Kingdom of Cambodia

FY 2016 Ex-Post Evaluation of Japanese ODA Loan Project

"Niroth Water Supply Project"

External Evaluator: Masumi Shimamura, Midori Kondo

Mitsubishi UFJ Research and Consulting Co., Ltd.

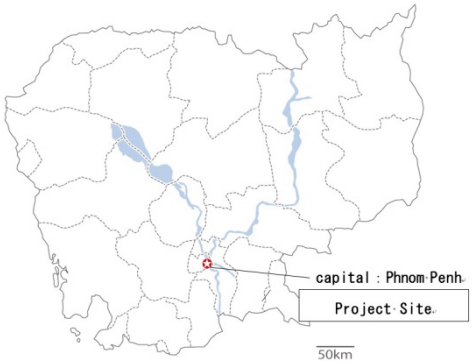
0. Summary

This project, which aims to provide a safe and constant water supply by developing a water supply facility, thereby contributing to improve living environment of residents including the poor in Phnom Penh city and the surrounding area and to improve the investment environment, is consistent with Cambodia's national development policies and with development needs as well as Japan's ODA policy; thus, the relevance of the project is high. Project cost was slightly higher than the original plan and project period exceeded the original plan, thus the efficiency of the project is fair. Operation and Effect Indicators set at the time of appraisal have been greatly achieved except for Water Quality (Color). Regarding the Water Quality (Color), the target figure set at the time of appraisal was not well grounded, and the actual figures significantly excelled from the standard of the World Health Organization (hereinafter referred to as "WHO") and the safety of the water is recognized, thus, it can be considered that it does not push down the evaluation of effectiveness of this project. The indicators of the whole service area, such as the number of households with water supply connections, have shown much higher actual achievement than expected at the time of appraisal, and from the results of beneficiary survey, it is considered that the effectiveness regarding the safety of water quality and the stable supply is high. As for impacts of this project, through stable supply of cheap and safe water, improvement of household expenditure, enhancement on the convenience of living and reduction of water related medical symptoms were seen; and, it was confirmed from the results of beneficiary survey etc. that there was impact on enhancement of the living environment of the households. In addition, the share of the water treatment plant which was constructed by this project in the Greater Phnom Penh area is 32%, It has been providing stable water supply to major industrial parks and commercial area, thus it can considered that this plant is playing an important role to improve the investment environment. Furthermore, it is considered that there were some contributions to poverty alleviation through subsidy program which assists water connection fees by the executing agency. Therefore, there are much more impacts than expected at the time of the appraisal, thus, effectiveness and impact of the project are high. No negative impact on natural environment, land acquisition and relocation has been observed. No major problem has been identified in the institutional, technical and financial aspects of the operation and maintenance as well as in the current status; thus, sustainability of the project effects is high. In addition to the efforts for reducing operating costs, such as reduction of the non-revenue water rate and high fee collection rate, efforts for expansion of income sources have been tackled by

the executing agency, and the executing agency continues to maintain its stable management.

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

1. Project Description



Project Location

Water Treatment Plant constructed by this project

1.1 Background

In Cambodia, since the mid-1990s, the water supply systems have started to develop mainly in the capital Phnom Penh city, and the number of water supply facilities has expanded and the capacity of human resources has been developed. However, in the Greater Phnom Penh area including Phnom Penh city and its surrounding area, water demand has been rapidly increasing with the increase of population and commercial facilities, and it was necessary to improve the water supply capacity urgently.

In respond to the rapid increase of water demand in the Greater Phnom Penh area, this project aims to secure a stable water supply by developing new water supply facility.

1.2 Project Outline

The objective of the project is to provide a safe and constant water supply by developing water supply facility in Greater Phnom Penh[1], thereby contributing to improve living environment of residents including the poor in Phnom Penh city and the surrounding area, and also to improve the investment environment.

Loan Approved Amount/ Disbursed Amount	3,513 million yen / 3,492 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2009 / March, 2009

[1] Phnom Penh city (12 districts) and the capital city of Kandal province (Takhmao city) are targeted area of this project.

Terms and Conditions	Interest Rate 0.01%; Repayment Period 40 years (Grace period) (10 years) Conditions for Procurement General Untied
Borrower / Executing Agency	The Royal Government of Cambodia / Phnom Penh Water Supply Authority (PPWSA)
Project Completion	August, 2014
Main Contractor (Over 1 billion yen)	Moya Asia Limited（Singapore）
Main Consultant (Over 100 million yen)	Safege (Société Anonyme Française d' Etude de Gestion et d' Entreprises) (France)
Feasibility Studies, etc.	Government of France, F/S “ Private Sector Study and Aid Fund (FASEP)” (May - October 2008)
Related Projects	【Technical Cooperation】 ・Development Study "The Study on the Master Plan of Greater Phnom Penh Water Supply in Cambodia" (1992 - 1993) ・Small-Scale Development Partnership project (Construction of Monitoring System for Distribution Block) (2001 - 2002) ・Technical Cooperation Project " The Project on Capacity Building for Water Supply System” (2003 - 2006) ・Development Study "The Study on the Master Plan of Greater Phnom Penh Water Supply in Cambodia (Phase 2)"(2004 - 2006) ・Technical Cooperation Project " Capacity Building for Water Supply System in Cambodia (Phase 2)” (2007-2012) ・Technical Cooperation Project " Project on Capacity Building for Urban Water Supply System in Cambodia（Phase 3）” (2012-2017) 【Grant Aid】 ・ "Phnom Penh Water Supply Development Plan" (1992) ・ "Phnom Penh Water Supply Development Phase 2" (1997 - 1999) ・ " The Project for Expansion of Phum Prek Water Treatment Plant" (2001 - 2003) ・ " The Project for Introduction of Clean Energy by Solar Electricity Generation System " (2010 - 2013) 【ADB】 ・ "Phnom Penh Water Supply and Drainage Project-Part A-" (1997-1999) 【World Bank】 ・ " Chrouy Changvar Water Treatment Plant Construction

	Project" (2000 - 2001) ・ "Urban Drainage Network Development Project" (2003) ・ "Provincial and Peri-Urban Water Supply Project" (2003-2008) ・ "Construction of Water Tower in Takhmao" (2006-2009) 【Government of France (Grant Aid)】 ・ "Improvement of filter basin of Phum Prek Water Treatment Plant " (1993) ・ "Development of distribution pipes of Phum Prek Water Treatment Plant" (1993) ・ "Chamkar Mon Water Treatment Plant Construction Project" (1993 - 1994) ・ "Expansion and Improvement of Chamkar Mon Water Treatment Plant" (1996 - 1997) 【French Development Agency (AFD)】 ・ "Expansion of Chrouy Changvar Water Treatment Plant" (2007 - 2009) ・ "Raw Intake Station & Raw Water Transmission Mains (Niroth 1) " (2009-2013) ・ "Extension of Greater Phnom Penh Water Supply System GPPWSS-Cham Chao Transmission Main and Niroth Water Production Facilities (Phase 2) " (2013-2017)

2. Outline of the Evaluation Study

2.1 External Evaluator

Masumi Shimamura, Midori Kondo, Mitsubishi UFJ Research and Consulting Co, Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: September, 2016 – September, 2017

Duration of the Field Study: November 29, 2016 –December 10, 2016, January 31, 2017 – February 3, 2017

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

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Cambodia

At the time of appraisal, Government of Cambodia, in *Rectangular Strategy-Phase I* and *National Strategic Development Plan* (hereinafter referred to as "NSDP") (2006-2010), stipulated to ensure "access to safe water" as substantive policy. Moreover, in *Master Plan for*

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

[3] ③: High, ②: Fair, ①: Low

Greater Phnom Penh of Phnom Penh Water Supply Authority (hereinafter referred to as "PPWSA"), which has planned its target year for 2020, "to realize stable access to water", "to ensure safe water supply", and "to enlarge the water supply area" were set as key goals and the necessity for expanding water supply capacity was pointed out.

At the time of ex-post evaluation, Government of Cambodia aims in *National Strategic Development Plan* (NSDP) (2014-2018), as policy targets, to enlarge the water supply area in rural area and urban area as well. Moreover, in the PPWSA's *The Third Master Plan for Greater Phnom Penh Phase Ⅲ*, it is planned to achieve some goals such as to provide water supply in the area where water consumption is high, to respond to a growing water demand and to achieve a network coverage (water supply coverage) of 100% in Greater Phnom Penh.

3.1.2 Consistency with the Development Needs of Cambodia

At the time of appraisal, in the surrounding area of Phnom Penh city, with population expansion and increasing commercial facilities, it was predicted that the water demand would rise sharply and it would exceed the existing water supply capacity. Since the water supply facilities in order to respond to water demand were not sufficiently developed, it was an urgent issue to improve supply-demand balance as soon as possible.

At the time of the ex-post evaluation, through this project, the water supply capacity of Greater Phnom Penh increased about twice as much compared with the capacity before the project (2009). However, the water demand has increased with the growth rate exceeding the initial forecast, and from the water demand forecasts from 2015 to 2030, the water demand is expected to double from 480,000m^3/d in 2015 to 940,000 m^3/d in 2030. Figure 1 compares existing water supply capacity with the future water demand.

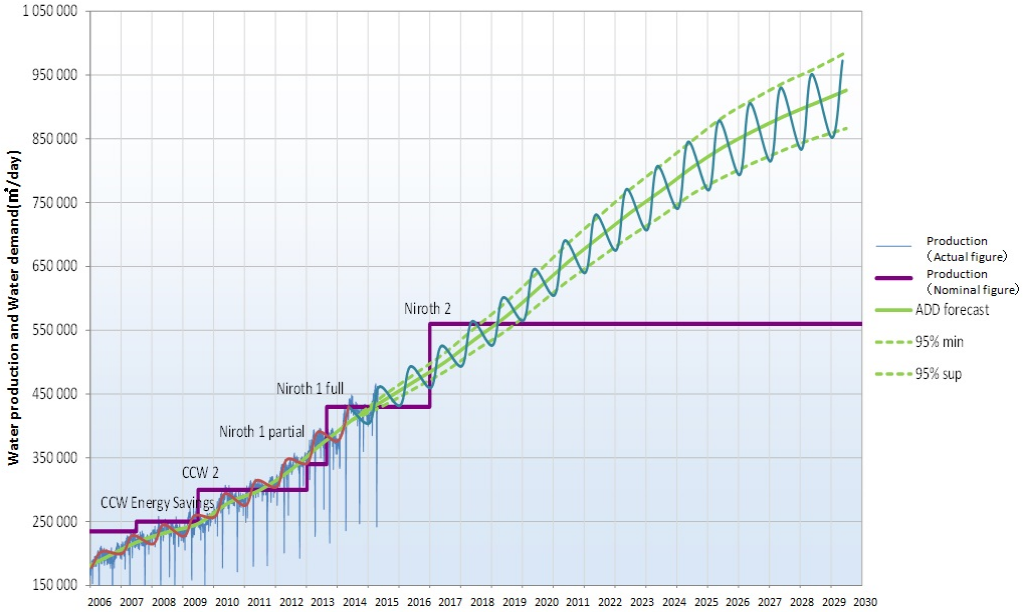


Figure 1: Forecast of Water Demand and Water Supply[4]

Source：Information provided by executing agency
Note：Purple = existing water supply capacity (including Niroth water treatment plant Phase 2 completed in January 2017)

Therefore, even at the timing of ex-post evaluation, to expand water supply capacity corresponding to a rapid increase of water demand is an urgent issue, and the importance of this project remains unchanged at the time of ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

The Country Assistance Program for Cambodia drawn up in 2002 indicated "Sustainable economic growth and realization of a stable society" and "Assistance for socially vulnerable people" as the specific priority areas for assistance. The objective of this project, which aims to bring the impact of improving the living environment of residents including the poor and contributing to improving the investment environment, is consistent with the priority areas mentioned above.

In the same *Country Assistance Program*, the "Mekong Region Development" was regarded as a priority area, and it stipulated to provide assistance actively utilizing both technical cooperation and financial assistances. Furthermore, in *Medium-Term Plan on Official Development Assistance* (February 2005), it was emphasized to promote sustainable economic growth through effectively combining ODA schemes and collaborating with other international organizations. This project has effectively combined with the assistance of other donor (AFD)

[4] a green solid line =forecast of water demand

by utilizing Japanese technical cooperation and financial cooperation schemes, and it was consistent with the Japanese government's policy at the time.

Therefore, 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

This project developed a water treatment plant with capacity of 130,000 ㎥/d to increase water supply capacity in Greater Phnom Penh. Table 1 shows the comparison of planned and actual project outputs.

Table 1：Comparison of Planned and Actual Project Outputs

Plan (at the time of appraisal)	Actual (at the time of ex-post evaluation)
1） Civil Works, Procurement of Equipment etc.	1） Civil Works, Procurement of Equipment etc.
<JICA portion> (1) Water Treatment Plant (2) Sludge Pipe (3) Treated Water Pumping Station (4) Treated Water Tank (5) Treated Water Transmission Mains (6) Sewer and Ancillaries <AFD portion> (1) Intake Tower (2) Raw Water Transmission Main	<JICA portion> (1) Water Treatment Plant (2) Sludge Pipe (3) Treated Water Pumping Station (4) Treated Water Tank (5) Treated Water Transmission Mains (6) Sewer and Ancillaries (7)Transmission network extension to Takhmao Pipe of DN 400mm =3,500m Pipe of DN 500mm =7,200m <AFD portion> (1) Intake Tower (2) Raw Water Transmission Main
Consulting services	
<AFD portion> Assistance in tendering, Construction supervision (Quality Management, Process Management etc.) Inputs of consulting services: Foreign Consultants: 70M/M, Local Consultants: 218M/M, Total :288 M/M	<AFD portion> Assistance in tendering, Construction supervision (Quality Management, Process Management etc.) Inputs of consulting services: Foreign Consultants: 80M/M, Local Consultants: 146M/M, Total :226 M/M
Out of the scope of this project[5]	
<AFD portion and PPWSA's own fund > (1) Distribution network extension	<AFD portion and PPWSA's own fund > (1) Transmission network extension (2) Distribution network extension

Source：Information provided by JICA (Planned figures at the time of appraisal), and results from questionnaire survey of executing agency (Actual figures at the time of ex-post evaluation)

Regarding civil works, expansion of transmission pipes was added to the project scope. This was to extend the transmission pipes to the area where the water pressure was low (Takhmao city), and it was necessary for ensuring smooth water supply; thus it is judged that it was appropriate, commensurate with inputs. In addition, regarding the water distribution portion which was outside of the scope of this project, the main distribution pipes completed in May 2012[6]. For the others, there is no change in the output.

[5] Although the total project cost does not include the water distribution part in this project, from the perspective of the whole effect of this project, the outputs of the water distribution part and the timing of development were reviewed.

[6] Water supply has started from the following month (October 2013) when the water treatment plant was completed.

As regards to inputs of consulting services (M/M), when compared with the plan at the time of appraisal, it decreased by 61.33 M/M in total. The reason for this decrease was, due to the prompt procurement, the work of construction supervision was completed in a shorter period than expected, and the period of consulting service was shortened from 36 months to 30 months.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost of this project was initially planned to be 6,532 million yen (out of which 3,513 million yen was to be covered by Japanese ODA loan), whereas the actual total project cost was 6,686 million yen (out of which 3,492 million yen was to be covered by Japanese ODA loan), exceeding the plan. (102% of planned).

Although the project period was extended from the planned period, the actual cost was about 2% increase from the planned cost because of depreciation of the local currency (Cambodia Riel) compared with Japanese yen during project implementation etc.

3.2.2.2 Project Period

The overall project period was planned as 50 months, from March 2009 (conclusion of Loan Agreement) to April 2013 (completion of warranty period) as opposed to 66 months in actuality, from March 2009 (conclusion of Loan Agreement) to August 2014 (completion of warranty period), which is longer than planned (132% of the initial plan). (Refer to Table 2)

Main reason for project delay was due to delay of approval procedures for selection of consultants and contractors (the selection period for consultants was 2.1 times compared with the plan at the time of appraisal, and the selection period for contractors was 2.1 times compared with the plan at the time of appraisal) .

Table 2： Comparison of Planned and Actual Project Period

Item	Plan (at the time of appraisal)	Actual (at the time of ex-post evaluation)
Selection of consultants	Feb, 2009 – Jul., 2009 (6 months)	May, 2009– May, 2010 (13 months)
Consulting services	Sep, 2009 – Aug, 2012 (36 months)	Aug, 2010 – Feb, 2013 (31 months)
Selection of Contractors	Jan, 2009 – Sep, 2009 (9 months)	Jan, 2009 – Jul, 2010 (19 months)
Construction (JICA)	Nov, 2009 – Apr, 2012 (30 months)	Aug, 2010 – Sep, 2013 (38 months)
Construction (AFD)	Nov, 2009 – Dec, 2012 (38 months)	Aug, 2010 – Sep, 2013 (38 months)
Extension of Transmission pipes (additional scope)	N/A	Oct, 2010 – May, 2012 (20 months)
Start of operation	N/A	Oct, 2013
Warranty period	May, 2012 – Apr, 2013 (12 months)	Oct, 2013 – Aug, 2014 (11 months)

Source：Information provided by JICA, and results from questionnaire survey of executing agency

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

The financial internal rate of return (FIRR) calculated at the time of project appraisal was 5.6%, on the assumption that sales from water tariffs generated from the project to be considered as benefit, expenses for construction cost and operation and maintenance cost to be regarded as cost, and project life assumed to be 30 years. The FIRR recalculated at the time of ex-post evaluation based on the same assumptions as the appraisal turned out to be 12.3%. The main reason for the higher figure in comparison with the figure at the time of appraisal can be attributed to the increase of water tariffs with the expansion of new connection to residents and commercial facilities than planned.

Therefore, both the project cost and project period exceeded the plan. Therefore, efficiency of the project is fair.

【Box.1 Close collaboration in the co-finance project】

In addition to being a co-finance project by AFD and JICA, this project did not include the water distribution network portion in its project scope, so it was pointed out that it was necessary to grasp the process of the whole project including the AFD portion and the water distribution portion, for ensuring its effectiveness of this project.

When confirming what collaborative system was taken among JICA, AFD and the executing agency in this project, it became clear that the close collaboration was promoted with the following efforts.

- Do not lose the substance of meetings - Discussion on the substance at the site and instant problem solving

During project implementation, a regular meeting was held every month[7], where in addition to

[7] While agreeing to hold meeting on a monthly-basis, the actual meeting for discussion was set by judging the timing when consultation was necessary.

AFD and JICA, the executing agency (PPWSA), contractors and consultants joined. This regular meeting aimed not to become “a meeting losing its substance” or “meeting for reporting” , and attached great importance at “bringing each other the issues and needs” while looking at the site, hence a place to open their mouths frankly on each other’s problems and circumstances was built.

For example, during the construction work, a meeting style was adopted where all stakeholders visited the construction site, and had a meeting in the water treatment plant after seeing the container facilities, maintenance site etc. During the discussion, the progress was shared based on the “spread sheet” in which the responsible work and scope and works of each stakeholder were described.

Furthermore, in addition to the regular monthly meeting, there were forums for instant discussions with JICA, AFD, the executing agency, and consultants when challenges and problems occurred. In this project, the yen has fluctuated from appreciation to depreciation during the implementation period and thus the cash flow fluctuated, so it became necessary to adjust the portion in charge and the funding plan. For this reason, JICA, AFD and the executing agency were conducting close discussions on disbursement and financial arrangements while monitoring the fund flow. In addition, even in the cases where compliance with the procurement guidelines and approval procedures of the government for amendment of contracts were necessary, a system in which all stakeholders collaborate was adopted. Regarding the explanatory materials and application documents to the government, the efforts to speed up procedures by discussing the description of these documents, among all stakeholders like JICA, AFD, and the executing agency, including consultants were made.

- Pursuing the “effectiveness” of the project – JICA and AFD as facilitators

According to the executing agency, AFD and JICA were being beyond financiers, demonstrating their roles as “facilitators”.

At the timing of appraisal and preparation for this project, JICA and AFD had set up the project design that maximized the effectiveness of the project through co-financing while taking into account the organizational aspects and financial aspects such as procurement and fund management. Moreover, during the construction work, the donors played a catalytic function, such as making consultants and contractors work collaboratively to confirm finely the quality of construction in order to ensure the project effects.

- Long-term allocation of the same staff and collaboration with national staff

During the implementation of this project, the same staff was consistently engaged in supervision of this project at the JICA office as the contact person for this project. The same staff was placed for a long period, from procurement procedures and construction management to the start of operation, and effective collaboration based on past history and discussions was realized. At the JICA office, a policy to utilize national staff was promoted, and along with the Japanese staff, the Cambodian national staff was allocated as a counterpart. Between the national staff and the Japanese staff, the leveling and sharing of information were promoted thoroughly and the substantial work was assigned to the national staff. In this system of two staffs with the involvement of a Japanese staff with a specialized background and the national staff, the amount of information entering the JICA side also increased, and from here it is considered that such personnel allocation structure pushed closer cooperation. In addition, since there are some areas and information that can be involved and available only by national staff, it can be said that JICA was able to approach with careful attention to the cultures and protocols unique to Cambodia. The executing agency side also had a similar structure, and the staffs who had been engaged for a long time since JICA’s technical cooperation project were consistently allocated as the counterpart of this project.

As a result of these collaborations, leading to the early actualization of the project effect in the end can be said as a good practice.

In this project, not only the AFD portion completed at the same time as the facilities of JICA portion (September 2013), but also the distribution network out of the scope of this project completed at an early stage (May 2012). Water supply was started from the following month

(October 2013) when the water treatment plant was constructed, and this can be regarded as the outcome of these close collaborative structures which were continuously conducted.

【Box.2 Stakeholder management taken by the executing agency】

PPWSA puts the philosophy of "all in all" (teamwork toward the same goal) in carrying out the project. This is a slogan of team management aiming for the same goal not only for employees but also for stakeholders as a whole, including contractors and consultants, local communities and local governments.

One example of good stakeholder management by PPWSA is that the executing agency formed good relations with contractors, local communities, and local authorities during construction work.

At the time of appraisal, it was planned to close the roads and lay a bypass during the construction of the water transmission mains, and there was a concern about the occurrence of large-scale traffic jam and an influence on the local residents' life. However, according to the interview with the residents and window for complaints, complaints from residents were hardly seen. As a background for this, the executing agency had frequently visited local authorities and resident communities, and had been making continuous efforts to gain cooperation and trust for this project from the mayors, village chiefs, and resident communities. Indeed, when setting up a bypass, cooperation from the local community, such as placing traffic control police officers and providing public information, has been obtained, and from here, it can be said that the efforts taken by the executing agency increased the acceptability of local residents.

In addition, efforts were made to build a good relationship with the contractor, and it was confirmed that the executing agency tried to make efforts to build a relationship with the contractor as a team member aiming for the final goal of "stable supply of a safe drinking water". Not only the staffs in charge of this project but also all the stakeholders of the major departments frequently visited the construction site, and, regarding the invoices from the contractors, they were thoroughly approved in the executing agency within 3 days, hence it has promoted to ensure contractor's motivation toward this project.

In this way, efforts were made to extract understanding and cooperation for this project through close dialogue with local residents and local authorities and establishing continuous relationships of trust. In addition, efforts were made to encourage stakeholders in the project to raise their awareness of participation and to change mindset from "be a stakeholder" to "be a collaborator". Through its "stakeholder management" that increases collaborators, enhancing organizational soundness, ensuring smooth project implementation and improving its service quality were worthy of special mention.

3.3 Effectiveness[8](Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1 Operation and Effect Indicators of this project

Regarding each Operation and Effect Indicators set at the time of project appraisal, Table 3 shows the comparison of the target figures and actual figures from 2014 to 2016.

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

Table 3：Operation and Effect Indicators of This Project

	Baseline	Target	Actual *Note 1)		
	2008	2015	2014	2015	2016[9] *Note 2)
	Appraisal Year	2 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Production Capacity of Niroth Water Treatment Plant (m^3/d)	-	130,000	(Nominal) 130,000 (Actual) 122,798	(Nominal) 130,000 (Actual) 143,894	(Nominal) 130,000 (Actual) 155,206
Water Quality (Turbidity) (Unit: NTU)	-	2	0.42	0.41	0.60
Water Quality (Color) (Unit: TCU)	-	0.7	1.69	1.21	1.95

Source：Information provided by JICA, and results from questionnaire survey of executing agency
Note 1) Figures to be compared with the target are the one of 2016, and the figures of 2014 and 2015 are indicated as reference
Note 2) Annual average figures were calculated based on actual results from January to September 2016

The Operation and Effect Indicators, except Water Quality (Color), exceeded the target figure at the year of 2015, and this shows that performance is greatly exceeding the target figure at the target year of 2016.

Regarding Production Capacity (m^3/d), the actual amount of water production (actual figure) exceeded 140,000 m^3/d from July 2014, and the actual figure of 2016 is 19% increase of the target figure set at the time of appraisal. Moreover, Water Quality (Turbidity) also achieved considerably low figure (0.4-0.6 NTU) with 30% or less when compared to the WHO standard (2 NTU or less).

Although the Water Quality (Color) achieved the target figure set at the time of appraisal, the target figure was not well grounded and the unit was not clear. In addition, the measurement results conducted by executing agency highly achieved the recommended standard of WHO (15 TCU or less), and the safety of the water is highly confirmed. Thus, it can be considered that this outcome alone does not push down the evaluation of effectiveness of this project.

3.3.1.2 Key indicators of the whole service area (Reference indicators) and other effects

The share of this water treatment plant in the Greater Phnom Penh area was calculated, and quantitative analysis of contribution to water supply in this area was attempted. Table 4

[9] When seeing the actual figures for 2016, the actual figure of Water Quality (Turbidity) is slightly lower than the previous year. According to the executing agency, it was because of adjustment made to optimize the safety of water quality and economic efficiency, while holding down the input amount of chemicals for water purification and ensuring high water quality.

summarizes the comparison of water supply capacityof 4 water treatment plants in Greater Phnom Penh.

Table 4：Share of This Water Treatment Plant (2015)

Water Supply Capacity （㎥/d） of existing water treatment plants (2015)		Total Water Supply Capacity in Greater Phnom Penh （㎥/d）	Share of each Water Treatment Plant (%) (2015)
Phum Prek Water Treatment Plant	146,449	443,786 *Note 1)	33
Chrouy Changvar Water Treatment Plant	142,011		32
Chamkar Mon Water Treatment Plant	13,313		3
Niroth Water Treatment Plant	142,011		32

Source：Information provided by JICA, and results from questionnaire survey of executing agency

Note 1：Due to rounding off, it is not consistent with the total of each water supply capacity of the existing water treatment plants.

The share of this water treatment plant in the whole service area is 32%, which implies that the plant plays an important role to ensure supply-demand balance in the Greater Phnom Penh area. Considering that this plant is supplying water to the major industrial area of the Greater Phnom Penh area, it can be said that it is important to facilitate the commercial activities and investment promotion. (Refer to “3.4 Impact” below.)

In addition, as regards the key indicators of whole service area[10], Table 5 compares the target figures at the time of appraisal with the actual figures from 2014 to 2016.

[10] Since the project scope of this project does not include the development of water distribution network, the indicators of whole service area, among the Operation and Effect Indicators, are treated as a reference indicator.

Table 5：Key Indicators of Whole Service Area (Reference Indicators)

	Baseline	Target	Actual		
	2008	2015	2014	2015	2016
	Appraisal Year	2 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion
Population served (Unit: person)	1,239,000	1,708,784	1,444,888	1,447,340	2,051,511
Water Coverage Rate	75%[11]	-	85%	87%	90%
The number of connections (Unit: household)	177,000	244,122	270,812	289,024	310,835
(1) Phnom Penh City	N.A.	-	260,189	276,894	297,270
(2) Outside of Phnom Penh City *Note 1)	N.A.	-	10,623	12,130	13,565
Service Hours of Water Supply		-			
(1) Phnom Penh City	24hours	-	24hours	24hours	24hours
(2) Outside of Phnom Penh City	N.A.	-	24hours	24hours	24hours
Volume of Water Sold(m^3/d) *Note 2)	-	N.A.	369,824	405,261	450,347

Source：Information provided by JICA, and results from questionnaire survey of executing agency

Note 1) ：The outside of Phnom Penh city refers to the area of capital city of Kandal province (Takhmao city)

Note 2) ：During the project implementation, "Volume of Water Sold(m^3/d)" was added as Monitoring Indicator. The target figures were not set.

When seeing the key indicators of the whole service area, the Population served, the Water Coverage Rate and the number of connected households as well are experiencing a steady increase. The number of connected households has increased by about 27% in 2016 compared with the target figure at the time of appraisal (244,122 connections). Also, when seeing the Population served, compared with the year 2008 which is the timing of appraisal and year 2014 when the Niroth water treatment plant was completed, it has increased by 16%. Furthermore, the Service Hours of Water Supply has achieved 24 hours even in the suburbs of Phnom Penh city since 2014.

According to the data provided by the executing agency, the number of new connections is 15,864 (2013), 18,497 (2014), 18,212 (2015) and 20,276 (2016). Compared with the year 2014 when this project was completed, the number of new connections has increased by about 19.8%

[11] Baseline figure at the timing of the Master Plant developed in 2007

in 2016. Assuming that five people were served per connection (one household), from 2014 to 2016, it comes to have achieved water supply to more than 290,000 new residents[12].

3.3.2 Qualitative Effects (Other Effects)

According to the results of the beneficiary survey[13], 97% of respondents responded "satisfied" with the water quality (Turbidity and Color), except for smell[14]. In addition, about 95% of respondents also indicated "satisfied" with the water supply service by the executing agency and the stability of water supply. From the results of the beneficiary survey, it is also judged that the effectiveness, from the perspective of safety of water quality and stability of water supply, is high.

Furthermore, according to the interview with the executing agency, as an effect of this project on the whole service area, the stabilization effect of the hydraulic pressure in the existing pipes (especially in the western area of Phnom Penh city) was mentioned.

[12] 58,877 households（the number of new connected households from 2014 to 2016）×5 \persons =294,385 persons

[13] The service area of Niroth water treatment plant constructed by this project was placed as the targeted area, and 4 administrative districts among the area were selected, and then a questionnaire interview survey was conducted. (residents were selected through random sampling, with 120 valid responses) The method of selecting respondents is as follows.

【Step 1: Selected the targeted administrative districts】

The following 4 administrative districts among the service area of the Niroth water treatment plant were selected so that there is no regional uneven distribution

- Takhmao city （a capital city of Kandal province）
- Dangkor district
- Meanchey district
- Chamkar mon district

【Step 2: Targeted the resident group】

- Residents who had lived in Phnom Penh city since before 2009.
  (Residents who were connected to the existing pipes and residents connected to the existing pipes but not started its transmission and were waiting water supply. Residents who understand the changes (changes of water pressure, changes of frequency of water cuts etc.) before and after the project were expected)
- Factory worker housing and apartments (Resident group who lived in the poor area and was targeted of "Clean Water Supply to the Poor" Program were expected)
- Residents who live in the surrounding area of Phnom Penh city
  (Residents connected to the new pipes. Residents who had no access to safe drinking water before implementation of this project and understand the changes of living environment etc., before and after the project were expected.)

[14] 88% of the respondents answered that the water quality (smell) was "satisfactory". According to the executing agency, there are individual differences in the sensitivity of the smell of chlorine, and there are also many residents unfamiliar with the smell of chlorine, hence the degree of satisfaction is low compared with turbidity and chromaticity.

Left：“Tap water in slum area” Clear water was confirmed

Right: Local residents who are washing with tap water

3.4 Impacts

3.4.1 Intended Impacts

3.4.1.1 Impact on the living environment of the households including the poor

Regarding the contribution to improving the living environment of residents including the poor in Greater Phnom Penh by this project, the results are as follows. (Each question has 120 valid responses)

- Improvement of overall living environment:

About 82% of the respondents answered “highly improved” or “improved”[15]

- Improvement of the convenience of living:

Approximately 92% of respondents answered “improved”[16]

- Reduction of the hours spent for going to draw water:

About 95% of respondents answered “shortened”[17]

- Increase of water consumption:

Approximately 88% of respondents answered that water consumption increased due to improvement of access to water[18]

-- Increase of frequency of sanitation management:

Approximately 90% of respondents answered that the frequency of bathing, washing hands and doing laundry “improved”[19]

In all questions, over 80% of respondents answered “improved / increased” or “improved”, indicating that this project has highly contributed to improving the living environment of local

[15] The Answer items are 3 of “Highly improved”, “Improved” and “No change”.
[16] The Answer items are 3 of “Improved”, “Not improved” and “I have no idea”.
[17] The Answer items are 3 of “Yes” , “No” and “I have no idea”.
[18] The Answer items are 3 of “Increased”, “Not increased” and “I have no idea”.
[19] The Answer items are 3 of “Enhanced”, “Not enhanced” and “I have no idea”

residents. As this background, it is identified that a substantial reduction in water tariff for about a quarter was made when comparing water purchase fee from water seller with the water tariff of the executing agency. The stable supply of cheap water enables to save water costs and improve livelihoods, and in addition, it enables to save time to spend for drawing water and purchasing water, which allows the married couples to both work, thus it was confirmed that this project has highly contributed to improving convenience of living for residents[20].

3.4.1.2 Impact on the reduction in medical expenditures due to decrease of sickness caused by unsanitary drinking water and daily life water

According to the executing agency, the residents who do not have access to the tap water are purchasing water from water sellers or using rainwater and well water, which indicates that they are using unsanitary water.

According to the results of the beneficiary survey, approximately 87% (104 people) of 120 respondents answered that the health condition and sanitation situation improved as a result of completion of this project. In addition, according to the results of interviews with residents, it was confirmed at almost all households that there used to be medical symptoms of waterborne infectious diseases (diarrhea, abdominal pain, etc.) before the project, but after the completion of the project, no health problems has been seen. Moreover, the frequency of bathing and doing laundry has increased three to six times, highly contributing to improved sanitation habits.

The results of interviews with residents are as follows.

- Frequency of bathing (taking a bath):

(Before connecting to tap water) Once every two weeks → (After completion of this project) Three times a day

- Frequency of doing laundry:

(Before connecting to tap water) Twice a month → (after completion of this project) 3-4 times per week

3.4.1.3 Improvement of the Investment Environment

The service area of this water treatment plant includes areas[21] where the industrial park of textile industry and special economic zone (SEZ) etc. are intensively located, and from the perspective of improving the investment environment in major industrial areas of Phnom Penh City, it can be said that there was of great significance. According to the executing agency,

[20] According to the interview with the residents, the real voices such as “traveling time and waiting time for purchasing water has gone away, and both wife and husband can work together because we could make time, and our life became richer” were confirmed.

[21] The area along national highway No. 4 and “Chom Chao area”.

starting to supply water to the district where the manufacturing base of a Cambodian major manufacturer is located, has contributed to the business expansion of this company. Others pointed out that the land development and factory attraction were promoted rapidly, and there was an impact in terms of activating commercial activities and investment.

When seeing the number of connections (total) to the commercial facilities in the whole service area, as shown in Table 6, it is about 39% increase from 2012 to 2016. As a result of the construction of this water treatment plant, it was considered that the realization of stable water supply in the all area of Greater Phnom Penh since 2014 has contributed to a certain extent to the increase in the number of commercial facilities.

Table 6：Number of Connection to the Commercial Facilities in the Whole Service Area (total)

(Unit: number of facilities)

	2009	2010	2011	2012	2013	2014	2015	2016
Commercial Facilities (Number of Connections ）	28,791	32,447	34,983	39,033	41,510	44,258	51,256	54,120

Source：Prepared by the evaluator based on the information provided by executing agency

As regards the effects on the local economy and business activities after the completion of the project, according to the results of the beneficiary survey, about 77% of the respondents answered “activated”[22] by the project, and it is judged that this project is generating a positive impact on the regional economy as well. (For specific examples, refer to Figure 2) Regarding the activation of the investment environment, about 52% of the respondents answered “activated”[23] by this project, with concrete examples such as increase of land prices and activation of real estate investment, etc. were indicated by residents.

[22] The Answer items are 3 of "Activated", “Not activated” and “I have no idea”.
[23] The Answer items are 3 of "Activated", “Not activated” and “I have no idea”.

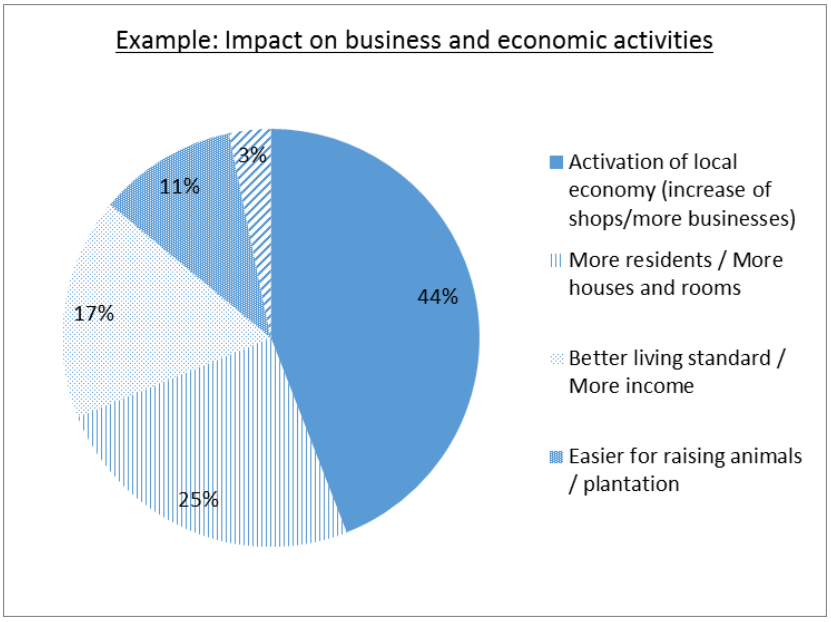


Figure 2：Impact on local economy and business activities (specific examples)

Source：Prepared by the evaluator based on the results of beneficiary survey (open-ended questions)

The surrounding area of the construction site of this water treatment plant is lined with luxury residential complexes and shopping area, and thus it was confirmed through the site visits, from the perspective of activation of the local economy and improvement of living environment, that there were benefits to the local residents.

3.4.2 Other Positive and Negative Impacts

3.4.2.1 Impacts on the Natural Environment

The executing agency conducted environmental monitoring (water quality of river, sludge etc.) during the project preparation and implementation as well as after the commencement of operation, and the monitoring results were submitted every quarter during construction and every six months during 2 years after the start of operation. Regarding the results of environmental monitoring, there was no problem such as exceeding the standard both during construction and after the start of water supply, and no particular negative environmental impact has been reported at the time of ex-post evaluation. In addition, no negative project effect on natural environment has been identified from the results of interview with the local residents.

3.4.2.2 Land Acquisition and Resettlement

At the time of appraisal, necessary land was already acquired and neither land acquisition nor relocation was expected. In actuality, relocation and land acquisition did not take place.

3.4.2.3 Contribution to Poverty Reduction

Since 1998, the executing agency has been conducting "Clean Water Supply to the Poor" Program, which assists water connection fees to poor households by evaluating[24] the economic situation of each household of the service area. In 2016, annual subsidy of connection fee to the poor provided by the executing agency is US$ 96,484[25], and the number of subsidized from 2013 to 2016 is 4,849 households. When calculating based on this figure, about 35 million yen has been subsidized to the poor since this plant has started its operation in 2013 to the time of ex-post evaluation (2016). Of the total number of connections (309,300 households) by 2016, about 10.98% is connected to the poor.

In addition, according to the results of the beneficiary survey, approximately 91% (111 people) of 120 respondents answered that the poverty situation of the poor households "significantly improved" or "improved" by this project. As the reasons for this, "reduction of the burden on households" and "access to safe water use" were indicated.

Cambodia's poverty rate[26] has drastically decreased from 30% (2011) to 14% (2014). According to the results of the beneficiary survey and interview from poor households, through this project, there are certain extents of contribution on the poverty alleviation of the poor in terms of a) significant improvement of the living environment of poor households, b) improvement of livelihoods of poor households. The improvement of the convenience of the whole lifestyle is identified with specific examples for a), such as "improvement of water quality of household water used by the poor, which contributed to the increase of the frequency of sanitary management and enhancement of health condition", and "saving of time due to reduction of drawing water". In addition, regarding b), "reduction of household expenses by saving water tariffs drastically compared with one of the past", "increase in household income due to realization of both husband and a wife to have jobs instead of drawing water", moreover, "improvement of livelihoods of poor households by subsidies through the program[27] which assists connection fee" are identified.

From the above results, this project has achieved its objectives as planned. Therefore effectiveness and impact of the project are high.

[24] The executing agency individually evaluates the situation of each household, and sets subsidy rates from 4 categories of 30%, 50%, 70%, and 100%. As criteria for evaluation, based on household income per day, family composition, living environment, presence / absence of assets, ability to read and write etc., the comprehensive evaluation has been conducted.

[25] Estimated figure of FY 2016

[26] Percentage of the population below the national poverty line (Definition of poverty in Cambodia. People less than a certain income / consumption level (poverty line) is defined as poverty).

[27] The amount of about 35 million yen has been provided to the poor, for approximately 4,849 cases (households), since the start of this project to the time of the ex-post evaluation.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The operation and maintenance after project completion is undertaken by PPWSA's Production and Distribution Department, and 22 staff members are placed on a 24-hour shift system for the operation of this water treatment plant. There is no particular problem in the operation and maintenance system, and enough number of engineers who are responsible for operation and maintenance has been secured.

Moreover, in PPWSA, some measures of organizational structure for enhancing its sustainability have been continuously undertaken. It was confirmed that strengthening the organizational management capacity and improving the sustainability of the project are being pursued by the leadership and know-how of the current General Director, organizational culture, incentives for staff, etc. (Refer to【Box.3 Organizational Management Efforts to Maximizing Business Performance by PPWSA】which is described later).

Therefore, no particular problem has been identified regarding the institutional structures of operation and maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

At this water treatment plant, engineers who have gained sufficient experiences through operation and maintenance of the existing water treatment plants and staffs who have technical skills are undertaking the operation and maintenance work. There is no problem with the technical level of staff in charge of operation and maintenance.

During project implementation, some training/ practical training / lesson programs necessary for operation and maintenance were carried out by consultants. Even after starting operation, internal training are provided regularly and it is mandatory to acquire knowledge on the latest maintenance technology. In addition, at the water treatment plant, its operation and maintenance has been taken place in conformity with ISO 9001 (quality management system). From the current satisfactory condition of operation and maintenance of equipment, no particular problem has been identified in terms of technical aspects.

In the series of technical cooperation project[28] which had been implemented before this ODA loan project, Kitakyushu City mainly had been providing long-term support with both know-how on organizational management as a waterworks (staffs training and evaluation system to raise the awareness of staffs, water leakage prevention for improving its profitability and customer relationship management methods etc.) and water infrastructure technology

[28] 1999 - 2002: Dispatch of experts (4 persons in total)
2001 - 2002: JICA Small-Scale Development Partner Project (total of 8 experts dispatched)
2003 - 2006: JICA Technical Cooperation "The Project on Capacity Building for Water Supply System" (Phase 1) (total of 18 experts dispatched)

(maintenance method of equipment, design and installation methods etc.) [29]. Thanks to a cooperative support, the skills and management capacity of PPWSA staffs were enhanced, and during the Phase II (2007 - 2012) and Phase III (2012 - 2017) of the technical cooperation project, PPWSA staffs have been contributing to transfer its technology to the local waterworks. Also, since 2012, PPWSA has been expanding its consulting service as a subcontractor, making full use of the know-how on maintenance of water infrastructure and installation method, and from this, regarding the technical aspects as well, high sustainability has been identified.

Therefore, no particular problem has been identified regarding the technical aspects of operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

The operation and maintenance cost for this water treatment plant has been properly allocated, and there is no financial problem.

In addition, regarding the financial situation of the whole PPWSA, the balance sheet in recent years (the past three years) is as shown in Table 7, and fixed, current assets and capital as well are steadily increasing and there is a tendency of expansion.

Table 7: Balance Sheet of PPWSA

（Unit：Million Riel）

	2013	2014	2015	2016
Assets	1,096,221	1,166,051	1,240,120	1,297,729
Fixed assets	846,438	878,093	939,355	1,038,638
Current assets	249,783	287,958	300,766	259,091
Liabilities and Equities	406,100	476,453	549,376	1,297,729
Equity	695,182	736,169	783,968	819,971
Non-current liabilities	347,243	376,626	396,654	399,503
Current liabilities	53,796	53,257	59,498	78,253

Source： PPWSA Balance sheet

In addition, assets and water sales have steadily increased every year, and as shown in Figure 3, net income is increasing.

[29] At the time of the ex-post evaluation, while technical support from Kitakyushu city to PPWSA is continuing, it has developed into a collaborative relationship as a business partner.

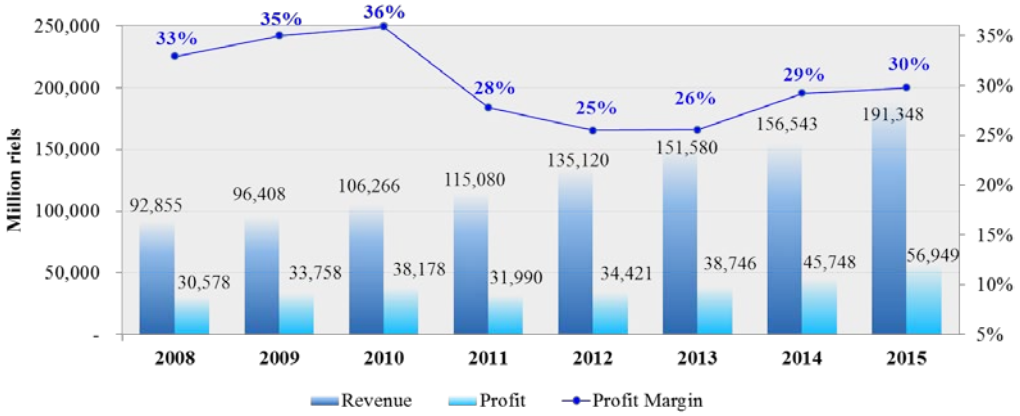


Figure 3：Trend of Profit Margin from 2008 to 2015[30]

Source： PPWSA Financial Statement

In addition, when seeing the revenue sources of PPWSA, incomes other than water sales (new water connection revenues, construction service fees as a sub-contractor, installation service fees related to directly connecting of water connection, etc.) are increasing[31]. Consulting service has been started since 2012, and the revenue as a sub-contractor has increased. With the diversification of its business, steady financial management has been realized. The breakdown of income sources of fiscal 2015 is as shown in Figure 4.

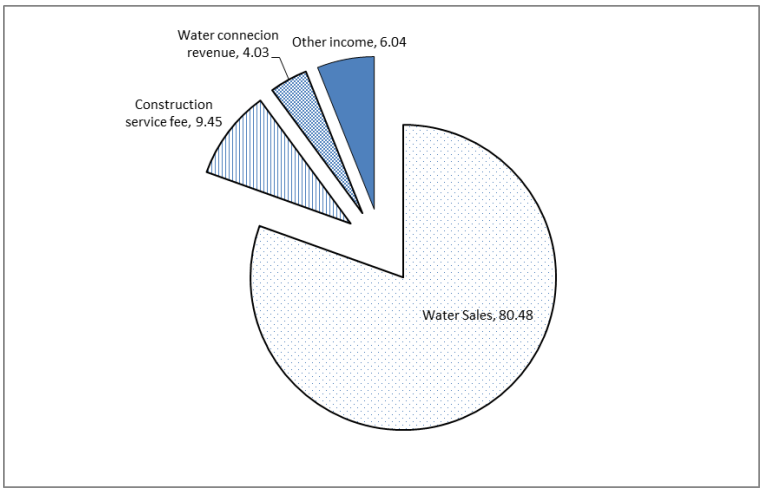


Figure 4：Breakdown of revenue sources of PPWSA (Fiscal 2015)

（Unit:%）

Source：PPWSA Annual Report 2015

[30] Actual figures of fiscal 2016: Revenue 224,858 (Million riels); Profit 50,438 (Million riels); Profit Margin 22%

[31] The 4 major revenue sources for PPWSA: (1) water fee revenue, (2) new connection fee (distribution network connection fee collected at the time of new connection), (3) construction service fee (construction of distribution pipe, delivery service of parts and equipment, equipment installation / assembly / construction services, etc., service income as subcontractor), (4) others (sales of water meters and spare parts, etc.).
In recent years, (3) and (4) are growing at rates exceeding new connection revenues. (As for (3), it increased by 8.7% in 2015 compared to the previous year, (4) was 19.7% higher than the previous year.)

Due to stable financial management, PPWSA was listed on the Cambodian Stock Market in 2012 and the dividend has been growing steadily. The dividends based on the settlement of accounts of fiscal 2015 is about 50% higher than those of the previous year and about 5.5 times compared with those in Fiscal year 2012.

The collection rate of invoice has become 99.93%, and the non-revenue water rate has been reduced to 5.99% at the time of 2015, from here it is recognized that the efforts to increase financial profitability have been continuing. The trend of the Non-Revenue Water Rate (1995 - 2016) is as shown in Table 8.

Table 8：Trend of Non-Revenue Water Rate (whole service area (Greater Phnom Penh))(%)

1995	2000	2010	2011	2012	2013	2014	2015	2016
60	35.5	5.85	5.22	6.51	6.9	7.76	5.99	7.77

Source：Prepared based on the PPWSA Annual Report

Therefore, no particular problem has been identified regarding the financial aspects of operation and maintenance.

3.5.4 Current Status of Operation and Maintenance

PPWSA has conducted water quality management such as water quality test at the water treatment plant (3 times a day) and sampling inspection (every week) at 80 distribution networks. Since start of its operation, water supply has been provided smoothly until the time of ex-post evaluation, and it is operated and maintained without any problems.

For operation and maintenance activities (maintenance and inspection), the manuals have been developed and updated annually. This manual is distributed to all 264 staff members, and it is required to comply with the manual, hence, appropriate maintenance and inspection activities have been carried out.

As for spare parts, enough number of spare parts is always stored in the warehouse, including spare parts that need to be procured from Japan. In addition, through the 5S activities[32] which have been introduced since 2016, sorting and setting and standardizing cleaning)of the water treatment plant have been ensured. The water meters installed in each facility and household are also instantly replaceable and repairable, and the water supply capacity of the water treatment plant constructed by this project is always ready for ensuring its water supply with 100% capacity.

Therefore, no particular problem has been identified regarding current status of operation and maintenance.

[32] The initial letter S taken from " Sort "," Set ", " Shine ", " Standardize " and "Sustain". A slogan used for maintaining and improving the workplace environment of manufacturing industry, service industry etc.

Therefore, 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.

【Box.3 Organizational efforts to maximize business performance by PPWSA】

As a source for its high performance shown in this project, there are various actions of organization management undertaken by PPWSA. It can be judged that the examples of management style as a public entity taken by PPWSA shall be useful resources for future similar projects. The main points are as follows.

- Empowerment of executive managers and autonomous leadership

While taking over the organizational reform that the former Director General built, under the current Director General, the authority is transferred to the executive officers and “empowerment” is strengthened. In other words, rather than top-down leadership, the organizational function that executive officers themselves can demonstrate its leadership autonomously is emphasized. The executive officers have been given the authority to realize the organizational mission of social contribution, and there is an encouragement to bring out the capabilities of executive officers who are players of organization reform.

- Management policy backed by technology

In PPWSA, born and bred technical staffs are appointed to the executive posts and key positions of each department, including the current Director General. Key Performance Indicators covering 31 items are set by executives who have abundant technical knowledge, and some management policies for enhancing the quality of services and profitability backed up by technical knowledge have been steadily implemented. These indicators are constantly monitored, and a system is adopted in which countermeasures are examined and implemented based on the progress. In addition, at the time of occurrence of troubles and problems at the site, the solution is implemented immediately under the leadership of current Director General and Executive Managers, and it can be said that it is a strength of the born and bred technical staffs managing its organization.

- Organizational culture that holds “helping each other as a "member of family”

In PPWSA, eliminating the walls of vertical hierarchical relationships, among departments, even executive managers and director members, helping each other as a “member of family” has been spread as a culture of internal communication. In addition, emphasis is placed on “trust” among staff members, and recreation and sports activities within the organization are actively carried out in order to maintain good relationships. In addition, when problems occur, cross-departmental team is set up, and management style that emphasizes the relationship of trust is thoroughly promoted.

- Organizational design and personnel system that motivates employees and work incentives

In PPWSA, tasks assigned to each staffs are “visualized”, and by directing young staffs with its responsibilities and authority clearly, efforts to derive employee’s willingness and motivation have been taken. In addition, some projects that are expected to achieve clear target figures and results, operations are carried out in the style of internal contract. For example, the team responsible for reducing the non-revenue water rate is an internal contract, and by establishing a flexible and diversified organizational design, a mechanism is set up that maximizes the ability of staff to perform their duties.

Moreover, staff evaluation is conducted every quarter, and the evaluation result is reflected to the salary grade. At the evaluation, its emphasis is placed not on the skills and ages, but on the high awareness, and there is an award system in which certificates are given to talented staff each year.

In addition, there is a regulation in which when the revenue of the organization exceeds the revenue at the time of plan, bonuses are provided to executive officers and all staffs with the same allocation. It is clearly stipulated in internal regulations and external open documents, and from here, it can be said to be an approach to enhance the motivation of staff. Indeed, even at the time of the ex-post evaluation, payment of bonus for three months has been realized in the past three years (from FY 2013 to FY 2015).

- Diversified management for expanding revenue sources

Efforts have also been made to enhance sustainability from a financial perspective. In PPWSA, there are three revenue sources as described above besides the water fees, and stable financial management is realized with diversification of business. For example, in 2012, a new branch was set up to expand the consulting business, and revenue as a sub-contractor (construction of water distribution pipes, delivery services of parts and equipment, and installation/assembly/ construction services etc.) has been increasing steadily year by year. In this way, efforts have been made to improve sustainable competitiveness by transforming from general business models as public waterworks and moving into new business fields.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project, which aims to provide a safe and constant water supply by developing a water supply facility, thereby contributing to improve living environment of residents including the poor in Phnom Penh city and the surrounding area and to improve the investment environment, is consistent with Cambodia's national development policies and with development needs as well as Japan's ODA policy; thus, the relevance of the project is high. Project cost was slightly higher than the original plan and project period exceeded the original plan, thus the efficiency of the project is fair. Operation and Effect Indicators set at the time of appraisal have been greatly achieved except for Water Quality (Color). Regarding the Water Quality (Color), the target figure set at the time of appraisal was not well grounded, and the actual figures significantly excelled from the standard of the WHO and the safety of the water is recognized, thus, it can be considered that it does not push down the evaluation of effectiveness of this project. The indicators of the whole service area, such as the number of households with water supply connections, have shown much higher actual achievement than expected at the time of appraisal, and from the results of beneficiary survey, it is considered that the effectiveness regarding the safety of water quality and the stable supply is high. As for impacts of this project, through stable supply of cheap and safe water, improvement of household expenditure, enhancement on the convenience of living and reduction of water related medical symptoms were seen; and, it was confirmed from the results of beneficiary survey etc. that there was impact on enhancement of the living environment of the households. In addition, the share of the water treatment plant which was constructed by this project in the Greater Phnom Penh area is 32%, It has been providing stable water supply to major industrial parks and commercial area, thus it can considered that this plant is playing an important role to improve the investment environment. Furthermore, it is considered that there were some contributions to poverty alleviation through

subsidy program which assists water connection fees by the executing agency. Therefore, there are much more impacts than expected at the time of the appraisal, thus, effectiveness and impact of the project are high. No negative impact on natural environment, land acquisition and relocation has been observed. No major problem has been identified in the institutional, technical and financial aspects of the operation and maintenance as well as in the current status; thus, sustainability of the project effects is high. In addition to the efforts for reducing operating costs, such as reduction of the non-revenue water rate and high fee collection rate, efforts for expansion of income sources have been tackled by the executing agency, and the executing agency continues to maintain its stable management.

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

4.2 Recommendations to the Executing Agency and JICA

Importance of new support to ensure more stable water supply service

According to PPWSA, the water tariff that is a major source of income is the decision of the Cambodian government and has not been revised since 2001. Also, with the current water tariff system, it is not allowed to raise the tariff or collect the basic water tariff in consideration of the inflation rate introduced in neighbouring countries, hence this tariff is not an appropriate tariff from the perspective of financial aspect nor a fair tariff in light of social realities. Despite this situation, PPWSA has made its own management efforts to get into the black through reduction of operating costs and expansion of income sources by diversifying business. Its high performance was observed in this ODA loan project as well, but it should be noted that PPWSA has been making the corresponding self-help efforts for this high performance.

In other words, this executing agency is a public service agency in a developing country, and stable operation has been maintained by the self-help efforts of PPWSA, in a situation that always includes potential risk such as external pressure from political situation and changes in the social environments. In the social structures peculiar to developing countries, there is a high probability of being influenced by various external factors that are outside the control of PPWSA. In light of the fact that this project is a public service management in the environment as described above, it is important to consider new support to ensure stronger and stable water supply service (such as dispatch of advisors to develop Cambodian government's water policy and systems).

Although remarkable achievements and impacts have been recognized, due to the expansion of the water supply area of PPWSA, the water demand has increased rapidly, and the need for early expansion of water supply capacity has enhanced.[33] Considering that the support

[33] PPWSA plans to expand water supply at an early stage through financial support under concessional terms from donors, as PPWSA is difficult to cover all the funds necessary for expansion on its own in the current financial

for PPWSA which effectively introduced financial cooperation after a series of technical cooperation is recognized as a good practice which has promoted its synergistic effects of both technical cooperation and financial assistances by making full use of know-how of Japanese local authorities, examining Japan's continuous involvement (such as financial cooperation) is considered to be meaningful.

4.3 Lessons Learned

Synergistic effects of technical cooperation and ODA loan utilizing municipality's experience

As a point worthy of special mention for this project, a series of technical cooperation[34] has contributed to promote maximization of the performance of this ODA loan project. Through the long-term capacity building for the executing agency, assistance by the ODA loan was introduced at the stage of sufficiently enhancing its technical capacity and organizational structure, hence, showing high performance from the perspective of sustainability and effectiveness. In other words, by providing financial cooperation at the timing when the organizational structure / human resources development for self-sustaining management was realized, it can be said that it was possible to maximize the impact. Therefore, high effectiveness is recognized as an assistance package effectively combining technical cooperation and financial cooperation.

In addition, the fact that not only private consultants but also Japanese municipalities have been involved as the technical cooperation partners can be considered as a background of the high performance of this project. As mentioned earlier, long-term technical cooperation by municipalities, mainly by Kitakyushu city, has been implemented before this ODA loan project. Technical cooperation unique to Japanese municipalities that have practical experience at site has played a major role in the background of PPWSA, the executing agency, in being listed on the stock market and raised to a profitable management.

In the future, when maximizing the impact of similar projects, it is considered effective to combine with technical cooperation unique to the municipalities who have practical experience on the ground.

Importance of building good relations with local authority and local communities

In this project, it is worthy of special mention as a lesson-learned that the executing agency has built a good relationship with local communities / local authority, and has made an effort to create a sense of unity of the project and a sense of union among concerned parties. On supervision of the project, the executing agency has undertaken various actions to activate communication with the local community (see Box 2 for details). As a result, almost no

situation.

[34] Beginning with the dispatch of experts in the 1990s, technical cooperation projects and grant aid have been implemented until the middle of the 2000s.

complaints from local residents occurred, and as regards construction work, active support from the local community has been obtained. In this way, managing the stakeholders of the project including the community and local authority as a team and emphasizing the process leading to build confidence contributes to the smooth operation of the project, which can be regarded as a good practice.

A close collaborative system among three parties (other donors, JICA, executing agency) in co-finance project

Although it is not easy in co-finance projects to align the completion timings of JICA's and other donor's scope of finance and to lead to the early actualization of the project effects, in this project, not only did the scope of JICA and the scope of AFD complete its construction at the same timing but also the water distribution network outside of the scope of this project was completed in May 2012, and water supply has started since the following month (October 2013) when the water treatment plant was completed.

One reason for this is that as stated in Box 1, a close collaboration system among the three parties (AFD, JICA and PPWSA) was continuously implemented. Also, in the supervision of this project, the same staffs in charge have been consistently engaged at JICA Cambodia Office and the PPWSA side, and such an allocation structure can be considered as a background for realizing the close cooperation. In co-finance projects, the collaborative system at the project supervision stage can have a direct impact on the timing of the project effect, hence this example of concrete collaboration system and process adopted in this project is considered to be useful for similar projects.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs	1） Civil Works, Procurement of Equipment etc. <JICA portion> (1) Water Treatment Plant (2) Sludge Pipe (3) Treated Water Pumping Station (4) Treated Water Tank (5)Treated Water Transmission Mains (6) Sewer and Ancillaries <AFD portion> (1) Intake Tower (2) Raw Water Transmission Main	1） Civil Works, Procurement of Equipment etc. <JICA portion> ・(1)～(6) As planned ・Additional output (7) Transmission network extension to Takhmao - Pipe of DN 400mm =3,500m -Pipe of DN 500mm =7,200m <AFD portion> As planned
	2） Consulting services ・ Assistance in tendering, Construction supervision (Quality Management, Process Management etc.)	2） Consulting services ・ As planned
2. Project Period	March, 2009 – April, 2013 (50 months)	March, 2009 – August, 2014 (66 months)
3. Project Cost		
Amount Paid in Foreign Currency	6,169 million yen	—
Amount Paid in Local Currency	363 million yen	—
	(13,595 million riel	—
Total	6,532million yen	6,686 million yen
ODA Loan Portion	3,513 million yen	3,492 million yen
Exchange Rate	1 KHR＝0.0267yen (As of October, 2008)	1 KHR＝0.0222yen (Average between 2009 and2014)
4. Final Disbursement	July , 2014	