strategy* (2004) stated plans to construct/strengthen new power sources about 5,000MW by 2012 and about 11,000MW by 2020, power transmission lines of about 10,000km in total, 230kV/132kV substations of about 17.5 thousand MVA, and 132/33 kV substations of 12 thousand MVA by 2020.

The 7th Five-Year Plan 2016 – 2020 (2015) [5], a national development plan at the time of the ex-post evaluation, states that an efficient and inexpensive electric power infrastructure needed to be established in order to maintain the growth of Bangladesh's international competitiveness. It plans to add following new substations within the planning period: approximately 11.8 thousand MVA of 400/230kV substations, 18.3 thousand MVA of 230kV/132kV substations, and approximately 17.3 thousand MVA of 132/33kV substations[6].

Furthermore, the *Power System Master Plan 2016* (2016), a sector development plan at the time of the ex-post evaluation, also states the necessity of building a high-quality electricity network to support long-term economic development[7].

As stated above, both national development plans and sector development plans of Bangladesh have positioned the increase and improvement in quality of electric power supply as the basis for economic development, both at the time of appraisal and at the time of ex-post evaluation of the Project. The Project supports these plans and is consistent with the development policy of Bangladesh.

3.1.2 Consistency with the Development Needs of Bangladesh

At the time of appraisal of the Project, electricity demand was rapidly increasing in Bangladesh at 300-400 MW per year (annual increase of about 8%) due to economic growth; therefore, capital investment was required to respond to the increase in demand in each department of electricity: generation, transmission, and distribution. Regarding the power

[3] Source: *Bangladesh Unlocking the Potential National Strategy for Accelerated Poverty Reduction*, General Economics Division Planning Commission, Government of People's Republic of Bangladesh, 2005
[4] Source: Materials provided by JICA
[5] The five-year development plan was replaced by a poverty reduction plan between 2002 and 2010. It then restarted from 2011.
[6] Source: *Seventh Five Year Plan FY2016-FY2020*, General Economics Division Planning Commission, Government of People's Republic of Bangladesh
[7] Source: Power Division, Ministry of Power, Energy and Mineral Resources, Government of People's Republic of Bangladesh, September 2016

transmission department, it was required to extend the transmission lines about 5,000km, increase the substation of 230kV/132kV about 8,000 MVA and 132kV/33kV about 5,000 MVA by 2012. The supply and demand of electric power was tight especially in major cities such as Dhaka, Comilla and Chittagong and surrounding areas where industrial concentration has progressed. In the project target area as of 2006, load cutoff of about 80 MW was implemented at the peak hours. Electricity issues including frequent power outages and low voltages affected mainly small and medium enterprises that cannot use private generators, posing a major obstacle to economic activity[8].

The capacity of the power generation facilities and the power demand in Bangladesh continue to increase even after completion of this project (see table 1). The nationwide capacity as of 2013 was surpassed by the peak demand as of 2017, in just four years. Considering that electricity demand will grow further in Bangladesh, which continues to grow economically, demand may exceed supply over the next few years unless investment is made for electric power infrastructure. Electricity demand in major cities including Dhaka, Comilla and Chittagong was also increasing at the time of ex-post evaluation; therefore, it is necessary to continue developing electric power facilities with a view to the future, in order to keep supplying electric power stably to such major cities which lead the economic growth of the country. Based on these observations, it is confirmed that there are needs for improvement of the electricity transmission network carried out by the Project.

Table 1. Capacity and peak demand of electricity nationwide and in major cities

Area	Item	2013	2014	2015	2016	2017
Nationwide	Total capacity (MW)	9,151	10,416	11,532	12,365	13,846
	Actual peak demand (MW)	7,482	8,488	8,124	9,286	9,507
	Peak demand / Total capacity (%)	82	81	70	75	69
Dhaka	Total capacity (MW)	3,894	3,407	3,575	4,322	4,644
	Actual peak demand (MW)	2,604	2,834	3,113	3,438	3,842
	Peak demand / Total capacity (%)	67	83	87	80	83
Comilla	Total capacity (MW)	1,341	1,332	1,732	2,192	2,465
	Actual peak demand (MW)	767	564	723	907	963
	Peak demand / Total capacity (%)	57	42	42	41	39
Chittagong	Total capacity (MW)	1,207	1,283	1,405	1,408	1,641
	Actual peak demand (MW)	687	743	925	1,079	1,155
	Peak demand / Total capacity (%)	57	58	66	77	70

Source: Materials provided by PGCB

[8] Source: Materials provided by JICA

3.1.3 Consistency with Japan's ODA Policy

At the time of appraisal of the Project, support for the electric power sector was positioned as a priority sector for "establishment of infrastructure for sustainable growth" in the *Medium-Term Strategy for Overseas Economic Cooperation Operations* (April 2005)[9]. In addition, in t*he Country Assistance Strategy for Bangladesh* (May 2006), electric power was positioned as a priority sector for support: a policy was stated to support and promote sector reform by providing loans in collaboration with other donors[10]. Furthermore, the *Country Assistance Program for Bangladesh* (May 2006) listed the development of infrastructure including electric power as a priority target and sector for economic growth, as it is important to the investment environment and has a direct effect on poverty reduction. The Project was aimed at the development of the economy and society by establishing transmission and distribution facilities in various parts of Bangladesh and supplying stable electric power, which was consistent with Japan's aid policy at the time of appraisal.

This project is sufficiently consistent with the development plan and development needs of Bangladesh, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

3.2.1.1 Construction and procurement of machinery

Table 2 shows the planned and actual output of the Project. Outputs were constructed and expanded as planned, except for the increase in number and scale of the facilities to be built at the substations in Brahmanbaria and Comilla North substation due to the increase in regional power needs.

Table 2. Plan and actual of the main outputs

Item	Plan	Actual
Construction of new substations and transmission lines	Daudkandi: 132/33kV substation including 2X50/75MVA, 3-phase transformers and all other necessary equipment and materials	As planned
	Brahmanbaria: 132/33kV substation including 2X25/41MVA, 3-phase transformers and all other necessary equipment and materials	Modification of the facility from 2X25/41MVA to 3X25/41MVA, 3-phase transformers and all other necessary equipment and materials
	Munshiganj: 132/33kV substation including 2X50/75MVA, 3-phase transformers and all other necessary equipment and materials	As planned

[9] Source: Materials provided by JICA
[10] Source: Materials provided by JICA

	Meghnaghat: 132/33kV substation including 2X50/75MVA, 3-phase transformers and all other necessary equipment and materials	As planned
	Transmission lines for the above substations (Approximately 80km of total extension 132kV double circuit transmission lines)	As planned
Extension of facilities in existing substations (transformers and other equipment)	Comilla North substation: Installation of new 3X75MVA 230/132kV single phase transformers along with necessary equipment for bay extension	2X50/75MVA 132/33kV 3-phase transformers along with necessary equipment for bay extension, in addition to the originally planned facilities
	Hasnabad substation: Replacement of existing transformer by the new 3X66/100MVA 132/33kV 3-phase transformers along with necessary equipment for bay extension	As planned
	Hathazari substation: Installation of new 1X150MVA 230/132kV 3-phase transformers along with necessary equipment for bay extension	As planned
	Madanganj: Installation of two 132kV line bays with necessary equipment for bay extension	As planned

Source: Materials provided by JICA and PGCB

Details and the reason for modifications in outputs

Taking into consideration the fact that an increase in power needs exceeding the demand forecast in the advance feasibility study, the following additions in facilities were carried out.

(Additions to the newly constructed Brahmanbaria substation)

Modification: Addition of a 25/41MVA transformer[11]

Reason: The establishment of Brahmanbaria substation was planned in 2003. With the passage of time, however, demand growth as of 2011 exceeded the demand forecast at the time of its planning. As it was predicted that further load interruption would occur, PGCB conducted a survey on the addition of a 25/41MVA transformer, which is necessary as power supply increases. Following the concurrence of JICA on the modification on February 12, 2012, additional extension was implemented. The additional 25/41MVA transformer was connected with a 70MW power station (Quick Rental Power Plant: QRPP[12]) installed adjacent to the new substation, to compensate for the power demand in the Brahmanbaria area.

[11] Source: Materials provided by JICA

[12] The Bangladesh government allows construction of rather expensive private rental power plants in order to meet urgent electricity demand. Source: Ministry of Power, Energy and Mineral Resources of Bangladesh (Quoted from the survey report on actual condition of BOP in Bangladesh (December 2012), Japan External Trade Organization (JETRO))

(Additions to Comilla North substation)

Modification: Upgrading from two 25/41MVA transformers to two 50/75MVA transformers[13]

Reason: Comilla North substation is located in the same area as Brahmanbaria. Due to the rapid demand growth in the region, in 2012, the Comilla North substation was experiencing overload situation. It was predicted that further load interruption would occur unless the transformer capacity was increased. Therefore, PGCB conducted a survey on replacing existing two 25/41MVA transformers with two 50/75MVA transformers. Following the concurrence of JICA on April 4, 2012, additional expansion was implemented.

3.2.1.2 Consulting Services

At the time of appraisal, PGCB was planning to use consulting services only for the construction of Munshiganj substation, where construction was necessary to deal with the special topography (it was necessary to lay overhead transmission line across the Daleshwari river). However, by the time the project was implemented, PGCB had implemented a number of constructions under similar conditions through other projects (ADB projects) and had accumulated sufficient know-how. For this reason, PGCB changed its decision and did not use consulting services for the construction[14].

Cancellation of the consulting services for the construction of Munshiganj substation did not affect the project period, and no additional costs were incurred as all the tasks were carried out by PGCB staff instead[15]. Furthermore, facilities are being operated with no problems at the time of ex-post evaluation. Because technical consulting was not necessary at the project execution stage, the change in their decision is considered appropriate.

On the other hand, not hiring a procurement support consultant caused delay in project completion as the executing agency was not familiar with the bidding procedure based on JICA's procurement guidelines for ODA loan projects. The risk of delay could have been lowered by receiving consultants' support on the procedural aspects of bidding. Therefore, measures should have been taken to prevent the delay in the Project by using consulting services even if only partially. (Refer to "3.2.2.2 Project period" and "Lessons learned")

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was within the plan (99% of the plan). The total project cost was planned to be 7,234 million yen (yen loan portion was 4,642 million yen), but the actual cost was 7,128 million yen (yen loan portion was 4,183 million yen). Although additions

[13] Source: Materials provided by JICA
[14] Source: Interview with PGCB
[15] Source: Answer to the questionnaire for PGCB

were made at two substations, the actual project cost was reduced due to the exchange rate fluctuations[16], cancellation of consulting services, and no utilization of resources for contingencies and price escalation[17].

3.2.2.2 Project Period

The original project period at appraisal was from June 2006 to June 2009, 37 months in total[18]. However, as mentioned in "Output", additional work was carried out at the substations in Brahmanbaria and Comilla North, for the purpose of responding to the increase in power needs. For this reason, the additional 19 months for this change was included in the comparison of planned and actual project period. As a result, the actual project period of 97 months from June 2006 to June 2014, significantly exceeding the plan of 56 months (173% compared to the plan).

The breakdown of the 41-month period of delay is as follows: 28 months for the construction of original scope, 2 months from the completion of the original scope construction to the start of the additional construction, 5 months for the additional constructions, and 6 months from the completion of additional work to the commencement of operation of the facilities. As described below, delay in the project period also occurred due to factors other than construction, during the process from bidding preparation to conclusion of contract in the original scope work, and when switching from temporary connection with a power station in additional work.

[Preparation for bidding - conclusion of contract with contractor]

Compared to the 3 months planned period (from July 2006 to September 2006), the actual period was 10 months (October 2006 - July 2007) for the preparations for bidding documents related to the construction and expansion of each substation and related facilities of this project. The bidding then began in December 2007, five months later.[19] The reason why the delay in the preparation of bidding documents occurred was that although PGCB decided that procurement support consultants were unnecessary at the commencement of the Project given their experience in preparing bidding documents for the ADB projects, it took more time than expected to finalize the content of the bidding documents as PGCB was unfamiliar with preparing documents based on JICA's procurement guidelines for ODA loan projects.

[16] 1 Bangladesh Taka (BDT) = 1.64 yen at the time of appraisal, and BDT 1 = 1.31 yen at the completion of the project; therefore, the yen strengthened about 20% against BDT.
[17] Source: Answer to the questionnaire for PGCB
[18] The project period was set to be from the Loan Agreement signing date (starting point) up to the commencement of operation (completion) of new facilities.
[19] Source: Materials provided by JICA

After preparing the bidding documents, a long period of time (more than 10 months) was also required to conclude the contract. The longest construction lot took 27 months from preparation of the bidding documents until the contract became effective[20].

[Delay in the additional work]

It was decided through formal procedures that in Brahmanbaria and Comilla North substations, additional work for electric facilities would be done in addition to the original work while the original work of development and expansion was completed. At Brahmanbaria substation, a method of temporary connection to QRPP, a 70MW power station, via a circuit breaker had been adopted until the completion of the 25/41MVA transformer. Although it was necessary to temporarily shut down QRPP when switching to connection via the 25/41MVA transformer after completion of the additional work and trial operation, it overlapped with the irrigation season which requires more power than usual. For the convenience of beneficiaries receiving electricity from QRPP, it was decided to wait for trial operation until May 23 of the same year when the irrigation period would end[21]. As a result, the trial operation which was originally scheduled on January 5, 2013 was delayed until May 23 of the same year.

As for the additional work at Comilla North substation, the date of trial operation was scheduled to be July 10, 2013; however, the actual date was December 6, 2013[22]. The delay was caused by the process of changing of L/C (letter of credit) issuing bank[23].

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

Since internal rates of return of the Project were not calculated at appraisal, recalculations were not made at the ex-post evaluation.

Although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

[20] In the construction of lot No. 3, bidding document was prepared in October 2007, then re-bidding was done in May 2008. After the conclusion of contract in December 2009, it became effective through the concurrence of JICA in January 2010 (Source: Materials provided by PGCB).
[21] Source: Interview with PGCB
[22] Materials provided by JICA
[23] Source: Interview with PGCB

3.3 Effectiveness and Impacts[24] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The operation and effect indicators set at the time of appraisal were "capacity utilization," "load shedding" and "voltage drop (%)." The baselines and targets of the indicators are shown in Table 3.

Table 3. Operation and effect indicators set at the time of appraisal

Indicator	2005	2012 (3 years after completion)
	Baseline	Target
Availability Factor (%)[Note 1]	88.14% (Average)	Below 100%
Load shedding (MW)[Note 2]	78MW (Total)	0MW
Voltage drop (%)[Note 3]	81% (Average)	Within +/-10% from 100% rated voltage

Source: Materials provided by JICA

Note 1: This indicator uses the average value of existing substations subject to the project. The Availability Factor of the new substation adopts the operation rate of the substation that supplies electricity to the area.

Note 2: Load shedding means stopping the supply from a substation in order to protect equipment in the event that demand occurs beyond the supply capacity of the transmission/substation equipment of the substation.

Note 3: Voltage is more stable as the fluctuation range of ± is smaller with respect to the standard value (indicated by 100%)[25]. The voltage drop rate compares the lowest voltage, which is expressed as a ratio (%) of the voltage dropped at the maximum against the standard value. The baseline value of the Project was set as the voltage drop rate at the time of appraisal at the site where the substations are to be newly established, and the target value was set as the range of voltage fluctuation at the new substations (± fluctuation range to 100%).

(1) Availability Factor

The availability factor of substations is required not to exceed 100%. At the time of appraisal, it was expected that the capacity utilization rate would exceed 100% in a few years without the Project. Then, an actual excess was observed. However, it has been maintained at 100% or less since completion of the Project, showing that the target has been achieved.

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

[25] Supplemental note: Voltage always fluctuates slightly, and when the fluctuation range exceeds a certain percentage, adverse effects such as deactivation occur on the electricity equipment at factory and electric appliances at home. Therefore, it is necessary to control the voltage so that the voltage drop rate falls within a certain range.

Table 4. Annual changes in availability factor of each facility

(Unit: %)

Year / Facility	2005 **Baseline**	2006	2007	2008	2009	2010	2011	2012	2013	Completion 2014	2015	2016	3 years after completion 2017 **Actual**
Construction of new substations and transmission lines													
Daudkandi	80	86	92	100	31	34	37	41	48	46	39	70	80
Brahmanbaria	85	91	99	107	75	80	88	95	51	65	67	88	88
Munshiganj	76	82	89	96	58	63	69	76	48	65	76	83	88
Meghnaghat	94	118	129	140	48	52	56	61	46	56	36	44	49
Extension of facilities in existing substations													
Comilla North	104	112	121	131	71	76	82	98	54	32	44	93	84
Hasnabad	82	89	96	104	56	61	65	71	48	56	56	58	69
Hathazari	96	104	112	121	71	78	87	96	72	72	79	75	73
Average	**88**	**97**	**105**	**114**	**59**	**63**	**69**	**77**	**52**	**56**	**57**	**73**	**76**

Source: Answer to the questionnaire and data provided by PGCB

(2) Load shedding

The load shedding in the project area remains at a low level following the completion of the Project and it has been on a downward trend, while it drastically increased once after the appraisal. The decrease rate of load shedding is only 35% in comparison of the actual amount at the time of ex-post evaluation (2017) with those of the baseline. However, in comparison with the peak of 348MV in 2010, there has been a major decrease of 85% so far. Although it has not reached the target of 0MW, the project is considered to have contributed to a substantial improvement in load shedding.

Table 5. Annual changes in load shedding of each facility

(Unit: MW)

Year / Facility	2005 **Baseline**	2006	2007	2008	2009	2010	2011	2012	2013	Completion 2014	2015	2016	3 years after completion 2017 **Actual**
Construction of new substations and transmission lines													
Daudkandi	8	9	10	11	12	14	13	10	10	12	14	12	13
Brahmanbaria	14	15	16	19	25	30	26	22	20	19	8	5	0
Munshiganj	30	33	35	38	45	52	48	38	38	33	11	9	7
Meghnaghat	18	19	20	27	33	38	34	27	27	24	10	11	14
Extension of facilities in existing substations													
Comilla North	8	25	43	63	76	87	80	63	62	55	18	15	10
Hasnabad	0	0	0	6	8	9	9	8	7	5	0	0	0
Hathazari	0	17	50	85	102	118	108	85	84	75	25	20	7
Total	**78**	**118**	**174**	**249**	**301**	**348**	**318**	**253**	**248**	**223**	**86**	**72**	**51**

Source: Answer to the questionnaire and data provided by PGCB

(3) Voltage drop

The actual voltage drop rate at the time of ex-post evaluation (2017) achieved the target rate of within -10% of the standard value.

Table 6. Annual changes in voltage drop of each facility

(Unit: %)

Year / Facility	2005 **Baseline**	2006	2007	2008	2009	2010	2011	2012	2013	2014 (Completion)	2015	2016	2017 (3 years after completion) **Actual**
Construction of new substations and transmission lines													
Daudkandi	84	84	85	86	97	96	95	94	96	97	96	97	98
Brahmanbaria	84	85	84	85	103	102	101	100	98	99	98	98	98
Munshiganj	77	79	80	80	81	89	94	97	98	97	98	98	98
Meghnaghat	79	84	82	86	97	96	95	94	97	98	98	98	98
Average	**81**	**83**	**83**	**84**	**95**	**96**	**96**	**96**	**97**	**98**	**98**	**98**	**98**

Source: Answer to the questionnaire and data provided by PGCB

3.3.1.2 Qualitative Effects (Other Effects)

The qualitative survey was conducted in all of the target areas of the construction of new substations and transmission lines (Daudkandi, Brahmanbaria, Munshiganj, Meghnaghat) and surrounding areas, and in the two places of the extension of facilities in existing substations (Comilla North and Madanganj). The subjects of the survey were PGCB personnel in charge of the operation, large-scale customers (SMEs, hotels, hospitals, schools, state power distribution companies etc.), chambers of commerce and other economic organizations. The key informant interview (KII) method was used for the survey[26]. Interview items were set regarding the stability of electric power service as a qualitative effect (stabilization of voltage, reduction of power failure time, etc.), and the accompanying economic and social impact for the purpose of investigating the difference between before and after the Project.

(1) Stable supply of electric power

In response to the questions concerning stabilization of electric power supply, the executing agency and all of the KII respondents replied that the number of the electrical equipment failure has decreased since the project implementation. For example, according to the owner of a rice mill factory in Madanganj, damage to the machine motor due to unstable voltage has

[26] The target of KII was a beneficiary that fulfilled the characteristics of each area subject to the Project and was a small business that was easily susceptible to load shedding. Specific subjects include 2 timber factories in Munshiganj, 1 hospital and 1 school in Meghnaghat, 1 confectionary shop and 1 clothing shop in Comilla North, 1 hospital and 1 general store that sells household electric appliances, etc. in Daudkandi, 1 office of a bus company and 1 restaurant in Brahmanbaria, 1 lumber trading company and one rice mill in Madanganj.

not occurred after the Project whereas it frequently occurred before the Project. Therefore, the implementation of the Project is considered to have contributed to the stabilization of electricity supply.

(2) Frequency of blackouts

Load shedding causes blackouts and electrical equipment failure. Through the development of new power transmission facilities, the reliability of the power system has been improved as load shedding has reduced as described in the quantitative effect above. According to the timber factory manager of Munshiganj, one of the respondents to the KII survey, the instantaneous interruption (momentary power failure) before the project was 5-6 times a day (total 1 to 2 hours), whereas there is almost none at the time of the ex-post evaluation. The implementation of the Project is considered to have contributed to the stabilization of electricity supply, as decreases in power outage and instantaneous interruptions have been observed after the Project.

(3) Customer satisfaction

According to the answers to the questionnaire to PGCB, complaints are decreasing as load shedding has decreased and the voltage problem has also improved after project implementation. In addition, no complaints about power service were heard in the KII. Therefore, the Project is considered to have contributed to improvement of customer satisfaction.

As described above, the data of the project area and the qualitative information obtained through the field survey confirm that the planned project effects have been achieved.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Economic effects

The answers to the questions on the economic effects in the KII were as shown in Table 7. The answers in the KII indicate that the number of factories and commercial facilities, etc. entering the beneficiary area is rapidly increasing due to stable supply of electric power. Respondents also experienced a rise in land prices due to these effects. Examples of the economic effects reported include increase in sales due to improvement in productivity of factory equipment and increase in sales at a bus company which uses an online reservation system, both due to stable operation of electricity equipment by stable supply of electric power.

Table 7. List of answers to KII regarding economic effects

Category	Economic effects	Attributable respondent(s)
Development of the entire region	We have felt the effects of the rapid increase in investment in the area as new commercial facilities, schools, hospitals, etc. are newly established.	All of the respondents
	As electricity is supplied in a stable manner, the number of entrants to the beneficiary area has increased, and land prices have increased three to five times.	Factory, hospital, school, clothing store, restaurant
Effects related to business management	Since the supply of electric power has become stable, business hours can be extended, which has led to improved sales. For example: Ÿ Prior to the project, it was able to operate effectively for only 5 hours due to unstable power supply, but it has been able to operate for 8 hours after the project. (A factory in Munshiganj) Ÿ After the project, rice mills can be operated overnight. As a result, the amount of rice that can be shipped to merchants has increased by 65% compared to the previous years. (A rice-milling plant in Madanganj)	General store, restaurant, factory, clothing store
	The respondent purchased new timber processing equipment as electricity was supplied in a stable manner, which led to an increase in its production volume. As a result, sales increased by 60% compared with before the project.	Factory
	Because it is able to operate the online reservation system stably after the project, the bus company acquires twice as many customers as before (400 people a day). Power stabilization has contributed to improve sales.	Bus company
	Electricity fees paid have increased, but the increase in revenue due to the stable supply of electricity is larger. For this reason, the respondent has experienced economic benefit.	Factory
	A large-sized in-house generator became unnecessary. It became possible to change it to a small one or not to use it.	Hospital, clothing company, restaurants
	Before the project, it was impossible to preserve merchandise (confectionery), but since the refrigerator works steadily after the project, it became possible to store the goods. As an effect, food loss has decreased by 35 to 45% compared with before project implementation, and sales have increased by 150%.	Confectionery shop
	Timber processing equipment can be operated stably now. Due to the increase in production volume, monthly sales have increased by 25 to 40% compared to before the project.	Timber trading company

The respondents to the KII recognize that while electricity expenditures have increased in comparison with that at the time of appraisal due to increase in tariffs and the volume of use of electricity, the effect of increased revenue from the stable supply of electric power outweighed these expenses. Therefore, beneficiaries are considered to have benefitted

economically from the Project.

(2) Improvement of social services

The steady supply of electric power has led to improvements in services at hospitals, factories and commercial facilities, as the disruption of work due to unstable electricity has been reduced. The KII respondents have also experienced improved quality of life such as the increase in streetlights and the stable consumption of electricity at home.

The effect of power stabilization is not limited to electric equipment. In the answers to the KII to the school, it was mentioned that increasing electricity supply amount facilitated learning at school because it enabled the school to stay well-lit and students to study even at home.

In terms of safety, it was also reported in the KII that security has been improved due to cities becoming better lit at night, or police investigation became more efficient due to an increase in the number of surveillance cameras installed.

Table 8. List of answers to KII regarding social services

Category	Social effects	Attributable respondents
Effects on the services of hospitals	Ÿ Prior to the project, surgery could only be performed on one operating table, but now it is possible to perform surgery simultaneously on three operating tables. (A hospital in Daudkandi) Ÿ Before the project, there were five to six instantaneous interruptions a day; this caused frequent interruption of medical examination when using machines, with only about 60% of an examination being completed. Such interruption has not occurred after the project implementation. (A hospital in Meghnaghat) Ÿ Prior to the project, not very much electric equipment had been introduced. At present, the hospital has introduced CT scan and ultrasound diagnostic equipment; therefore, the range of medical services the hospital can offer has increased. (A hospital in Daudkandi)	Hospital
Effects on general consumers	The sales of electrical appliances such as household appliances and pumps have increased by 20 to 25% compared with before project implementation. (A general store in Daudkandi)	General store
Effects on schools	Ÿ Keeping the classroom well-lit makes it easier for students to study at school. Students can also study at home. Ÿ In classes using projectors, interruption of classes due to instantaneous power interruption occurred before the project, and they could not follow the schedule. Currently such classes can proceed without problems.	School
Effects on security	The city became well-lit and safe due to the increase in street lights etc. It has enabled people to walk at night. For example: The effects of an increase in the number of installed surveillance cameras have been felt. (A factory in Munshiganj)	Factory, restaurants, bus company

(3) Contribution to economic development (Reference only)

The GDP growth rate of Bangladesh as a whole is shown in figure 1, which is alternative information as a reference as GDP growth rate in the direct beneficiary area of the Project could not be obtained. The GDP growth rate since the 2015 fiscal year, when the Project was completed, has continued to rise by more than 7%, and has been at a high level in recent years. Not only PGCB, but Bangladesh Power Development Board, Dhaka Power Distribution Company, and Electricity Generation Company of Bangladesh have implemented projects related to power generation, transmission and distribution. The realization of stable supply of electric power by these projects is considered to have contributed to the economic development of the whole country.

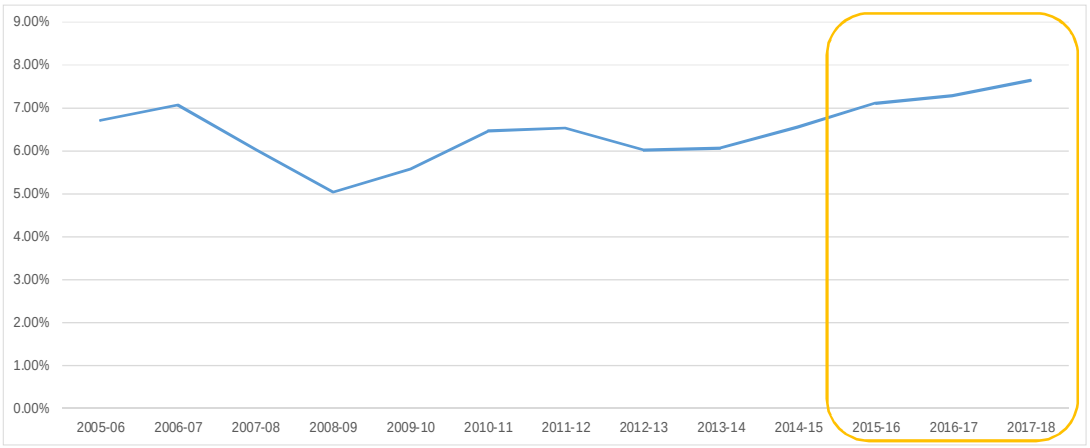


Figure 1. Annual changes in real GDP growth rate in Bangladesh

Source: Bangladesh Bureau of Statistics

Note: Bangladesh's fiscal year is from July to the end of June in the next year.

Other than the Project, facilities development including the establishment and renewal of power grid and substations etc. of PGCB has been carried out sequentially with the funds of other donors and as self-financed projects. Therefore, the above impact is recognized as a composite effect of these facilities development projects.

Table 9. A list of PGCB's projects with the funds of other donors or GOB, which were completed from the completion of this project until the time of ex-post evaluation

	Facility improvement project [Note 1]	Year of completion (Fiscal year)	Financing [Note 2]
1	Haripur 412 MW combined cycle power plant and associated substation (PGCB Part)	2013/2014	JICA, GOB
2	Meghnaghat – Aminbazar 400 kV transmission line project (Phase 1)	2013/2014	ADB, GOB
3	Grid inter connection between Bangladesh (Bheramara) and India (Baharampur)	2013/2014	ADB, GOB
4	Construction of new substation and expansion of substation including transmission line facility	2013/2014	ADB, JICA (this project), GOB
5	Transmission efficiency improvement through reactive power compensation at grid substation and re-enforcement of Goalpara substation	2013/2014	KfW (German Government-owned Development Bank), GOB
6	Aminbazar – Old Airport 230 kV transmission line and associated substations	2014/2015	ADB, GOB
7	Siddhirganj – Maniknagar 230 kV transmission line project	2014/2015	WB, GOB
8	Tripura (India) – Comilla (Bangladesh) Grid Interconnection Project	2015/2016	GOB
9	Bibiyana – Kaliakoir 400 kV and Fenchunganj – Bibiyana 230 kV transmission line	2016/2017	EDCF (Korean Economic Development Cooperation Fund), GOB

Source: Annual reports of PGCB

Note 1: These are included in PGCB's annual development program, and many use the funds of donors or Bangladesh government. Besides these projects, many facility improvements have been done using PGCB's own funds.

Note 2: The description of PGCB's own fund expenditures is omitted.

3.3.2.2 Other Positive and Negative Impacts

(1) Impact on the Natural Environment

According to the executing agency, environmental mitigation measures and environmental monitoring plan formulated under Initial Environmental Examination (IEE) were partially implemented[27]. It was confirmed by the executing agency and the KII that the construction was adequately managed in terms of the environment. Environmental influences on air, noise and vibration seemed to have occurred to some extent during construction, although no complaints were received. Regarding measures to prevent pollution, it was confirmed through site inspections that no negative impact on the environment occurred, as pollution was

[27] In this ex-post evaluation, the environmental monitoring report could not obtained although it was requested to the executing agency. For this reason, it was regarded that the environmental monitoring plan was partly implemented, referring to the response of the executing agency. Meanwhile, since there were no complaints heard around the target facilities, it was recognized that there was no particular negative environmental impact by the Project implementation.

prevented by using water spray. Also, the Project is considered to have been managed appropriately as there were no complaints about negative impact on the environment according to the information from KII respondents. Therefore, the implementation of the Project is judged to have had no negative impacts on the natural environment.

(2) Resettlement and Land acquisitions

Land acquisition was conducted according to the government regulation (The Acquisition of Waste Land Act, 1950). The site was 8 acres in size, and land acquisition was done from 23 landowners. There was no relocation of residents and/or livestock as the site was not used for those purposes. It was confirmed with the executing agency and through the KII that no complaints occurred due to the land acquisitions.

The implementation of the Project has enabled continuous and steady supply of electric power even under the continuous increase in power demand. As an effect, the frequency of power failures and accidents has decreased. In the hospitals, factories, and commercial facilities in the beneficiary area, stable operation and extension of working hours without concern for voltage interruption has been realized. The Project contributes to improve the quality of medical services and industrial services in the beneficiary area as well. These improvements contribute to the social and economic development of the country.

Given the above, this project has largely achieved its objectives and therefore the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The number of personnel at the new substations at the time of ex-post evaluation was confirmed through the site inspections and with PGCB headquarters (see Table 10). Basically, there was no major change in the number of personnel at the time of appraisal and ex-post evaluation. However, it was observed that the number of engineers at Munshiganj, Daudkandi and Brahmanbaria was insufficient. Engineers who actually work in the substation are staff below the level of field workers (Foreman), and junior engineers and engineers are in the position of supervisors. In view of this point, the insufficient number of staff below foreman is assessed to be a problem at the substations where the number of technicians is insufficient. According to PGCB, the insufficient number of technicians is a factor causing insufficient daily maintenance. On the other hand, there is a practice in place at each substation: if a situation arises that cannot be dealt with by the personnel in the substation, a junior engineer

(or someone who fulfills that role in absence of a junior engineer) contacts the executive engineer responsible for the Grid Maintenance Division (GMD), the maintenance department of power transmission in the regional jurisdiction, and GMD then dispatches necessary engineers to the substation[28]. Based on these facts, PGCB considers there to be no major problems due to lack of personnel. This systematic backup works 24 hours a day, 365 days a year. For this reason, a mechanism for maintaining sustainability is considered to have been established as an entire system.

According to the Human Resources Department of PGCB, new personnel with technical skills are scheduled to be placed at the substations with insufficient number of technicians. It was also mentioned that there is a plan to provide training for the new personnel. (Refer to the recommendation for "Formulation of human resources recruitment and capability building plan based on accurate information management on substation technical staff")

Table 10. The number of personnel at the new substations at the time of ex-post evaluation

Substation	Reply from PGCB headquarters	Reply during site inspections *The number of staff (Foreman or below) except for Munshiganj
Brahmanbaria substation	7 people in total: ・ Engineer 1 ・ Junior engineer 4 ・ Foreman 0 ・ Electric engineer/overhead wire engineer 1 ・ Technical assistant 1	4 people in total: ・ Foreman 1 ・ Electric engineer/overhead wire engineer 1 ・ Technical assistant 2
Daudkandi substation	9 people in total: ・ Engineer 1 ・ Junior engineer 4 ・ Foreman 0 ・ Electric engineer/overhead wire engineer 1+2 ・ Technical assistant 1	6 people in total: ・ Foreman 2 ・ Electric engineer/overhead wire engineer 3 ・ Technical assistant 1
Meghnaghat substation	9 people in total: ・ Engineer 1 (Newly hired) ・ Junior engineer 6 ・ Foreman 0 ・ Electric engineer/overhead wire engineer 0 ・ Technical assistant 2	The number of staff is sufficient (There was no response on the detail of the number of staff)
Munshiganj substation	6 people in total: ・ Engineer 0 (a junior engineers takes the responsibility as an engineer) ・ Junior engineer 5 ・ Foreman 0	7 people in total: ・ Engineer 1 (on leave) ・ Junior engineer 5 ・ Foreman 0

[28] As for the frequency of dispatch from GMD, it is irregular as it is performed on as-necessary basis. The dispatched engineer addresses equipment problems in which failure has occurred by checking the operation state of each part, testing the operation, replacing parts with problems and filling lubricating oil, etc.

	・ Electric engineer/overhead wire engineer 0 ・ Technical assistant 1	・ Electric engineer/overhead wire engineer 0 ・ Technical assistant 1

Source: Interview with PGCB, site inspection

3.4.2 Technical Aspect of Operation and Maintenance

At the time of appraisal, PGCB was implementing projects for the development of transmission lines without problems supported by ADB etc. without hiring consultants. It was also maintaining facilities appropriately[29]. At the time of the ex-post evaluation, all the staff at the substations are required to attend 72 hours of training per year in order to maintain their technical capabilities. In the operation and maintenance training for technical staff (Technical Officers), 5 days of training courses are provided to learn about equipment maintenance and safe operation, equipment monitoring, trouble and coping methods, disaster response methods etc. In addition, JICA has provided technical cooperation on total quality control (TQM) to the power sector of the country since 1999. It also implemented a technical cooperation project "Strengthening Management and Performance Standards in Power Sector of Bangladesh through Promotion of TQM" from 2006 to 2009, simultaneously with the implementation of the Project. In these projects, introduction of TQM, improvement of maintenance management technique, establishment of quality control (QC) circle, training of QC trainers, etc. were carried out. According to PGCB, TQM has contributed to enhancing the technical capability of operation and maintenance.

The operation and maintenance manual of each equipment have been distributed to and utilized by the engineers and staff. In addition, a service manual has been prepared by PGCB which includes the method of disassembling and assembling of facilities, cleaning and inspection etc. of each equipment. Safety manuals are also included in the service manual of PGCB. These manuals have been utilized mainly by junior engineers and foreman, and are stored together with maintenance records[30].

Currently, there are limited persons with skills to respond to the problems occurring at substations. However, technical upgrades are considered to be underway as all the staff must receive periodic training and the manuals have been utilized in the operation. (See the recommendation concerning "Implementation of training to secure long-term sustainability")

3.4.3 Financial Aspect of Operation and Maintenance

From the time of appraisal[31] to the time of ex-post evaluation, PGCB has maintained sound financial condition in general as well as positive operating results for the past five years (See

[29] Source: Materials provided by JICA
[30] Source: Answer to the questionnaire for PGCB, interview with PGCB
[31] Source: Materials provided by JICA

Table 11 below). Financial expenses (such as long-term borrowing interests) are growing because PGCB is actively investing capital in facilities such as transmission lines as mentioned above in the "Impact" section. As an effect, although it recorded a deficit in 2013/2014, PGCB has maintained steady operating results following a significant increase in revenue from transmission fees from 2015/2016. The annual changes in its financial ratios over the past five years (See Table 12 below) also show stable financial conditions: capital expenditures have been carried out with sufficient consideration of financial stability, as certain margin has been maintained in repaying the principal and interest. The financial figures also indicate that PGCB maintains a certain level of repair and maintenance costs, substantiating the answer to interviews during site inspections that there have been no problems in particular regarding the budget for repair and maintenance expenses. From the above analysis, there is considered to be no problem in the financial aspects of operation and maintenance.

Table 11. Annual changes in PGCB's revenue and expenditure and surplus for past 5 years

(Unit: Million BDT)

Item	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Revenue (Transmission fees)	7,870	8,671	9,378	12,722	14,368
% of change from previous year	*10%*	*10%*	*8%*	*36%*	*13%*
Cost of revenue (Transmission costs)	4,718	6,145	6,903	7,228	8,034
% of change from previous year	*9%*	*30%*	*12%*	*5%*	*11%*
(Repair and maintenance cost)	*(234)*	*(217)*	*(327)*	*(326)*	*(329)*
Profit from revenue	3,151	2,526	2,474	5,493	6,334
% of change from previous year	*12%*	*-20%*	*-2%*	*122%*	*15%*
General & admin. expenses	254	341	347	542	620
Operating profit	2,897	2,184	2,126	4,950	5,713
Non-operating income & expenses (financial exp. etc.)	-781	-1,585	-2,198	-2,545	-2,694
Income before tax	2,015	570	-71	2,291	2,876
Income after tax [Note]	1,010	-29	416	1,226	1,995
Surplus	5,774	4,613	4,567	5,180	6,380

Source: Annual reports of PGCB (fiscal year is from July to the end of June in the next year)

Note: In 2014-2015, income after tax is larger than income before tax due to the adjustment for deferred tax effects.

Table 12. Annual changes in PGCB's financial ratios for past 5 years

Financial ratio	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Debt-servicing capability					
1. Current ratio	1.55	0.81	2.58	3.10	2.78
2. Debt equity ratio	2.49	2.69	2.59	2.57	2.49
3. Debt service coverage ratio	1.90	1.11	1.14	2.26	2.56
Financial stability					
4. Equity ratio	0.27	0.25	0.26	0.26	0.26
Profitability					
5. Sales profit ratio (%)	40	29	26	43	44
6. Operating profit ratio (%)	37	25	23	39	40
7. Rate of return on assets (ROA) (%)	0.9	0.0	0.3	0.9	1.3
8. Rate of return on equity (ROE) (%)	3.4	-0.1	1.3	3.5	4.8
Other					
9. Receivables turnover period (days)	59	60	61	71	69

Source: Calculated by the evaluator based on the figures in PGCB's annual reports (the figures of 3. "Debt service coverage ratio" is transferred from the annual report)

3.4.4 Status of Operation and Maintenance

The substations newly established by the Project operate without problem at the time of ex-post evaluation. According to the response to the questionnaire to PGCB, all the new substations are in good condition. Meanwhile, as stated in "Organizational aspect of operation and maintenance" described above, there is room for improvement as there is insufficient daily maintenance at each substation because of a lack of field technicians below foreman. Maintenance is performed once a year, and if there is a problem, parts replacement is carried out each time.

PGCB uses a method of parts replacement in which each substation obtains necessary parts each time from the central repository. In the central repository, there is always inventory to prevent the occurrence of missing items, by ordering spare parts from the manufacturer beforehand. During the site inspection, it was observed that there were some damages to equipment such as electric circuit breaker etc. in Comilla North, Daudkandi, Meghnaghat, and insufficient stock of spare parts in Munshiganj, Meghnaghat and Daudkandi. However, in the practice of replacing spare parts, each substation obtains necessary parts from the central repository as soon as possible, according to the explanation of substation staff. Equipment, helmets, gloves and other equipment for repair and maintenance are sufficiently secured at each substation. Based on the results of site inspection, the shortage of spare parts occurring at each substation is considered to have been duly addressed.

No major problems have been observed in the institutional, technical, financial aspects and

current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented with the objective of stably providing high-quality electric power by constructing and expanding transmission lines and sub-stations in major cities such as Dhaka, Comilla and Chittagong and surrounding areas where rapid increase of electricity demand was expected. The relevance of the project is high as it is consistent with the country's development plan which places the promotion of the electric power infrastructure as an important field for the sustainable development of society and the economy, the need for development to establish a stable and reliable electric power supply, as well as Japan's ODA policy. Although the project cost was within the plan, the project period exceeded the plan due to the fact that it took time to prepare the bidding document and the delay occurred in the additional work to respond to the increase in regional power needs. Therefore, the efficiency of the project is fair. The implementation of the Project has enabled a continuous and steady supply of electric power even under the continuous increase in power demand. As an effect, the frequency of power failures and accidents has decreased, which has contributed to the enhancement of economic activity in the target area and the improvement of quality of social services such as hospitals and schools. Therefore, the effectiveness and impacts of the project are high. With regard to the operation and maintenance of grid substations constructed and expanded during the Project, there were issues with securing technicians and parts in some instances. However, considering that a backup structure of the executing agency is in place and that the substations are in operation without issue, the sustainability of the transmission system overall has been secured. In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

<u>Formulation of human resources recruitment and capability building plan based on accurate information management related to substation technical staff</u>

It was observed during the site inspection that there is a practice of dispatching necessary engineers from GMD to the substation without sufficient number of skilled-technicians. Therefore, it was confirmed that a mechanism for maintaining the sustainability has been established as an entire system. However, it was observed in this evaluation study that there is a difference in the grasp of the number of technical staff members located at each substation between the headquarters and substations concerned. Therefore, it seems that there is room for

improvement in management of information as a prerequisite for formulating a recruitment/capability building plan. It is recommended that the executing agency accurately grasp and manage the information of the current status of technical staff such as their position and capability level before the planning for recruitment and contents of training etc. and putting them into implementation.

Implementation of training to secure long-term sustainability

From a long-term perspective, it is necessary for an organization to maintain technical capacity even when experienced engineers retire. For this reason, it is important to incorporate training of young people into the plan, and to increase the number of employees who have acquired daily maintenance and troubleshooting skills. The training of high level technicians cannot be achieved by training alone, but requires daily experience. For this reason, it is recommended to develop a mechanism to promote practical training for technical staff, so that those who accumulate such experiences for working as a foreman, the highest technical worker.

4.3 Lessons Learned

Appointment of a procurement support consultant

The implementation period of the Project ran considerably longer compared to the plan. One of the reasons for the delay was that the executing agency was unfamiliar with the preparation of the bidding documents based on JICA's procurement guidelines for ODA loan projects. For this reason, it took more time than expected until the contents of the bidding document were finalized, through a series of discussions between the JICA and the Bangladesh side. In order to prevent this situation beforehand, it should have confirmed the degree of proficiency of the executing agency regarding the bidding procedure of ODA loan project at the time of appraisal.

If a procurement support consultant had been appointed, PGCB would have been able to save time on considering the bidding procedure which ultimately took a long time, and JICA would have been able to manage the schedule more easily as well. In future project implementations, it is desirable to examine a way to reduce the risk of delay at the bidding stage including an appointment of a procurement support consultant who supports the bidding process through the stage of implementation of the bidding, if the executing agency is unfamiliar with the bidding procedure for ODA loan projects. Or, it is also recommended that JICA consider conducting concentrated procurement management seminars in advance if the executing agency decide not to appoint a procurement support consultant.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Construction of new substations and transmission lines	Ÿ Daudkandi: 132/33kV substation Ÿ Brahmanbaria: 132/33kV substation Ÿ Meghnaghat: 132/33kV substation Ÿ Munshiganj: 132/33kV substation	Ÿ As planned Ÿ Adding a 25/41MVA transformer Ÿ As planned Ÿ As planned
Extension of facilities in existing substations (transformers and other equipment)	Ÿ Comilla North substation: Installation of new transformers along with necessary equipment Ÿ Hasnabad substation: Replacement of existing transformer along with necessary equipment Ÿ Hathazari substation: Installation of new transformers along with necessary equipment Ÿ Madanganj: Installation of two line bays with necessary equipment for bay extension	Ÿ Upgrading transformers from the existing 25/41MVA to 50/75MVA in addition to the originally planned facilities Ÿ As planned Ÿ As planned Ÿ As planned
2. Project Period	June 2006 – June 2009 (37 months)	June 2006 – June 2014 (97 months)
3. Project Cost		
Amount Paid in Foreign Currency	4,642 million yen	4,183 million yen
Amount Paid in Local Currency	2,592 million yen (1,970 million Bangladesh Taka)	2,944 million yen (2,102 million Bangladesh Taka)
Total	7,234 million yen	7,128 million yen
ODA Loan Portion	4,642 million yen	4,183 million yen
Exchange Rate	1 Bangladesh Taka = 1.31509 yen (As of February 2005)	1 Bangladesh Taka = 1.4002 yen (Average between June 2006 and June 2014)
4. Final Disbursement	October 2013	