Ex-Post Evaluation 2011: Package Ⅱ- 4
(Cambodia, Ghana, Nicaragua)

October 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

Earth and Human Corporation

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the results of the ex-post evaluation of ODA Loan projects that were mainly completed in fiscal year 2008, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2007. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

October 2012

Masato Watanabe
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

This volume of evaluations, the English translation of the original Japanese version, shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA. JICA is not responsible for the accuracy of English translation, and the Japanese version shall prevail in the event of any inconsistency with the English version.

Minor amendments may be made when the contents of this volume is posted on JICA's website.

JICA's comments may be added at the end of each report when the views held by the operations departments do not match those of the external evaluator.

Kingdom of Cambodia

Ex-Post Evaluation of Japanese ODA Grant Aid Project

"The Project for the Rural Electrification on Micro-Hydropower in Remote Province of Mondul Kiri"

External Evaluator: Machi KANEKO, Earth and Human Corporation

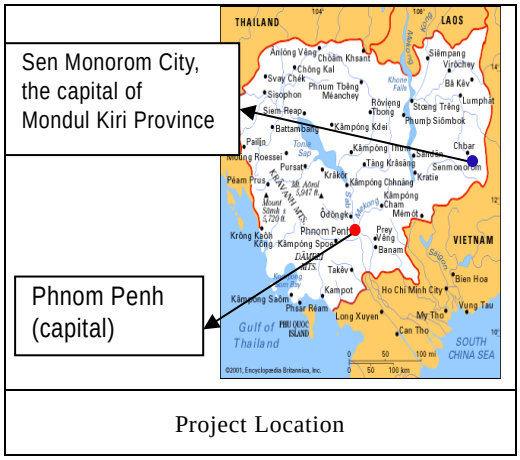
0. Summary

The objective of the Project was to supply a stable supply of electric energy by constructing micro-hydropower plants and auxiliary facilities in Mondul Kiri Province. This objective has been highly relevant with the development plan of Cambodia and development needs both at the time of planning and at the time of ex-post evaluation, therefore its relevance is high. The hydroelectric power facilities that were constructed has been maintained in good operating condition, and the objectives of power supply and electrification, which are indicators of effectiveness, have been achieved as planned. As a result, electricity availability in the target area has been vastly improved, with increase in the number of restaurants, guesthouses and hotels. There have also been increases in the number of people moving into the area and in the number of tourists visiting Sen Monorom, and thus, the Project has contributed to lead the entire growth of regional economy through the development of local tourist industry. Additionally, improvements have been seen in the widespread use of consumer electrical appliances by general households and in better public services, and thus there has been a positive impact on the living condition of rural people.

And the project cost was within the plan, however the project period was exceeded, therefore efficiency of the project is fair. With respect to maintenance of the facility, the Project provided for the foundation of an operating and maintenance system, which was fortified through the technical cooperation project afterwards. Therefore, sustainability of the project effect is high.

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

1. Project Description



Project Location

O'Moleng Micro-Hydropower Station, Intake Weir and Sedimentation Basin

1.1 Background

Many of the existing power facilities in the Kingdom of Cambodia (hereafter referred to as "Cambodia") were devastated during the civil war that took place in Cambodia over a 25-year period, with the result that power development has been significantly delayed. Because of this, as of 2002, electric power was being supplied to only around 13% of all households in Cambodia, and annual per capita power consumption was measured at 35 kWh, which was the lowest level anywhere in the Indochina Peninsular countries. Moreover, electrification was extremely slow to progress in rural areas, where about 85% of the populations live, and only 9% of households enjoyed the benefits of electricity.

The provincial capital, Sen Monorom City in Mondul Kiri Province (2004 population: about 8,000), which is the target site for the Project, is located in the mountainous near the border of Vietnam, and despite Sen Monorom City being the provincial capital, there was no public power service. Because of this, there was a chronic power shortage, and small-scale private power providers were using diesel generators to provide power only during morning and evening meal times. Additionally, private power providers set electric tariff rates at anywhere from 1,800 riels per kWh (48.3 yen/kWh) to 2,300 riels per kWh (61.7 yen/kWh), which is about 4 times that in Phnom Penh, and these high rates were impossible for people in the low income group to pay.

This situation was posing a hindrance in terms of Mondul Kiri Province being able to reduce poverty and promote rural development, and the province desired to assure a power energy source for the region at the earliest possible timing. In 1999, the Mekong River Commission carried out an investigation on small hydropower generation in Sen Monorom City and its vicinity. Based on the results of this investigation, the Cambodian Government

requested application of Japan's Grant Aid to a plan of constructing micro-hydropower plants.

In response to this request, the Project was implemented with the aim of the construction two runoff river type small hydropower plants and an auxiliary power source for the dry season, which will use diesel power generator in Sen Monorom City of Mondul Kiri Province.

1.2 Project Outline

The objective of the Project is to supply a stable electric energy by constructing a micro-hydropower plants and auxiliary facilities in Mondul Kiri Province.

Grant Limit / Actual Grant Amount	1,066 million yen / 1,059 million yen
Exchange of Notes Date	June 2006
Implementing Agency	Ministry of Industry, Mines and Energy
Project Completion Date	December 2008
Main Contractor	Konoike Construction Co., Ltd.
Main Consultant	J-POWER Co., Ltd. and Nippon Koei Co., Ltd. / Joint venture
Basic Design	May 2005
Related Projects (if any)	Technical Cooperation Project "The Project for Operation and Maintenance of the Rural Electrification on Micro-hydropower in Mondul Kiri, Cambodia" (December 2008 - March 2011) (hereafter referred to as "the technical cooperation project").[1]

2. Outline of the Evaluation Study

2.1 External Evaluator

Machi KANEKO, Earth and Human Corporation

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: October 2011 - August 2012

Duration of the Field Study: March 26 – April 14, 2012 and May 26 – June 9, 2012

2.3 Constraints during the Evaluation Study

None.

[1] The relevant technical cooperation project was implemented over a two-year period starting immediately after the completion of the Project, and indicators that were set as overall goals, like the quantitative effects of the Project, were "increasing household electrification ratios" and "stable supply of electric energy".

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

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Cambodia

At the point of planning of the Project, the Cambodian government was endeavoring to achieve an electrification rate of 25% of all households by 2010 and 70% by 2030, but because of constraints in terms of funding and technology, it was difficult to achieve these objectives without assistance. Furthermore, the Energy Sector Development Policy (2004 – 2020), which is a high-level policy of Cambodia, calls for the electrification of rural areas as a foremost issue in order to eliminate disparities between urban areas and rural areas, improve living condition, and reduce poverty. The Project was aimed at reducing poverty in Mondul Kiri Province which is located in the mountains near the border of Viet Nam, and at providing better conditions for people living there, and was relevant to development policies at the time of planning.

At the point when the ex-post evaluation was done, in the Rectangular Strategy developed by Cambodia in 2004 as a framework for national development, infrastructure refurbishment was identified as a central strategy, with "Energy Field and Power Network Development" being an item of strong focus. Moreover, the National Strategic Development Plan (2006 – 2010) formulated in order to embody the Rectangular Strategy also emphasized the promotion of power supplies, and numerical targets for electrification rates, like those at the time of Project planning, were set with the aim of increasing the electrification rate to 25% by 2010 and 70% by 2030, by means of an on-grid (grid-connected) network.

The following shows trends in the amount of power supplied by Electricité du Cambodia (EDC). Compared to 2005, when the Project was planned, the amount of power has increased more than 3.7-fold. At the same time, however, ongoing and proactive measures will be required in order to fulfill the specified objectives, and with respect to electrification in rural areas, where refurbishment has been delayed, the aim is to refurbish facilities and improve operating control technology in order to enable stable supplies of power at low prices[4].

Table 1: Trends in power supply volume in regions supplied by EDC

	2005	2006	2007	2008	2009	2010
Nationwide	145.59 GWh	199.75 GWh	268.57 GWh	349.61 GWh	441.91 GWh	542.63 GWh
Increase rate		37.20%	34.45%	30.17%	26.40%	22.79%

Source: Data provided by Electricité du Cambodia (EDC)

The above indicates that the Project is relevant with the development policy of the

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

[3] ③: High, ②: Fair, ①: Low

[4] There are not only EDC but a large number of small-scale private power contractors in rural areas in Cambodia, but the Cambodian government has a policy to promote electrification in rural areas by expanding the national grid managed by EDC in the future, making EDC's role more important.

Cambodian government, which aims at increasing the rate of electrification in rural areas.

3.1.2 Relevance with the Development Needs of Cambodia

Because of the civil war that went on in Cambodia from 1970 into the 1980s, many of the existing power supply facilities have been devastated, and the national electrification ratio was at a standstill, at 13%. Moreover, at the time when the Project was planned, electrification was concentrated in urban areas such as Takeo Province and Kampot Province on the outskirts of Phnom Penh, and electrification in rural provinces, including the target province of the Project, Mondul Kiri Province and provincial capital, had advanced very little, with few residents endowing the benefits of electricity.

Because of this, when the Project was planned, Sen Monorom City, which is the provincial capital of Mondul Kiri Province, was not connected to a public power service, and the supply of electrical energy was limited to small-scale private power providers. Moreover, there were frequent power interruptions, and electricity tariff rates ranged from approximately 48 to 62 yen per kWh, which was about 4 times the rate in Phnom Penh, and made it impossible for low income groups to pay for power. For this reason, at the time when the Project was planned, only 31.7% of households (377 households out of 1,189) had electrical power, despite Sen Monorom City being the provincial capital, and this was hindering vitalization and promotion of the area. Additionally, at the time when the Project was planned, plans to expand the national transmission system (targeted for 2016) did not include Mondul Kiri Province, and no power transmission could be expected from the outside. Furthermore, donor aid from France, Germany and other countries was concentrated primarily in Phnom Penh, delaying power development in rural provinces.

At the point when the ex-post evaluation was done, low-priced power was being supplied on a stable basis to a certain extent as a result of implementation of the Project, and the number of households contracting for power supply within the target area was increasing. Specifically, at the end of 2011, about 80% of households in the area had contracts with the Mondul Kiri branch of Electricité du Cambodia (EDC) (formerly EUMP[5]), and that number is currently increasing.

Also, in terms of the regional promotion that was expected when the Project was planned, in addition to assuring stable supplies of power, road refurbishment was also being promoted at the same time, and this was leading to increases in the population and the number of tourists. Thus, the Project is contributing to the revitalization of the regional economy, primarily in terms of the tourism industry, and is relevant to the needs of the target area.

[5] EUMP was newly established through the Project, but later, in June 2010, was taken over by Electricité du Cambodia (EDC), a large-scale government corporation, and now operates as a branch in Mondul Kiri Province of EDC.

3.1.3 Relevance with Japan's ODA Policy

With respect to the Country Assistance Plan for Cambodia, which is one of Japan's ODA policies relating to Cambodia, because Cambodia's development needs are both wide-ranging and vast in scope, assistance is being provided with a heavy emphasis on priority issues. Moreover, when assistance is implemented, sustainable economic growth and poverty reduction are foremost issues, and every effort is being made to give adequate consideration to measures that target the socially disadvantaged. There is a strong need for refurbishment of basic infrastructures devastated as a result of the long-term civil war in Cambodia, as well as to rebuild systems that have been worn down by the long-running conflict. There is also a need to cultivate personnel who can help to offset severe shortages of human resources.

By refurbishing power facilities in rural provinces, the Project is contributing to promoting the refurbishment of social and economic infrastructures in regions where development has been delayed, and is providing support for sustainable economic growth. Furthermore, improved access to power by the poverty classes in rural areas will help to reduce poverty. All of these aims are relevant with Japan's ODA policy.

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

3.2 Effectiveness[6] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Power supply and electrification ratio

Table 2: Trends in power supply, hours of power supply and electrification relating to the Project[1)]

Indicator		At time of planning (2004)	Target (end of 2013 [5 years after completion])	Achievements			
				2008[2)]	2009	2010	2011
Power Supply	Daily max.[3)]	170kW (private power providers)	400kW	267 kW	357 kW	490 kW	618 kW
	Hours of power supply	Morning: 3 hrs. Daytime: 3 hrs. Night: 6 hrs.	24-hour supply	N/A	24-hour supply	24-hour supply	24-hour supply
Electrification ratio		32%	about 80%	29.8%	71.7%	76.3%	80.5%
Contracting households/ Total households[4)]		N/A		465/1560	1180/1645	1304/1710	1444/1795

Source: Data provided by EDC

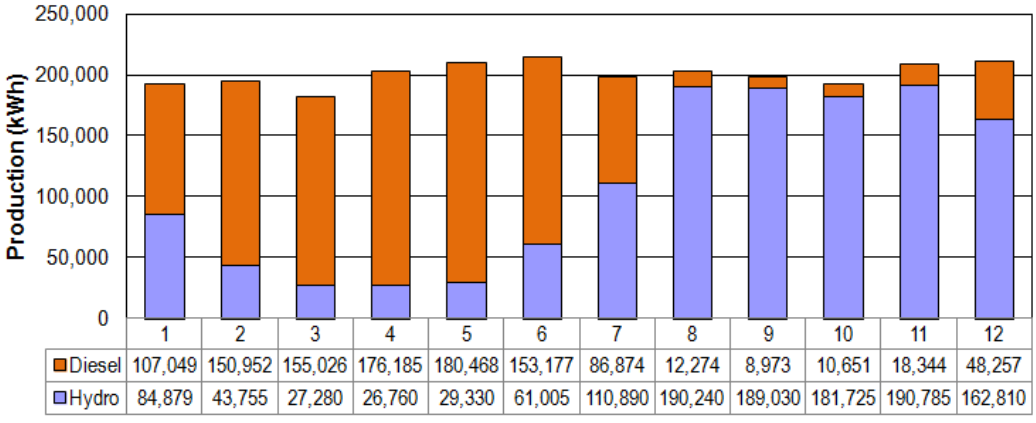
Notes: 1) Each indicator covers Sen Monorom City.
2) The power facility went into full-fledged operation in December 2008. For this reason, the period of operation indicated for 2008 is the figure for one month.

[6] Effectiveness should be judged in consideration of impact to determine a rating.

3) Daily maximum: Anticipated demand for power was measured at the time of planning, and the daily maximum power demand five years after the completion of the project, which is the target year for the outcome, was set at 400 kW. Also, where hydropower is in full operation during normal seasons and diesel power is used as reserve power, the aim was to apportion hydropower and diesel power during the dry season, when river flow rates are low, achieving a stable power supply (400 kW) year-round.
4) According to the report prepared at the completion of the relevant technical cooperation project, "The value for total households is the number of buildings within range of the power distribution network in Sen Monorom City, and was calculated by taking the value surveyed in September 2009, prior to electrification, as the base, with a performance increase rate up to that point of 5.5%. Because of this, the electrification ratio is an estimated value." For this reason, it should be noted that the electrification ratio noted above is not the actual performance value. However, the number of contracted households is the actual value.
The indicators that were set as overall goal of the relevant technical cooperation project, like the quantitative effects of the Project, were "increasing household electrification ratios" and "stable supply of electric energy".

Table 2 above shows trends in power supply, electrification ratio and other parameters in 2008 and later years. As a result of implementation of the Project, power supply had reached a daily maximum of 618 kW by 2011, with power being supplied 24 hours a day, and the objectives set at the time of planning were achieved. For the electrification ratio as well, the value immediately following completion of the Project (December 2008) was 29.8% (465 of 1,560 households), but the number of contracted households continued to increase subsequently, and as of December 2011 the ratio had reached 80.5% (1,444 of 1,795 households). Thus, the value of 80%, which had been set as the target value for 2013, has already been met.

Figure 1 below shows a breakdown of power production volume by month, categorized by power production source. Starting around July, when the rainy season begins in Mondul Kiri Province, the percentage of power produced using hydropower begins to increase, and until the dry season approaches in December, the amount of power supplied using diesel power generation, which incurs fuel costs, is kept low. Thus, the facility is operating as planned in the initial planning.



	1	2	3	4	5	6	7	8	9	10	11	12
Diesel	107,049	150,952	155,026	176,185	180,468	153,177	86,874	12,274	8,973	10,651	18,344	48,257
Hydro	84,879	43,755	27,280	26,760	29,330	61,005	110,890	190,240	189,030	181,725	190,785	162,810

Figure 1: Monthly power production by generation source in 2011

Source: Data provided by EDC Mondul Kiri branch

In 2011, the daily maximum supplied power was 618 kW, which was approaching the level of 670 kW that is the power production capability limit for the Project. Because further power increases are anticipated, EDC has formulated and implemented planning for importing power from Vietnam, and this power transmission began on January 19, 2012[7]. Once power is being transmitted from Vietnam, diesel power generation facilities will be used as last priority in the system fuel mix and as reserves, in the event of an interruption in power transmission from Vietnam, a water shortage, or a breakdown at a hydropower plant, and will serve in a backup capacity.

(2) Electricity tariff rates

Table 3: Electricity tariff rates for the Mondul Kiri branch of Electricité du Cambodia (EDC)

Indicator		At time of planning (2004)	Target (end of 2013 [5 years after completion])	Achievements				
				2008 (before project)	2008 (after project)	2009	2010	2011*2)
Electricity tariff rates (riels/kWh)	General household	1800 riels/ kWh~2300 riels/ kWh (Private power providers)	Avg. about 670riels/ kWh *1) (18.0 yen/kWh)	2800 riels/kWh ~3500 riels/kWh (Private power providers)	1700 riels/ kWh	1500 riels/ kWh	1500 riels/ kWh	1500 riels/ kWh
	Restaurants, guesthouses, hotels etc.				1900 riels/ kWh	1700 riels/ kWh	1700 riels/ kWh	1700 riels/ kWh
	Factory				1700 riels/ kWh	1700 riels/ kWh	1700 riels/ kWh	1700 riels/ kWh

Source: Data provided by EDC

Notes: 1) The target values for tariff rates were set based on the ability of residents to pay (opinion poll) and on values calculated for the cost price of power generation. In the target values, electricity tariff rates were slightly higher than when the basic design was done because of design changes (the number of hydropower bases was changed from three locations to two, and the output of diesel power generation, which is governed by fuel costs, increased slightly. See the section on "Effectiveness").

2) Based on the exchange rate for December 2011, figures were calculated at 1,500 riels = 28.6 yen. Also, even in minority (Pnong people) villages, electricity tariff rates were set at the same level as those for cities, at 1,500 riels / kWh. If there are likely to be discrepancies in usage conditions, however, appropriate measures will be taken.

With respect to electricity tariff rates, as indicated in Table 3 above, the actual value in December 2011 was 1,500 riels / kWh (28.6 yen / kWh), which was more than the target value of 670 riels / kWh (18.0 yen / kWh). Furthermore, as shown in Table 4, the electricity tariff rate in Phnom Penh is 610 riels / kWh, which is higher than in other provinces.

At the same time, however, electricity tariff rates charged by private power providers in Sen Monorom City in 2008 ranged from 2,800 riels / kWh (63.5 yen / kWh) to 3,500 riels / kWh, and had skyrocketed further compared to the time when the planning was formulated.

[7] Because EDC does not have experience with systems for connecting the hydropower of the Project and the power being imported from Vietnam, a request was made to implement follow-up cooperation on the Japan side after the relevant technical cooperation project has been completed, and four Japanese experts were dispatched from October 2011 until March 2012. Also, EDC headquarters bore all the cost of constructing the system for connecting power being imported from Vietnam.

When compared to these rates, the electricity tariff rates based on the Project were about half the amount, which is a significant improvement. Moreover, the per capita Gross National Income (GNI)[8] when the Project was planned (2005) was US$ 1,020, while the GNI in 2010 was US$ 2,080. Thus, it is assumed that households were better able to pay the tariff rates than when the Project was planned. So even though the tariff rates were set higher than the target values, it is believed that this trend is one factor in the steady increase in the number of households contracting for electricity.

Table 4: Electricity tariff rates in principal cities (2011)

Province	Electricity tariff rates riels/kWh	Notes
Phnom Penh	610	50 kWh/month or less
Takeo	920	Low-use households
Siem Reap Sihanoukville	820	Low-use households
Battambang	1,000	Low-use households
Prey Veng	1,220	Low-use households
Mondul Kiri	**1,500**	**All households**
Kratie	1,700	All households

Source: Data provided by EDC

According to an explanation by EDC, the low electricity tariff rates set in Phnom Penh was putting pressure on management by EDC, but based on the experience that it was difficult to increase tariff rates once they had been decided, currently the tariff rates are decided by the procedure that each power contractor/producer calculates the required cost then Electricity Authority of Cambodia (EAC) examines it. Moreover, compared to the point when the target values for the electricity tariff rates were first set (2004), the price of crude oil[9] has more than doubled, and this has been pushing up the unit cost of power generation in the dry season, when there is greater reliance on diesel power generation.

Currently, there are no problems with management by the Mondul Kiri branch of EDC, and based on EDC's experiences in other provinces to date, the current tariff rates are judged to be appropriate. Once the transmission of power (coming from hydropower) from Vietnam has stabilized, however, and contracts with large consumers such as factories have advanced, it will be necessary to review these tariff rates based on revenue balances and other parameters.

Moreover, according to the beneficiary survey, there is a high level of satisfaction concerning unit prices of electricity, which are significantly lower than earlier prices, but because the amount of monthly payment for electricity is higher than before, an increasing number of households are not necessarily satisfied with the current unit prices for electricity. As indicated in Figure 2 at the right,

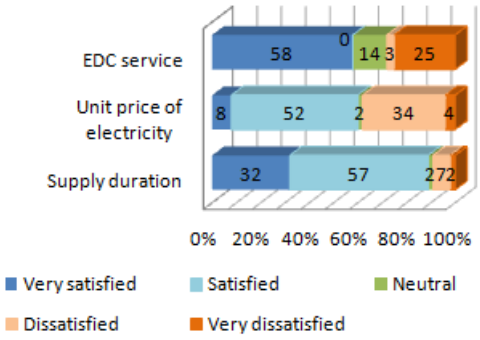


Figure 2: Satisfaction with supply time, electricity unit price, and EDC service (results of beneficiary survey)

[8] The Gross National Income (GNI) figures for 2005 and 2010 are based on data provided by the World Bank.

[9] At the time when the Project was planned, the price of crude oil (WTI) used to calculate the unit cost of power generation was US$ 41.45 per barrel (2004), but by 2011 it had soared to US$ 95.05 per barrel.

about 90% of the residents are satisfied with the amount of time that power is supplied, but about 40% are dissatisfied with the unit price of electricity, and this is one factor that is lowering the degree of satisfaction with EDC services. Conversely, however, as shown in Figure 3, the number of household appliances owned by residents is increasing, and electricity usage time is increasing in step with the increase in

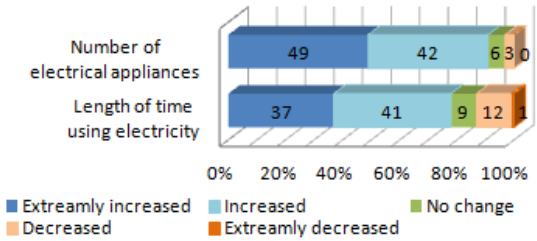


Figure 3: Increases/decreases in number of electrical appliances and length of time using electricity
(results of beneficiary survey)

appliances, so higher amounts for electricity are a natural outcome. Some residents, however, are unhappy that unit prices have been set higher than those of other provinces, and some are expressing distrust in the way that meters are read. Thus, there are apprehensions that the increase in the amounts being paid for electricity will prompt dissatisfaction with EDC

services. EDC is about to increase opportunities to offer explanations to residents, including the calculation method of electricity charges and accuracy of meters, but it is believed that the time is coming when personnel who deal with complaints of residents will have to be prepared as well as more effort will have to be put into educating people about saving electricity, so that electricity will be used more carefully.

3.2.2 Qualitative Effects

As a result of the Project, electric power can now be supplied 24 hours a day, which means that emergency surgeries can now be performed around the clock including emergency treatment at night as well as vaccines can be maintained in a stable state at Sen Monorom Referral Hospital[10], all of which contribute to improved services for local residents.

This hospital is the largest-scale hospital in Mondul Kiri Province, and is the only hospital that can accommodate obstetric surgeries. Prior to the implementation of the Project, however, the hospital relied on civilian power companies and household diesel generators for its power supplies, and was unable to use medical devices that required power on an ongoing basis. In interviews, physicians stated that

Table 5: No. of outpatients seen in 2011
(Sen Monorom Referral Hospital)

	In province	Other provinces/ districts	Total
Transferred from health centers	43	38	81
Autonomous treatment	1620	0	1620
Total	1663	38	1701

Source: Interviews conducted at Sen Monorom Referral Hospital

[10] Sen Monorom Referral Hospital was established in 1986, and the current facility was refurbished in 2004 through ADB assistance after the civil war and comprises 17 wards. There are three physicians, one intern, 26 nurses, six midwives, and 100 beds, and the hospital serves as a referral hospital supporting medical services in the province.

they now have access to stable power supplies, and are able to perform emergency surgeries at night and engage in other aspects of treatment without worrying about power (see Tables 5 and 6). And the hospital has an operating room that was donated by a medical organization in France, but power was necessary even during surgeries performed during the day, and it was confirmed that the Project has contributed to the improvement of medical services in the target area as a result of power supply.

Figure 6: Number of births in 2011 (Sen Monorom Referral Hospital)

Category		Total	Still-births
Normal deliveries		271	0
Difficult births	Cesarean sections	12	
	Severe hemorrhages	7	0
	Eclampsia	5	0
	Other	3	0
Total		298	0

Source: Interviews conducted at Sen Monorom Referral Hospital

3.3 Impact

3.3.1 Intended Impacts

(1) Development of the regional economy and tourism industry

As indicated in Table 7, the number of restaurants, guesthouses and hotels in Sen Monorom City has been increasing from one year to the next, and improvements in the power situation as a result of the Project have been helping to promote the development of tourism. Furthermore, the number of tourists visiting Sen Monorom City in 2011 surpassed 60,000, which was three times the approximate number of 20,000 tourists who visited in 2008.

Table 7: Trends in tourists visiting Sen Monorom City

Category	2008	2009	2010	2011
No. of restaurants	16	18	20	27
No. of guesthouses & hotels	19	19	22	25
Tourists	21,420	30,256	50,568	63,636
Increase in tourists (%)	-	41 %	67 %	26 %

Source: Data provided by EDC

The increase in the number of tourists has been spurred by the refurbishment of National Road No. 7[11] and National Road No. 76[12], as well as by other improvements that have made it significantly easier to reach Mondul Kiri Province. Because of this, a number of large-scale hotels are currently being constructed in several locations, and further development of the tourism industry can be

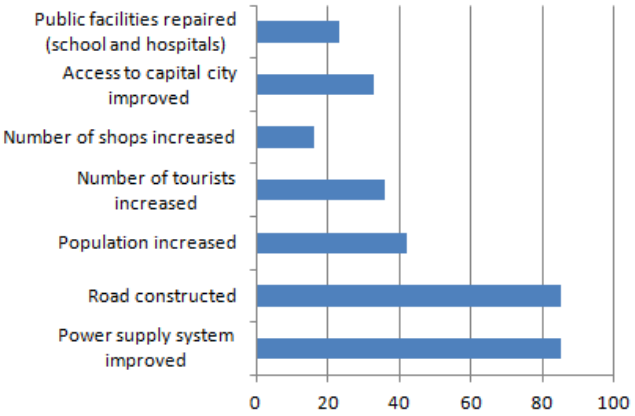


Figure 4: Reasons for the positive turnaround in the economy (results of beneficiary survey)

[11] Japan grant aid project: Between Phnom Penh and Kompong Cham
[12] China preferential loan project: Between Mondul Kiri and Ratanakiri

expected.

In the results of the beneficiary survey conducted among residents, 85% of households responded that the economy was better than prior to the Project, and as shown in Figure 4, the primary reasons cited for the turnaround were electrification within city limits, and refurbishment of roads. The survey indicates that residents feel that implementation of the Project has had a positive impact on the development of the regional economy by means of the electrification of Sen Monorom City.

(2) Improvement of residents' living conditions

In Cambodia, a greater percentage of the population has been moving to urban areas, and as shown in Table 8 below, the population of Sen Monorom City has been increasing from around 8,000 at the planning stage. According to an explanation by EDC, there had been an increase in incomers from other provinces. In interviews conducted at the Sen Monorom market, many of the residents who depend on trading to make a living have moved there from other provinces, and in interviews conducted with those residents, the reason for selecting Sen Monorom as a place to live was that electricity was available, as well as a rich natural environment.

Table 8: Trends in population in Sen Monorom City and principal public facilities

	2005	2008	2009	2010	2011
Population	about 8,000	9,572	9,838	9,940	N/A
Hospitals	1	1	1	1	1
Elementary schools	3	3	3	3	3
Junior high schools	1	1	2	2	2
High schools		1	1	1	1
Streetlights	0	0	135	135	170

Sources: Documents provided by EDC, 2008 population census, trial calculations by EDC based on increase rates in 2009 and later

Power line in Laoka. Electricity is being provided to contracting households.

Also, as shown in Figure 8, the numbers of schools and streetlights have increased as well, and residents' living conditions have been improving. Residents have voiced the opinion that better lighting has brought about improvements in public safety. Additionally, the Project (stable power supply) is seen as a significant turning point that has greatly changed the living condition in Sen Monorom City, and there has been a dramatic pickup in movements of both people and commodities such as immigrants and tourists since around 2009. As a result, the city has seen an increase in the number of guesthouses and hotels being built, as well as the number of restaurants, retail stores and money-changing establishments. A majority of the responses indicated that, as a result, there has been an improvement in household incomes.

Lighting device installed in a kitchen

In other results, there are villages where a minority called the Pnong people live in mountainous areas of Mondul Kiri Province, and construction is currently underway that will extend power transmission/distribution lines to these villages. For example, construction of power lines from the city to Putang Village and Laoka Village, located four to five kilometers from the city, was begun in 2011, and the power supply to contracted households began in May 2012. Construction has also been planned to bring power to Keo Seima District in 2012, where large numbers of minorities live, and electrification of minority villages is taking place little by little.

According to observations of family households, the use of consumer electrical appliances by general households are now widespread among the general households, and surveys of beneficiaries indicate that when the numbers of appliances owned prior to the implementation of the Project and currently owned were compared, the percentage of lighting devices increased from 39% to 100%, while mobile phones had increased from 64% to 100%, TVs from 35% to 97%, and water pumps from 35% to 84%. The number of households owning rice cookers had increased from 13% to 70%, and those with refrigerators had grown from 6% to 26% (see Figure 5). Because purchases of household appliances are governed by the economic strength of individual families, even though the outcome of the Project is not the sole factor behind the increase in the possession of household appliances, the Project can be considered to be contributing to the propagation of household appliances that alleviate the burden of housework for women, such as water pumps and rice cookers. Additionally, as seen in Figure 6, 97% of respondents said that the burden of women's housework has been alleviated, and the electrification of households can be considered to have brought about changes in women's housework.

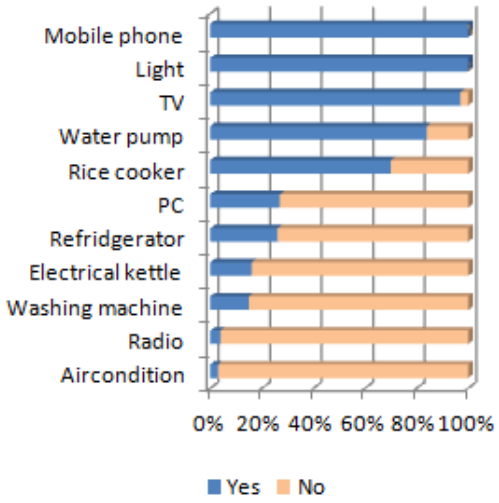


Figure 5: Appliances currently owned
(results of recipient study)

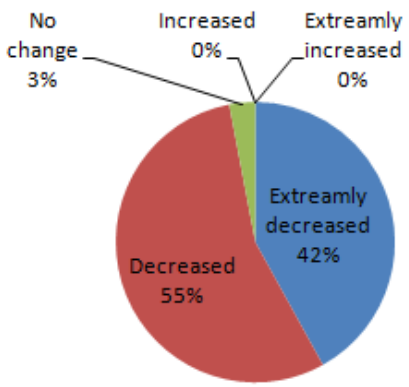


Figure 6: Increases/decreases of women's housework
(results of recipient study)

As described above, the improvement in the power situation in Sen Monorom City as a result of implementation of the Project has helped to improve the living environment for residents and to improve the quality of public services.

3.3.2 Other Impacts

① Impacts on the Natural Environment

The Project primarily involves power generation using hydropower, which is a form of renewable energy and has little impact on the environment.

There is a waterfall in O'Mleng that is a tourist draw, and the design has taken the environment and scenery into consideration in ways such as burying water pipes and hiding intake weirs in locations that will not be visible to tourists from the general activity range. Also at the stage of construction, environment was taken into consideration so as not to give impact to water quality and volume of the river.

After starting operation of the facility, in the dry season, which is the tourist season, the operation of hydropower facilities is limited during 9:00 in the morning to 4:00 in the afternoon, in order to keep the way to discharge water to the waterfall so as not to interfere with the scenery. In the field study that was conducted, it was confirmed that the sufficient volume of water flows at the waterfall even for the dry season, and that the power generation facility, which is located upstream, was not affecting it. Additionally, No negative impact has been given to the ecological system in the downstream area and neighbor residents.

O'Romis Waterfall has become a tourist site.
Photo: April 2012

② Land Acquisition and Resettlement

No residents have been relocated, and there has been no opposition to the construction. With respect to the acquisition of sites, most of the construction sites have comprised forest land owned by the government, so there were no problems in implementing the Project, and refurbishment of sites, including the removal of trash prior to construction, has been carried out appropriately before implementing the Project.

In light of the above, this project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

Table 9 shows the outputs with respect to the Project. Changes occurred in the planning and

actual results for the following two items:

- The number of hydropower plant sites was reduced by one (the Prek Dakduer Hydropower Station).
- Power output was increased at the remaining two locations (O'Mleng and O'Romis) to assure the output specified in the planning.

Table 9: Project outputs (planned and actual)

Item	Planned	Actual
Japan side:		
1 Power generation planning		
1) Output of small-scale hydropower stations: Total a) O'Moleng Hydropower Plant b) O'Romis Hydropower Plant c) Prek Dakduer Hydropower Station	370 kW 130 kW 130 kW 110 kW	370 kW **185 kW** **185 kW** **Deleted**
2) Diesel power plant output Diesel power plants	250 kW	**300 kW**
2 Transmission line planning		
1) Medium-voltage transmission lines	Voltage: 22 kV, Extension: 33 km	Voltage: 22 kV, Extension: 33 km
2) Low-voltage transmission lines	Voltage: 400/230V, Extension: 33 km	Voltage: 400/230V, Extension: 33 km
3 Civil engineering equipment		
1) O'Moleng Hydropower Plant equipment	Pressure pipe Inner diameter 0.6－1.0 m Extension 416m	Pressure pipe Inner diameter 0.6－1.0 m Extension 416m
2) O'Romis Hydropower Plant equipment	Conduit Width 1.0 m Depth 1.2 m Extension 1,024m	Conduit Width 1.0 m Depth 1.2 m Extension 1,024m
3) Prek Dakduer Hydropower Plant equipment	Pressure pipe Inner diameter 0.6－1.0 m Extension 536m	**Deleted**
4 Hydropower generation devices		
1) O'Mleng Hydropower Plant equipment a) Hydraulic turbine Maximum water volume used Maximum output b) Generator Rated capacity Maximum rated output	 1.02 m^3/s 144 kW 180 kVA 130 kW	 **1.45 m^3/s** **200 kW** **250 kVA** **185 kW**
2) O'Romis Hydropower Plant equipment a) Hydraulic turbine Maximum water volume used Maximum output b) Generator Rated capacity Maximum rated output	 0.75 m^3/s 144 kW 180 kVA 130 kW	 **1.05 m^3/s** **200 kW** **250 kVA** **185 kW**
3) Prek Dakduer Hydropower Plant equipment a) Hydraulic turbine Maximum water volume used Maximum output b) Generator Rated capacity Maximum rated output	 1.10 m^3/s 120 kW 150 kVA 110 kW	 **Deleted**
5 Diesel generator Rated output	 250 kW	 **300 kW**
6 Administration building	189 m^2	189 m^2

7 Equipment Dolly for working at heights Pickup truck	 1 1	 1 1
Cambodia side:		
Land acquisition and lease fee Improvement and repair of existing roads, and maintenance costs Costs for removal of existing power equipment Construction cost for transmission lines to general customers Construction costs for indoor lines Cost of training local staff Cost of preparing to start operation	15 ha 20 km 1 set 1200 households 1200 households 1 set 1 set	15 ha 20 km 1 set 1200 households 1200 households (Construction for 1180 households completed in 2009 and for 1200 households in 2010) 1 set 1 set

The background behind the changes noted above, and the reasons, are described below.

Bidding on the Project was carried out in October 2006, but the lowest bid price significantly exceeded the planned price of 967 million yen, at 1,123 million yen. Subsequent price negotiations were not successful. Because of this, when consultants examined the reasons for the failed negotiations, the following were cited: (1) a construction rush in the capital city of Phnom Penh had caused an increase in construction machinery procurement costs; (2) increased demand for labor in urban areas had caused an increase in rural-area allowances for workers and technicians; (3) the prices of fuel, construction materials and other items had risen; and (4) exchange rates were fluctuating. It was found that these factors had caused significant increases in civil engineering construction costs. Also, because the scope of the increase was more than could be absorbed through competition between contractors, the implementing agency in Cambodia had made requests that involved design changes. A design policy was formulated such that, when design changes were made, the changes would not result in a smaller range of electrification, but rather would maintain the same level of power supply capability as in the basic design.

As a result, as shown in Table 9 above, it was decided to eliminate one of the hydropower plants, and to increase the power output at the remaining two locations in order to ensure the level of output specified in the planning. It was confirmed that this change did not deviate from the initial objectives of the Project, and the change was approved. However, changing the design increased the output of diesel power generation by 50 kw which incurs fuel cost (no fuel cost incurred by hydropower generation), as well as fuel prices were higher than those at the time of planning, making it necessary to add in a higher power tariff rates (about 6% higher than at the time when the Project was planned).

The changes to the Project design described above had almost no impact on indicators involving efficiency, and a rationalization plan was formulated that would reduce project

costs while at the same time maintaining the electrification range and power supply capability. The changes made were judged to have been appropriate.

3.4.2 Project Inputs

3.4.2.1 Project Cost

As for the cost provided by the Japanese government for the Project, the E/N limit was 1,066 million yen while the actual cost amounted to 1,059 million yen. Therefore, the cost at the Japanese side was lower than planned (99%).

Moreover, the amount to be borne by the Cambodian government was estimated at US$ 190,000 (approximately 21 million yen), and according to explanations made by the Cambodian side, disbursements were made as planned. It has not been possible, however, to confirm precise figures.

3.4.2.2 Project Period

The Project was planned to span a period of 22 months, but the actual implementation period was longer than planned by 132%, running 29 months, from June 2006 through November 2008.

The reason for the overrun was that, as described above, bidding conducted in October 2006 failed, and new bidding was conducted in April 2007 after changes were made to the design. Thus, the planned start of construction was delayed by around six months.

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

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

Through the soft component of the Project, conducted up until November 2008, a governing body for the Project and a Project Management Advisory Committee were established, and systems were established for the operation of the Project. Specifically, support was provided for establishing EUMP, and guidance in the operation and maintenance of power facilities was provided to 31 personnel (three managers dispatched from the Ministry of Industry, Mines and Energy (MIME), and 28 others from the local area). With respect to obtaining approvals for the electrical operation and tariff rate structure, guidance was provided through the soft component, and applications were submitted for approval of power contractors and for tariff rates. Approval was obtained from the Electricity Authority of Cambodia (EAC) in October 2008, and systems were constructed so that power supply could begin rapidly after the construction was completed.

Subsequently, EUMP's systems were strengthened as a result of the technical cooperation project "The Project of Operation and Maintenance of the Rural Electrification on Micro-hydropower in Mondul Kiri Province" that was implemented starting from December 2008, and the next two years were spent strengthening the organization, technology and systems. Moreover, EUMP was originally planned to be run as an independent organization, but on June 8, 2010 control was transferred to Electricité du Cambodia (EDC), a large-scale government corporation, and it became the Mondul Kiri branch of EDC. Most of the EUMP personnel continued to work as employees of EDC and were transferred to the new system. At that point, the EDC Keo Seima Division in Mondul Kiri Province, in which electricity had been introduced as a result of the transmission lines from Vietnam, was added to the Mondul Kiri branch of EDC, making the organization larger than originally planned (a total of 44 people).

According to interviews with employees, an extremely large percentage of the regional staff hired when EUMP was newly established remained with the organization. Furthermore, employees were highly satisfied with the work in which they were engaged, of promoting the region, and there is good teamwork among employees. According to the project planning for the EDC Mondul Kiri branch, further expansions are planned, such as the extension of the power transmission/distribution network to villages where large numbers of minorities live, at a distance from the city, as well as the acquisition of large-scale consumers. In order to maintain the current operation and maintenance systems, which are working well, it will be important to continue expanding the Project while giving consideration to the appropriate personnel scale and human resource cultivation.

3.5.2 Technical Aspects of Operation and Maintenance

As part of the soft component, manuals for civil engineering facility maintenance and power generation facility maintenance were prepared, and technical aspects relating to civil engineering facilities and electrical facilities were strengthened by means of OJT. Training was also conducted using the actual equipment, with workers operating and stopping the power plant, carrying out other operations, and confirming the plant circumstances. In this training, emphasis was placed on improving employees' skills and knowledge of electricity. Other endeavors included training in inspection records, as well as hands-on training throughout the test operation period.

Following the completion of the soft component, further strengthening of technical aspects was carried on by means of the relevant technical cooperation project, with four periodic inspections being conducted during a two-year period, and operation adjustments were made in two seasons, the rainy season and the dry season, with technology transfer being carried out by means of OJT. As a result, when the relevant technical cooperation project had ended,

employees were able to handle parallel operation of the hydropower plant and diesel plant, to start and stop the plants, to handle accidents, and to take care of other operation tasks that came up. In terms of operation and maintenance of civil engineering structures, employees were also able to discover irregularities during patrols and carry out minor repairs. Additionally, an appropriate loss rate of 10 to 12% per month for the power transmission/distribution system is currently being maintained, following the yearly decrease trend of 19.12% in 2009, 15.45% in 2010, and 9.68% in 2011. Note that loss of the power transmission/distribution system is caused by technical problems, but not by theft.

Employees have been measuring the flow rate and water level, which are fundamental to hydropower generation, have been conducting periodic inspections of various equipment, and have been carrying out daily patrols, by following the instructions in the maintenance manual. Also, when data provided by the EDC Mondul Kiri branch was confirmed, it was found that output categorized by power generation source, production volume, loss rates and other data were being updated monthly, and that the technical prowess of the employees has been maintained at the same level as when the relevant technical cooperation project ended.

Thus, as described above, personnel with the necessary technologies for maintaining the facilities constructed through the Project have been appropriately cultivated through the soft component and relevant technical cooperation project, and no problems have been observed. In interviews conducted at the EDC Mondul Kiri branch, employees had undergone comprehensive technical instruction with the aim of a firm grounding of technology from Japanese experts, and many of the employees voiced confidence that they could continue maintaining the power generation facilities in the future.

3.5.3 Financial Aspects of Operation and Maintenance

As described in Section 3.5.1 above, an independent organization EUMP was newly established through the soft component of the Project, and this organization will run the electricity part of the business. Plans were formulated to strengthen business management aspects necessary in order to manage the electricity business, along with strengthening financing aspects. Specifically, a business operation manual was prepared, employees were trained in order to boost their office skills, improvements were made to the day-to-day work, and accounting systems were put in place so that electricity fees could be collected and cash flow control could be carried out. Essentially, an infrastructure was put in place during this time for running the electrical business. Also, to give employees a chance to experience the actual collection of electricity tariff rates and to manage disbursements, onsite tests were conducted several times, and training was carried out to increase employees' proficiency at reading the meters of power users in the city, creating invoices, and collecting tariffs.

Subsequently, financing aspects were strengthened by continuing on from the relevant

technical cooperation project and creating a system through which employees on the Cambodian side could handle financial control on their own while working with the Engineering Department overseeing operation of the power generation facility, and that system is currently being maintained. Moreover, after EUMP came under the control of EDC and became the Mondul Kiri branch of EDC (June 2010), the same finance control system as that used by the EDC headquarters was promptly introduced.

The financial status of the EDC headquarters is shown here. As indicated in Table 11 below, net profits had shown a deficit until 2008, but began showing a surplus starting from 2009, and management is currently sound. Support is being provided by the Asian Development Bank, the World Bank, France and other sources to improve the financial situation of the EDC headquarters, and efforts have been underway in particular to build financial systems that include unified control of customer data, and to improve figures such as fee collection rates in areas under the jurisdiction of the capital city of Phnom Penh and power transmission/distribution loss rates, among others.

Table 11: Financial situation of EDC headquarters (Phnom Penh) (Unit: US$)

	2008	2009	2010	2011
Sales	237,541,778.46	220,822,215.06	297,351,584.14	338,446,705.80
Operating profit (pre-depreciation profit)	2,879,104.32	27,523,044.08	52,865,700.71	44,605,354.52
Operating profit (pre-tax)	(1,800,290.88)	23,163,769.42	46,242,946.36	35,925,730.68
Net profit (after taxes)	(4,203,657.60)	18,401,019.88	37,925,058.86	28,465,430.12

Note: The above financial information covers only the jurisdiction of Phnom Penh.
Source: Data provided by EDC

Table 10 below shows a revenues and expenditures report for the Mondul Kiri branch of EDC. After EUMP became the Mondul Kiri branch of EDC, accounts settlements began being done based on the same financial control system as that used at EDC headquarters.

Table 10: EDC Mondul Kiri branch 2011 revenue and expenditure report

Item	Amount (riels)	Notes
A. Revenues	**3,107,143,745**	(Approximately US$ 722,592)
(1) Sales	3,058,247,845	
General households	1,605,180,200	The information at the left shows a breakdown of sales, with revenues from households making up 52%, or approximately half of all sales. Commercial businesses accounted for 22%, hotels for 15%, and government systems for 26%. Recently, revenues from antenna devices such as mobile telephones have been increasing.
Commerce	681,762,900	
Industry	68,919,700	
Government	192,812,000	
Hotels	460,609,900	
Private business	54,843,000	
Streetlights	16,317,000	
Previous-year	-22,196,855	

Item	Amount (riels)	Notes
adjustment		
(2) Other revenues	48,895,900	
B. Expenditures	**2,419,740,669**	(Approximately US$ 562,730)
C. Operating profit (pre-depreciation profit)	**687,403,076**	(Approximately US$ 159,861)
D. Depreciation	**2,813,113,764**	(Approximately US$ 654,213)
E. Net profit	**-2,125,710,688**	(Approximately US$ -494,351)

Note: The above revenues and expenditures report does not include revenues and expenditures for the EDC KEO SEIMA Division, which was consolidated following the transfer to EDC.

According to the above report on 2011 revenues and expenditures, operating profits (pre-depreciation profits), in which B. Expenditures are subtracted from A. Revenues, indicated a total of 687,403,076 riels (approximately US$ 159,861), indicating that operation at the Mondul Kiri branch of EDC has been running smoothly since the end of the relevant technical cooperation project. Because the Project facilities were provided through grant aid, accounting is different from that of ordinary companies, but the accounting method in which depreciation costs are not included in the accounting figures but reserve funds are set aside for large-scale renovations and water shortage countermeasures was approved through mutual agreement between Japan and Cambodia at the time that the relevant technical cooperation project was implemented and was continued until 2010. Starting from 2011, however, category D in the table, Depreciation costs, was added in keeping with EDC's financial control system, and reserve funds have been identified to cover funding costs necessary for large-scale renovations that will be necessary in the future. As a result, net profits show a deficit, taking depreciation costs into consideration.

At the same time, however, as of December 2011 the customer roster of the Mondul Kiri branch included 1,444 households (electrification ratio: 80.5%), and the tariff collection rate was being maintained at 97%. The background behind this is that, as at EDC headquarters, customer data and financial data are being appropriately controlled and updated at the branch, and in particular, customers who are late with their payments are dealt with promptly, which is an effective approach for avoiding the problem of large amounts of delayed payments accumulating. Moreover, data such as the amounts of power used by each customer are categorized by month and analyzed, making it possible to accurately forecast the amount of demand for power.

In light of these circumstances, in order to accommodate future improvements in power shortages[13] and the financial situation at the Mondul Kiri branch, EDC headquarters has decided to expand the amount of power supplied by importing power from Vietnam, and has refurbished power transmission lines using its own capital. After starting the transmission of

[13] As noted on page 8, the daily maximum amount of power supplied was 618 kW in 2011, which is close to the power generation capability of the Project, at 670 kW.

power from Vietnam, EDC headquarters has already succeeded in securing new contracts with quarrying plants and in concluding contracts with large-scale, high-revenue customers.

As indicated above, the EDC headquarters is taking prompt action as an organization with respect to two issues: the deficit in net profits posted by the Mondul Kiri branch, and the insufficient amount of power being supplied. In the future, as well, it is anticipated that the net profit will turn into surplus by support provided to help the Mondul Kiri branch in terms of financial and organizational aspects. Moreover, from the end of the Project to the current point in time, the Project outcomes have been continued, and operation and maintenance of materials, as well as injections of the capital necessary to expand the business, are being implemented on an ongoing basis. Thus, it is judged that there are no obstacles in terms of the financial situation.

3.5.4 Current Status of Operation and Maintenance

The relevant technical cooperation project was implemented during the approximately 2 years since the time that the Project described here was completed, and it has been confirmed that basic operations such as power generation, power transmission and the collection of electricity tariffs have been implemented appropriately.

With respect to plans for the affiliation with Vietnam, all aspects from planning to implementation have been carried out under the auspices of EDC, and Japanese experts have provided technical transfers through follow-up cooperation after the relevant technical cooperation project; thus, a system for a methodical affiliation has been appropriately constructed. Moreover, employees from the EDC Mondul Kiri branch visited Vietnam in April 2012 in order to help stabilize the affiliation with Vietnam, and talks were carried out with personnel at power companies and power generation facilities in Vietnam. In the course of those talks, interaction between personnel and between technologies was tried by means such as tours of Vietnam's hydropower generation facilities, and a system is being put in place by which corrective action could be taken promptly in the event that a problem occurs.

In light of the above, it was decided that system operation can be implemented in the future with no problems.

As indicated above, an organizational base for operation and maintenance of the Project had been put in place through the soft component, and subsequently, the prepared organization had been strengthened into an organization that actually functions by the technical cooperation project which was implemented following the soft component. Further, the organization has expanded its business receiving support by the follow-up cooperation. Thus, it has been judged that a system appropriate for operation and maintenance of the Project has been constructed. Also, now that the system is under the jurisdiction of EDC,

financial control aspects and human resource management aspects will be strengthened, enabling growth into an organizational system that offers greater stability.

No major problems have been observed in the structural, technical or financial aspects of the maintenance of the Project, therefore sustainability of the Project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the Project was to supply a stable supply of electric energy by constructing micro-hydropower plants and auxiliary facilities in Mondul Kiri Province. This objective has been highly relevant with the development plan of Cambodia and development needs both at the time of planning and at the time of ex-post evaluation, therefore its relevance is high. The hydroelectric power facilities that were constructed has been maintained in good operating condition, and the objectives of power supply and electrification, which are indicators of effectiveness, have been achieved as planned. As a result, electricity availability in the target area has been vastly improved, with increase in the number of restaurants, guesthouses and hotels. There have also been increases in the number of people moving into the area and in the number of tourists visiting Sen Monorom, and thus, the Project has contributed to lead the entire growth of regional economy through the development of local tourist industry. Additionally, improvements have been seen in the widespread use of consumer electronics by general households and in better public services, and thus there has been a positive impact on the living condition of rural people.

With respect to maintenance of the facility, the Project provided for the foundation of an operating and maintenance system, which was fortified through the technical cooperation project afterwards. Therefore, sustainability of the 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

(1) Efforts in electricity-saving education

It has been three and a half years since it became possible to supply electric energy on a 24-hour basis, and residents have become accustomed to the convenience of electricity. At the same time, however, some households are beginning to feel a sense of burden from increased monthly electricity charges as they use larger amounts of power, and are beginning to express dissatisfaction with the unit price of electricity, which is higher than that in other provinces, as well as distrust of the readings from electricity meters. Because the trend shows that power demand by individual residences will continue to increase, it will be necessary to carry out

education in ways to reduce electricity use, targeting general households, children, and other segments of the population. When conducting this education, in addition to guidance in ways to save electricity charges and to explain the calculation method of electricity charges, which EDC is currently conducting, it will be important to provide education in the meaning of using electricity carefully. In addition to prepare personnel who deal with questions and complaints of residents, it is required to summarize the opinions, consult for getting solutions, and also build a system to feed them back to the power services.

(2) Business expansion and personnel systems

It is envisioned that the Mondul Kiri branch of EDC will be expanding its business as the regional economy in Mondul Kiri Province develops. In order to continue the appropriate operation and maintenance systems and the technical capabilities that are now evident, it will be necessary to assign personnel in a manner appropriate to the business scale, and to educate them. In particular, because the area targeted by the branch is located in a mountainous region, the burden of maintenance and customer services after power transmission lines have been extended will be larger than that in urban areas. It is hoped that adjustments will be made in terms of business expansion and increases in personnel, taking this point into consideration.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Because there are extremely few engineers and managers in Cambodia who have experience in operation and maintenance technology and in business management technology pertaining to hydropower generation, the construction of organizational systems for operating and maintaining the power generation facilities has been incorporated from the outset as a part of the soft component of the Project, and activities are being carried out as a technical cooperation project to strengthen capabilities so that the organization will function autonomously immediately after the Project is completed (from the point when the power generation plant goes into operation). A noteworthy point is that personnel from the local area who have no experience in the power sector were hired to run the power generation facility, which needs high levels of technical prowess and management capabilities. Efforts to cultivate these human resources and to strengthen their capabilities are being carried out, which has produced smooth operation of the facilities and organization so far.

This success can be attributed to the shift from the soft component to the technical cooperation project having been appropriate. First, at the stage when the soft component was implemented, a number of issues were identified having to do with improving human resource

cultivation capabilities in the various divisions (Accounting, Power Generation, Power Transmission, etc.) of the hydropower plant, and the results of those evaluations were adequately shared between personnel from Cambodia and Japan, which led to the request for and implementation of the technical cooperation project.

Furthermore, the objective of both sides, which was to supply a stable electric energy through autonomous facility management by the newly established organization, was shared not only by upper-level personnel in the organization, but throughout the organization down to the end personnel level, and the fact that every employee was aware of the objective and aware of problems was an important factor in improving the efficiency and sustainability of the Project. In interviews with personnel, many people said that they become aware that the power supply to Sen Monorom City would begin immediately after the facility went into operation, and they were aware that if the facility stopped, the power supply would stop as well, which provided a sense of crisis. Also, Japanese experts provided technical guidance while still maintaining the autonomy of the staff, and many people said that this helped change their awareness with respect to their work. Additionally, the employees experienced for themselves the extent to which the power sector improves living conditions in Sen Monorom City, and being engaged in management of the sector was another factor in heightening their motivation with respect to their work. The construction of the facility through the grant aid project and human resource cultivation through the technical cooperation project functioned as expected from the outset, making this a case in which the advantages of both schemes were put to work.

This Project will definitely serve as a reference when constructing facilities that require a certain level of technological prowess in countries like Cambodia, where human resources with the necessary technical capabilities are in short supply.

Kingdom of Cambodia

Ex-Post Evaluation of Japanese ODA Grant Aid Project

"The Project for the Rehabilitation of the Kandal Stung Irrigation System"

External Evaluator: Machi KANEKO, Earth and Human Corporation

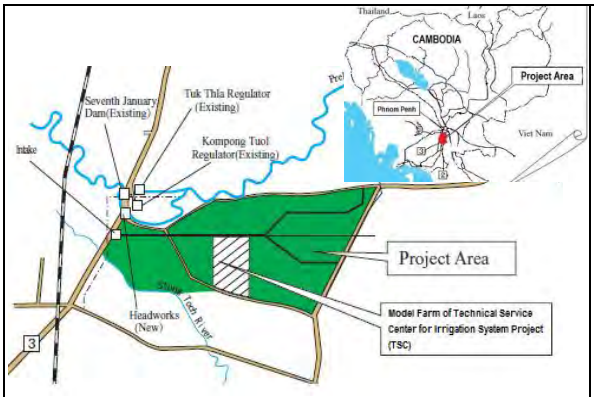
0. Summary

This project is intended to rehabilitate existing irrigation facilities in the Kandal Stung irrigated area and provide stable supply of irrigation water in the rainy season. The objective of the project is relevant with the development plan of Cambodia "community livelihood improvement through agriculture production" and its development needs. Therefore, the relevance of the project is high. The rehabilitated irrigation facilities caused the discharge of the main canal to increase, which has promoted conversion to the irrigated agriculture in the area concerned. The cropping area, yield per hectare, and farm income have almost achieved their targets to be aimed for in four years after completion, and farmers are fully satisfied with agricultural water supply.

Since the rehabilitation of secondary and tertiary canals borne by the Cambodian side was delayed, however, the efficiency of the project is low. As for maintenance of facilities, a framework of farmer's group for operation and maintenance has been organized, but further reinforcement is required for developing into an independently functioning organization. Therefore, the sustainability of the project is fair.

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

1. Project Description



Project Location

Headwork (top) and main canal (lower right) rehabilitated under this project

1.1 Background

Now that peace is being built and people are returning to a peaceful life in the Kingdom of

Cambodia (hereinafter referred to as “Cambodia”), the government of Cambodia has promoted agricultural development, thinking that development of agriculture, a key industry of the country, is required to increase national economy and reduce poverty. Especially as a part of agricultural development, Cambodia focuses on the conversion from rainfed agriculture to irrigated agriculture to improve farm income and the standard of living for accomplishment of the above goals. When the project was planned, however, 70% of existing irrigation facilities were damaged due to civil war, flood etc. and hardly fulfilled their functions.

Since the Kandal Stung irrigated area (hereinafter referred to as the “Project Area”), about 20 km southwest of Phnom Penh, has fertile soil and offers good access because of its location along National Roads No.2 and No.3, it is expected to play a role as the food supply base for Phnom Penh. The Project Area, however, has not fulfilled its function properly because of the unsatisfactory condition of the existing irrigation facilities.

Under such a situation, the Cambodian government requested the Japanese government to provide technical assistance on integrated agricultural development focused on rehabilitation of the existing irrigation facilities in the suburbs of Phnom Penh including the Project Area. In reply to this request, the Japanese government undertook the “Master Plan Study on the Integrated Agricultural and Rural Development Project in the Suburbs of Phnom Penh” from 1994 to 1995. As a result, the Kandal Stung irrigated area, the Project Area, of 1,950 ha was selected as the first priority area for development. At that time, the Project Area had the existing irrigation facilities constructed under the “Pol Pot Regime” (such as regulating gate and Pol Pot canals[1]), but they were severely deteriorated. Especially, the main canal was silted with its slopes seriously eroded. Furthermore, improper design of both gradients of canal and facilities prevented distributed irrigation water from reaching the end of fields.

Consequently the Cambodian government requested grant aid from the Japanese government for rehabilitation of regulating gates and main canal aiming at stable supply of irrigation water.

In the Project Area, a technical cooperation project, the Project for Technical Service Center for Irrigation System (TSC1) was implemented from 2001 to 2005 to develop the skill of irrigation engineers of the Ministry of Water Resources and Meteorology (MOWRAM), with a part of the irrigated area (260 ha) selected as an OJT (On-the-Job Training) model site. After that, the phase 2 of the above project (TSC2) was implemented in three provinces from 2006 to 2009. Further following TSC1 and TSC2, the Improvement Agricultural River Basin Management & Development Project (TSC3) started in six provinces in 2009 and will last

[1] Those main canal and related structures constructed under the Pol Pot Regime (in the 1970’s) are called “Pol Pot canals.” Since Pol Pot canals were arranged on a grid along latitudes and longitudes regardless of land gradient, they often function improperly; water does not reach fields with an inverse gradient.

until 2014.

1.2 Project Outline

The project is intended to rehabilitate the existing irrigation facilities (intake facilities, irrigation canals, and maintenance roads) for stable irrigation water supply in the rainy season.

Grant Limit / Actual Grant Amount	1,740 million yen / 1,709 million yen
Exchange of Notes Date	January 2005
Implementing Agency	Ministry of Water Resources and Meteorology
Project Completion Date	August 2007
Main Contractor	Konoike Construction Co., Ltd.
Main Consultant	Nippon Koei Co., Ltd.
Basic Design	December 2004
Related Projects (if any)	- Development study, "Master Plan Study on the Integrated Agricultural and Rural Development Project in the Suburbs of Phnom Penh" (1994 - 1995) - Technical cooperation project, "Project for Technical Service Center for Irrigation System" (Phase 1: 2001 – 2005, TSC1), (Phase 2: 2006 - 2009, TSC2) - Technical cooperation project, "Improvement Agricultural River Basin Management & Development Project" (2009 - 2014, TSC3)

2. Outline of the Evaluation Study

2.1 External Evaluator

Machi KANEKO, Earth and Human Corporation

2.2 Duration of Evaluation Study

The External Evaluator performed an evaluation study as follows in the course of this ex-post evaluation:

Duration of the Study: October 2011 – August 2012

Duration of the Field Study: March 26 – April 14, 2012 and May 26 – June 9, 2012

2.3 Constraints during the Evaluation Study (if any)

None.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Cambodia

When the project was planned, agriculture is the main industry in Cambodia accounting for 36% of the GDP and 70% of employment. In Cambodia's national policy of second Socio-economic Development Plan (2001-2005), "sustainable national resources management in consideration of environment" was proposed as one of the basic policies. To improve agricultural productivity, Cambodia thought it is indispensable to develop irrigation for effective use of water resources. Especially to increase productivity of rice cropping that is a key product in Cambodia, great emphasis was placed on improvement of irrigation and drainage infrastructure and development of human resources. Further the Cambodian government identified rehabilitation of old irrigation facilities and enhancement of their maintenance as a short-term policy.

As of the ex-post evaluation, the Cambodian government recognized management of water resources and irrigation as well as increase of agricultural productivity as top priority in the Rectangular Strategy announced as framework for Cambodia's national development in 2004. The measures for increased agricultural productivity and diversified production include increase of yield from existing farmlands, installation of irrigation facilities, and improvement of water management as key elements.

In the National Strategic Development Plan (2009-2013) enacted to realize the Rectangular Strategy, emphasis was still placed on development of the agriculture sector and increase of agricultural productivity. Then actual targets for expansion of irrigation area and increase of rice yield per hectare were set (irrigation area: expansion by 25,000 ha/year, rice yield per hectare: 3.83 ton/ha).

As a result, the project aiming at expansion of irrigation area and increase of rice yield per hectare by rehabilitation of irrigation facilities was relevant with the policies of the Cambodian government when it was planned. Also the project is still relevant with them as of the ex-post evaluation, judging from the fact that expansion of irrigation area and increase of rice yield per hectare remain key policies.

3.1.2 Relevance with the Development Needs of Cambodia

In Cambodia, the civil war lasting 20 years caused agricultural infrastructure such as irrigation facilities to be seriously damaged and many irrigation engineers to be lost. In consequence of this, irrigation has been developed improperly. The Project Area, Kandal

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

Stung irrigated area, was in the similar condition. Since facilities were designed and constructed in disregard of basic technical information such as topographic map and design standards, irrigation facilities suitable for this area were not provided. In most of the area, gravity irrigation was not available even in the rainy season. For this reason, agriculture in the Project Area was subject to substantially the same cultivation conditions as those under the rainfed circumstances, and limited to single cropping (cropping once a year) of local rice varieties having resistance against unstable water utilization. Few farmers having their farmlands near canals, however, could use pump for irrigated agriculture. There was a gap in income between farmers with double cropping of rice by taking in irrigation water and farmers with singe cropping of only local rice varieties. Further, since the Prek Thnot River shows a great difference in river discharge between the rainy season and dry season, the Project Area is often exposed to flood or drought risk. This fact had prevented conversion into cropping of high-yield rice varieties that require adequate water management.

Consequently, farmers in this irrigated area had no alternative to cropping of local rice varieties with low-yield (1.7 to 2.0 ton/ha), which had mainly caused low farm income.

As of the ex-post evaluation, implementation of the project had provided stable irrigation water supply necessary for the entire Kandal Stung area (1,950 ha) as well as foundation for promotion of irrigation development in the area. This allowed farmers to convert rainfed agriculture that depends only on local rice varieties (low-yield) to irrigated agriculture of IR varieties (high-yield). In this respect, the project is relevant with the development needs of Cambodia.

While the rice yield per hectare[4] (2010) has been increased to about 2.97 ton/ha due to recent rehabilitation or construction of irrigation facilities, it still remains lower than other neighbor countries such as Socialist Republic of Vietnam (about 5.32 ton/ha), Lao People's Democratic Republic (about 3.59 ton/ha), and Union of Myanmar (about 4.12 ton/ha). Reinforcement of irrigation facilities is still required.

3.1.3 Relevance with Japan's ODA Policy

In the Cambodia-specific aid plan, one of Japan's Cambodia aid policies, "realization of sustainable economic growth and stable society" is identified as an important field. This includes development of agriculture and rural communities as well as improvement of agricultural productivity. Further a policy to proactively promote grant aid for rehabilitation of irrigation facilities and improvement of water management systems is identified.

Through implementation of the project, irrigation facilities constructed under the Pol Pot Regime have been rehabilitated to provide the foundation for stable supply of irrigation water which farmers require for irrigated agriculture.

[4] Source: Food and Agriculture Organization of the United Nations (FAO).

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

3.2 Effectiveness[5] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Intake volume

This project is intended to supply irrigation water enough to introduce double cropping in the rainy season in the entire Kandal Stung irrigated area (1,950 ha) through improvement and rehabilitation of existing irrigation facilities in that area. For this objective, the amount of water resources available for this project was reviewed based on the water balance of the Prek Thnot River (including obligatory discharge outflow), and the start discharge of the main canal was set at 2.73 m^3/sec. Also since the river discharge of the Prek Thnot River is decreased during about a half month from the end of April to the beginning to May during which they prepare for early cropping, shortage of soil pudding water occurs, which is a difficult situation to introduce double cropping. To solve this situation, the storage function was improved by gate heightening the crest of the Seventh January Dam with a capability of holding an intake level as well as that of the existing regulating gates to ensure stable supply of irrigation water in the rainy season including the above half-month period.

At the ex-post evaluation, the start discharge of the main canal was kept at 2.73 m^3/sec as planned. Further the gate heightening of the Seventh January Dam and regulating gates improved the storage function as planned and produced effects that allow for steady intake when river discharge comes short during a period from the end of April to the beginning of May.

In this irrigated area, Pol Pot canals had operated as existing canals though their capability was low. Rehabilitation of the main canal caused discharge volume of those Pol Pot canals directly linked to the main canal to increase. In the interviews with farmers in this irrigated area, it was pointed that the discharge volume of existing canals was increased just after the rehabilitation of the main canal, which led to considerable increase of crop productivity.

(2) Irrigation area

At the planning stage of this project, an actual irrigation area was set as an indicator for quantitative effects, besides intake volume as described in (1). An actual irrigation area is an area of the land in which the proposed cropping pattern has been implemented, and the target area to be aimed at four years after the completion of the project is set to 800 ha. The proposed cropping pattern is based on the cropping pattern and cropping ratio (174%) both of which were proposed at the development study conducted prior to this project. In the

[5] Effectiveness should be judged in consideration of impact to determine a rating.

proposed cropping pattern, the objective is to single crop in the rainy season at 1950 ha, double crop in the rainy season at 975 ha and crop in the dry season at 468 ha in the entire irrigated area eight to ten years after the completion of the project. On the other hand, MOWRAM has collected data on cropping area in each season in the entire irrigated area, but has not identified the proposed cropping pattern as an indicator of the project objective. Thus MOWRAM was not able to determine the total area of the farmlands in which the proposed cropping pattern was implemented.

Some farmlands are not included in an actual irrigation area, though irrigated agriculture is already implemented there. Since cropping area expands in such farmlands, an actual irrigation area is not an adequate indicator for the ex-post evaluation to be conducted about three years after the completion of the project. MOWRAM has data about actual cropping area in each season (single cropping in the rainy season, double cropping in the rainy season, and cropping in the dry season), as shown in Table 2 below. The latest cropping areas are 1,593 ha for single cropping in the rainy season, 339 ha for double cropping in the rainy season and 294 ha for cropping in the dry season, and a total cropping area is 2,226 ha. This indicates the irrigation facilities constructed under this project operate as planned to allow for stable intake and supply of irrigation water, which has increased the cropping area in each season to the current level.

Further, some farmers triple crop rice (cropping three times a year), though the number of such farmers is still small. The trial of triple cropping is being made in farmlands in which access to water is available in the dry season with attention to the water volume of the main canal. The following <Reference Information> and Table 5 (page 12) show the features of each season. Now farmers in the Project Area can decide the number of cropping, cropping season and rice variety for themselves considering conditions of water supply to their farmlands and manpower and crop based on their decision. For example, a farmer who mainly depends on farm income for living selects a high-yield rice variety of early growing type to double crop while a farmer who earns wage income other than farm income selects a rice variety with a high unit sale price to single crop. Such diversified livelihoods of farmers are attributed to expansion of the irrigation area where irrigation water is stability supplied. This also contributes to the stabilization of farmer income throughout the year.

Table 2: Cropping state by season in each commune (May 2011 – April 2012)

(Unit: ha)

Commune name	Possible irrigation area based on secondary and tertiary canals	Single cropping in the rainy season		Double cropping in the rainy season	Cropping in the dry season	Total cropping area
		Mid-growing varieties (high-yield)	Local varieties	IR varieties (high-yield)		
1) Preah Putth	390	100	290	65	52	507
2) Tien	208	110	98	87	78	373
3) Rolous	153	70	83	40	70	263
4) Barku	380	150	230	50	-	430
5) Kong Noy	224	80	144	50	70	344
6) Anlong Romiet	22	12	10	2	-	24
7) Kork Trab	168	120	48	30	14	212
8) Siem Reap	48	30	18	15	10	73
Total	1,593	672	921	339	294	2,226

Source: Information provided by MOWRAM

(Reference Information)

Type	Period	Cropping state	Remarks
Single cropping in the rainy season	Jun to Nov	In this season, there are much rainfall and river discharge and the canal water level rises to the maximum. Water management is easy because the period with less rainfall corresponds to the harvest time.	 This photo was taken in May 2012. From the front, you can see paddy fields just after soil pudding, paddy fields after the first time of the double cropping in the rainy season, and paddy fields before the harvest of the cropping in the dry season. In this season, the project is very effective, because river discharge is decreasing while more irrigation water is required. The data also show each farmer has come to be able to select a desired cropping timing, number of cropping, and rice variety based on his/her life style pattern.
Double cropping in the rainy season	Apr to Jul Aug to Dec	To double crop in the rainy season, cropping has to start around April. At this time, however, soil pudding can be done only in lands for which water is secured from canals.	
Cropping in the dry season	Jan to Apr	In the dry season, cropping is available only in lands for which water is secured with pump from the main canal and/or secondary canals. Vegetable farming is also done.	

Under this project, the rehabilitation of secondary and tertiary canals was originally planned at the Cambodia side in parallel with the rehabilitation work by the Japanese side, but its completion was delayed until 2011. This caused the expansion of the irrigation area based on the rehabilitated secondary and tertiary canals to 1,593 ha as shown in Table 2 to be delayed to 2011[6]. As described above, however, the existing canals called Pol Pot canals in the Project Area distributed water from the main

Tertiary canal rehabilitated by Cambodia side

[6] According to MOWRAM, further rehabilitation of canals and aids for farmers are planned to achieve expansion of the irrigation area to 1,700 ha (in 2012), 1,800 ha (in 2013), 1,900 ha (in 2014), and 1,950 ha (in 2015).

canal to farmlands to the right or left of the main canal. Then farmers utilized such water for pump irrigation. Besides, an NGO implemented minor rehabilitation of existing canals in some places. As a result, the condition of existing canals had become better compared to that when the project was planned, which partially contributed to prompt supply of irrigation water.

The area for double cropping in the rainy season is rather slowly expanded due to the delay of the rehabilitation work at the Cambodia side, but this does not become a major obstacle because the area for single cropping in the rainy season has been largely expanded. Though neither the executing agency nor the District Agriculture Office has collected data about the cropping area before 2011, the change of rice production amounts as shown in Table 3 supports the effectiveness of this project. When compared between the original planning time (2001 to 2002) and the completion time of the main canal under this project (2008), rice cropping amount grew by 150%. After that it continued to grow and almost doubled in 2011. Since anxiety about unsteady water condition was alleviated, more farmers have chosen cropping of high-yield rice varieties that require adequate water management and productivity has been considerably increased.

Consequently, the irrigation area for which irrigation water is stability supplied has been expanded as planned since the completion of the project, and this clearly resulted in increase of productivity.

Table 3: Change of the rice cropping amounts in the Project Area (Unit: ton)

Commune name	2001-2002	2008	2009	2010	2011
1) Preah Putth	628	1350	1565	1593	1593
2) Tien	475	624	910	1015	1033
3) Rolous	420	459	544	513	676
4) Barku	530	1376	1505	1720	1720
5) Kong Noy	227	672	750	838	959
6) Anlong Romiet	366	72	77	84	84
7) Kork Trab	834	678	791	693	693
8) Siem Reap	-	189	202	221	221
Total	3480	5420	6344	6676	6977
(Increase ratio compared to 2001-02)	-	(156%)	(182%)	(192%)	(200%)

Source: Information provided by MOWRAM

3.2.2 Qualitative Effects

As qualitative effects of the project, it is assumed that stable supply of irrigation water is secured through rehabilitation of major irrigation facilities and 40% or more of the farmers in the Project Area convert from rainfed agriculture to irrigated agriculture.

At the planning stage of the project, most farmers in the Kandal Stung irrigated area farmed depending on rain water. To introduce double cropping in this irrigated area, a problem is that irrigation water has to be secured during the period from the end of April to the beginning of May. Figure 1 shown right illustrates the months in which irrigation water shortage occurred in 2011 based on the results of the beneficiary survey[7]. According to this figure, almost half of the respondents answered "shortage occurred" in February and March (the dry season), but its ratio decreases in April and May, the months in question. This implies conversion from rainfed agriculture to irrigated agriculture progresses smoothly.

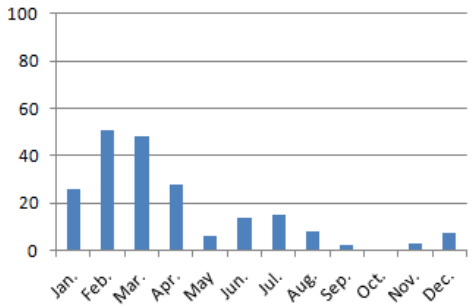


Figure 1: Months when irrigation water shortage occurred (in 2011)
Source: Current beneficiary survey

Also through the implementation of this project, as described in the section 3.2.1, the increased discharge of the main canal allows for irrigated agriculture in about 80% of the entire Project Area (1,593 ha). This can be confirmed from the results of the beneficiary survey. As shown in Figure 2, 97% of the respondents answered irrigation water has "increased" compared to five years ago. Also Figure 3 shows 88% of the respondents are satisfied with water level in canals and 78% are satisfied with the distance to canals.

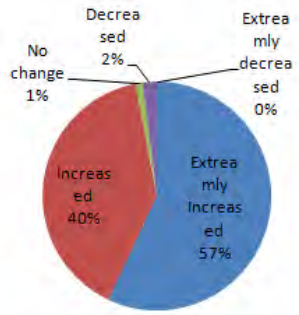


Figure 2: Increase/decrease of irrigation water compared to 5 years ago
Source: Current beneficiary survey

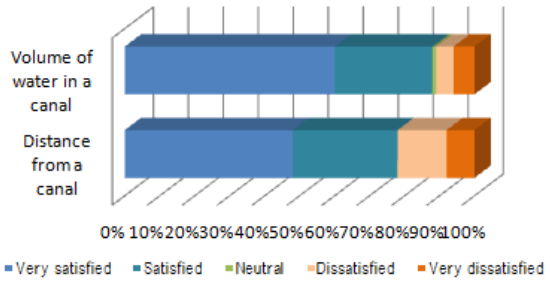


Figure 3: Satisfaction level with the water volume in canals and distance to canals
Source: Current beneficiary survey

[7] The beneficiary survey was conducted in the Kandal Stung irrigated area in May 2012. In consideration of farmer population scale and distance to the main canal, Tien commune, Barku commune, Kong Noy commune, and Kork Trab commune (separated into inside TSC model site and outside TSC model site) were identified as survey target. On condition that each household questioned has farmed for eight years or longer (since 2004), 20 households in each of the five communes, a total of 100 households were selected. The number of samples was set to 100 according to the ex-post evaluation guide line.

3.3 Impact

3.3.1 Intended Impacts

Table 4 below lists expected indirect effects of this project.

(1) Realization of irrigated agriculture in the Project Area (1,950 ha): As of April 2012, four years after completion of the construction, the area for single cropping in the rainy season was 1,593 ha, meaning achievement rate of 82% compared to the target value to be aimed at eight to ten years after completion of the construction (1,950 ha), and has been favorably increased. (2) Realization of double cropping in the rainy season: Though the area for double cropping in the rainy season was 100 ha to 200 ha before the start of the project, it has almost doubled and currently reaches 339 ha. (3) Increase of productivity (yield per ha): Both IR varieties and local varieties almost satisfy their targets, which means cropping based on the water conditions of farmlands and advantageous features of each rice variety has been achieved.

Expansion of the cropping area and increase of yield per hectare also contribute to (4) increase of farm income, as shown in Tables 4 and 5. In either cropping pattern, the yield per hectare exceeded the target value of 418US$/ha. Further according to the results of the beneficiary survey as shown in Table 4, as a reason for increased income many households mentioned “duration of water availability increased”, “increase in rice crop yield per ha”, and “practice double cropping” and have actually felt the effects of the project.

Table 4: Indirect Effect Indicators of This Project

Expected indirect effects	Target Value	Actual value (May 2011 to April 2012)
(1) Realization of irrigated agriculture (double cropping in the rainy season, single cropping of local mid-/late-growing varieties, farming irrigation) in the Project Area (1,950 ha)	(8 to 10 years after completion of the construction) Single cropping in the rainy season: 1,950 ha (local mid-/late-growing varieties) Double cropping in the rainy season: 975 ha Cropping in the dry season: 468 ha	(4 years after completion of the construction) Single cropping in the rainy season: 1,593 ha (mid-growing variety: 672 ha, local variety: 921 ha) Double cropping in the rainy season: 339 ha Cropping in the dry season: 294 ha
(2) Realization of double rice cropping in the rainy season (April to the middle of December)	(8 to 10 years after completion of the construction) Crop intensity: 174% (where double cropping in the rainy season: 975 ha)	(4 years after completion of the construction) Crop intensity: - (where double cropping in the rainy season: 339 ha)
(3) Increase of productivity (yield her ha) Local variety IR variety	(4 years after completion of the construction) 3 t/ha 4 t/ha	(4 years after completion of the construction) 3.5 t/ha 3.6 t/ha
(4) Implementation of cropping in the dry season and increase of farm income (net profit)	(4 years after completion of the construction) 418 US$/ha	(4 years after completion of the construction) Double cropping in the rainy season: 762 US$/ha Single cropping of middle-growing variety: 635 US$/ha Single cropping of local variety: 529 US$/ha

Table 5: Yield per hectare, and gross and net profits per ha in the Project Area

	Yield per ha (ton/ha)	Unit sale price (Riel/ton)	Gross profit (Riel/ha)	Net profit (Riel/ha)	Features of each variety
Double cropping in the rainy season (IR HYV)	3.60	700,000	2,520,000×2 = 5,040,000	3,276,000 (762 US$)	IR variety HYV: Early-growing type, suitable for double cropping in the rainy season because of its short growing period (3 to 4 months). If sufficient water is not secured, however, yield will be considerably decreased.
Single cropping of middle-growing variety (HYV)	3.50	1,200,000	4,200,000	2,730,000 (635 US$)	Middle-growing variety HYV: High-yield variety, a longer growing period (4 to 6 months), and a high sale price because of its good smell and taste.
Single cropping of local variety	3.50	1,000,000	3,500,000	2,275,000 (529 US$)	Local rice variety: A longer growing period (4 to 6 months) and a high sale price because of its good smell and taste. Many farmers grow this rice variety for personal consumption.

Source: Yield per hectare and unit sale prices are based on the information provided by MOWRAM, and features of each variety are based on the information provided by MOWRAM and the hearing from farmers
Note: Net profits are calculated with the same method as in B/D (net profit = gross profit×65% (production cost)).

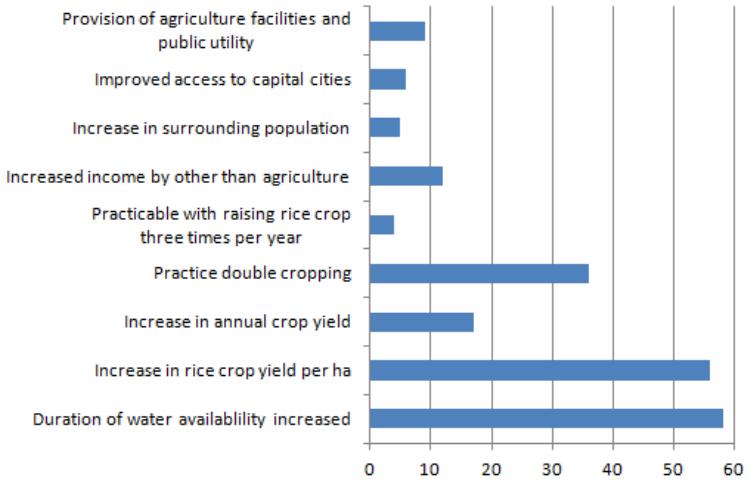


Figure 4: Reason for increase of income (multiple answers allowed)
Source: Current beneficiary survey

3.3.2 Other Impacts

1. Impacts on the Natural Environment

According to the Law on Environmental Protection and Natural Resources Management and the Sub-decree on the Environmental Impact Assessment (EIA) Process in Cambodia, EIA should be carried out for any irrigation project with its developing area exceeding 5,000 ha. This project is not subject to EIA because its objective is rehabilitation of existing facilities and the irrigation area is limited to 1,950 ha. No special mitigation scheme is designed because the construction stage does not include any work affecting the environment.

On the other hand, the District Agriculture Office has provided farmers with instructions (including signs) on use of pesticide and manure after completion of the construction. When rehabilitating secondary and tertiary canals, the Cambodian government also rehabilitated drainage canals as an effort for environmental conservation in the Project Area.

2. Land Acquisition and Resettlement

The facilities rehabilitated by the Japanese side have not caused a land acquisition or resettlement problem.

For rehabilitation work by Cambodia, some lands were acquired though no resettlement was necessary. Specifically, when expanding the width of secondary and tertiary canals (total expansion of 39km) for their rehabilitation, farmlands necessary for the construction were provided by farmers. Based on the result of consultation with the commune, the lands were acquired with land cost in line with the standards established by the government. The total cost of land acquisition is 2,409,988 US$ (about 196 million yen).

In light of the above, this project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ①)

3.4.1 Project Outputs

As shown in Table 6 below, two changes have been made in the outputs at the Japanese side. However, there is no change in major facilities and the corporation scale remains unchanged.

As for outputs at the Cambodian side, the rehabilitation of secondary and tertiary canals was largely delayed. This is because the Ministry of Economic and Finance did not give priority to contribution of the counterpart fund to this project and it took a long time to obtain the budget approval. Further the establishment of the Farmer Water User Community was also delayed due to the delayed rehabilitation of secondary and tertiary canals.

Table 6: Outputs of This Project

Item	Basic Design (B/D)	Output
Japanese side: 1) Headwork (a) Weir type (b) Weir width (c) Weir height (d) Floodway gate (e) Sluiceway gate (f) Flow equalization gate (g) Road bridge (h) Other related facilities	 1 site - Movable weir (all gates) - 50.0m - 4.8m - 3 gates, steel roller gate, motor-driven - 1 gate, steel slide gate, manual - 1 gate, steel slide gate, manual - Road bridge (National Road No. 3) x 1 (simple steel beam bridge, total effective span length 50m) - Control building, Electric generator building x 1	No change from B/D

Item	Basic Design (B/D)	Output
2) Rehabilitation of existing weirs and regulating gates		
2)-1 Seventh January Dam	- 213m	No change from B/D
(a) Weir width	- 0.55m, over-flow weir crest height: EL.11.80m	
(b) Gate heightening height		
(c) Sheet pile	- Continuous impermeable wall of steel sheet piles L=4.0m×610 sheets	
2)-2 Tuk Thla regulating gates		No change from B/D
(a) Gate heightening of the existing gates	- 25 gates	
(b) Gate heightening height	- 0.4m, gate crest height: EL.11.80m	
(c) Sheet pile	- Continuous impermeable wall of steel sheet piles L=4.0m×120 sheets	
2)-3 Deum Russ regulating gates		No change from B/D
(a) Gate heightening of the existing gates	- 3 gates	
(b) Gate heightening height	- 0.2m, gate crest height: EL.11.80m	
2)-4 Kompong Tuol regulating gates		No change from B/D
(a) Gate demolishment	- 1 site	
(b) Road pavement	- 320m^2	
3) Rehabilitation of irrigation facilities		
3)-1 Irrigation canals		No change from B/D
(a) Planned length	- 5.3km	
(b) Canal type	- Concrete block lining for both slopes with earth lining	
3)-2 Rehabilitation of intakes	- 1 site	- No change
3)-3 Turnout	- 26 sites	- **26 sites→24 sites**
3)-4 Water level regulating gate	- 2 sites	- No change
	- 8 sites	- No change
3)-5 Canal crossing work	- 6 sites	- **6 sites→7 sites**
3)-6 outlet work	- Rehabilitation of roads along the main canal of 5.3km (width: 5.5m) and roads along the secondary canals of 9.3km (width: 4.5m)	- No change * The above two changes were made upon the request from the Cambodian side.
3)-7 Maintenance roads		
Cambodian side: Items to be undertaken for implementation of this Project at the Japanese side	1) Paperwork necessary for the grant aid project 2) Land acquisition 3) Investigation/disposal of bombs (including mines) 4) Establishment and management of the MOWRAM maintenance office 5) Formation of intake rule at the Roleang Chrey regulating gate	The items shown left have been properly carried out.
Rehabilitation of secondary and tertiary canals	Implementation of rehabilitation of secondary and tertiary canals (Detailed design, construction, and land acquisition were conducted in parallel with grant aid project)	Secondary canals: 21,392m Tertiary canals: 17,749m Drainage canals: 12,100m The above works from design to construction were conducted by TSC trainees (irrigation engineers) at the Cambodian side and completed in 2011. The successful implementation of secondary and tertiary canal rehabilitation attributed to TSC Japanese specialists' efforts to the Cambodian side. Information about design and construction are shared with TSC3 Japanese specialists and technical support has been provided as necessary.
Establishment of Farmer Water User Community	Establishment and training of Farmer Water User Community that is responsible for maintenance at related structures	Farmer Water User Community was established in April 2011 and registered in August 2011.

3.4.2 Project Inputs

3.4.2.1 Project Cost

As for the cost provided by the Japanese government for this project, the E/N limit was 1,740 million yen while the grand amounted to 1,709 million yen. Therefore, the cost at the Japanese side was lower than planned (98%).

As for the cost provided by the Cambodian government, on the other hand, it was estimated at 957,200US$ (about 105.8 million yen) at the basic design study assuming that the counterpart fund would be utilized, but actually amounted to 6,295,171 US$ (about 512 million yen). Therefore, the cost at the Cambodian side was significantly higher than planned (483%).

The increase of the project cost at the Cambodian side was mainly caused by rising prices[8] due to the delay of the project start; land price, cost associated with bombs and mine, labor cost, and construction cost were all largely increased. Especially as for land acquisition cost, the land price of the Project Area was sharply increased because Kandal Stung is in the suburbs of the capital of Cambodia, and the Cambodian government had to buy lands they had originally expected to be donated by farmers.

Further, the considerable increase of the project cost partially caused further delay of the budget approval for the counterpart fund at the Cambodian side, which, in turn, resulted in the elongated project period. It should be noted that the designed project cost at the Cambodian side is the cost estimated at the basic design study, but not that estimated at the detailed design study.

3.4.2.2 Project Period

Though the project period at the Japanese side had been expected to be 33 months, it was actually 32 months (January 2005 to August 2007). Therefore, the project period at the Japanese side was shorter than planned (97%).

At the Cambodian side, the project period had been expected to be 33 months just like the Japanese side. However, the project did not start until 2010, which, in turn, delayed the completion of the project to December 2011. As a result, the period was increased to 84 months (January 2005 to December 2011). Therefore the project period at the Cambodian side was significantly longer than planned (255%). The reason for the delayed start of the project is late budget approval for counterpart fund at the Cambodian side, as described above.

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[8] According to World Economic Outlook Database (April 2012) provided by International Monetary Fund (IMF), the consumer price index (CPI) at the time of planning (2005) was 86.89 while the index at the time of project implementation (2011) was 145.03, which shows good economic growth during the period. Note that the calculation here is based on CPI in the period from October through December 2006 as 100.

Although the project cost/project period at Japan's side was within the plan, that at the Cambodia's side significantly exceeded the plan. Therefore the efficiency of the project is low.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

Table 7: Training conducted by TSC
(total number of trainees)

Target	TSC2	TSC3	Total
Kandal province office	46	33	79
(where engineers in charge of daily inspection)	(18)	(12)	(30)

Source: Information provided by TSC3

The irrigation facilities constructed under the project shall be operated and managed by the control of the Ministry of Water Resource and Meteorology (MOWRAM). Actually engineers of MOWRAM as well as its Kandal Provincial Department of Water Resourced and Meteorology (PDA) are responsible for the operation and maintenance of these irrigation facilities. Through the technical cooperation projects (TSC2 and TSC3), these MOWRAM and PDA engineers have improved their technical abilities, which contributes to the establishment and reinforcement of the operation and maintenance scheme. Table 7 above shows the number of engineers receiving TSC training.

In PDA at Kandal Stung district, the Project Operation and Maintenance Office was established to which eight members are currently assigned. Though the original plan assumed that staff would be dispatched from the Ministry of Agriculture, Forestry and Fisheries to diffuse agriculture, no one has been assigned yet at the current point in time. Thus a current issue is that no system is available for giving agricultural training to farmers.

To solve such a situation, with collaboration between TSC3 and the technical cooperation project called "Agricultural Productivity Promotion Project in West Tonle Sap (APPP)" (from October 2010 to March 2015), a plan to bring Kandal PDA staff in APPP-conducted training[9] is in progress so as to diffuse farming technology APPP has to Kandal province. Since APPP designates the Ministry of Agriculture, Forestry and Fisheries as the counterpart, it is expected to take this opportunity to reinforce the collaboration with the ministry.

The establishment of the Farmer Water User Community (FWUC), which shall maintain secondary canals, tertiary canals and related structures, was behind schedule. In 2010, however, eight beneficiary Farmer Water User Groups (FWUG) were formed according to the 8-step procedure for FWUC organization stipulated in the Guideline for Participatory Irrigation Management Development (PIMD) in Cambodia (published in June 2000), as shown in Table 8. Then FWUC was established in April 2011, and registered as corporation in August 2011. And TSC2 and TSC3 were conducted to provide technical support for the

[9] The training is scheduled from July to October 2012. Two PDA members will receive 5-week training (5 sessions) in total. After training, they will cooperate with diffusing members from the District Agriculture Office to diffuse farming technology in the Project Area.

establishment of FWUC and FWUG.

Trainings associated with water management and maintenance of canals have been conducted for FWUC according to the budget and activity plans designed by MOWRAM. At present, 57 key members from FWUC and FWUG are receiving training and instructions about the role of farmers using irrigation facilities. According to the beneficiary survey, 97% of the households know the existence of FWUC. This means the canal organization is becoming well-known.

Table 8 below shows the actual state of each commune (= FWUG) comprising FWUC. Reinforcement of the organization for committing maintenance activities of secondary and tertiary canals to farmers still stays at an early stage. According to the beneficiary survey, about 30% of farmers thought payment of irrigation service fee was “not so necessary.” To raise farmers’ awareness of irrigation service fee payment and grow FWUC into an independently functioning organization, MOWRAM should continue to take careful actions under the medium-term plan in the future. (Irrigation service fee payment is further described in the section 3.5.3 below.)

Table 8: Actual State of FWUCs established in the Kandal Stung Project Area

FWUG Number	Commune name	Number of households	Number of FWUG’s key members	Number of villages in the Project Area (number of villages in the commune)
1	Along Romiet	48	6	2 villages (6 villages)
2	Kork Trab	381	10	4 villages (9 villages)
3	Preah Putth	485	12	5 villages (5 villages)
4	Rolous	603	8	3 villages (4 villages)
5	Tien	284	6	2 villages (5 villages)
6	Kong Noy	351	10	5 villages (5 villages)
7	Barku	725	12	5 villages (7 villages) The first FWUC chairman was elected from FWUG7.
8	Siem Reap	86	4	1 village (7 villages)
Total		2963	68	27 villages (48 villages)

Source: Information provided by MOWRAM

* FWUG7 is a commune where the TSC model site is located.

3.5.2 Technical Aspects of Operation and Maintenance

Through implementation of technical cooperation projects (TSC1, TSC2, and TSC3), support for establishment of Technical Service Centers for irrigation system (TSC), preparation of documents and manuals concerning the improvement of fields, training for irrigation engineers of MOWRAM and PDA in Kandal province, and support/instruction for construction of canals and related facilities within the model site (260 ha) located in the Project Area (1,950 ha) have been implemented. As a result, MOWRAM, TSC, and PDA engineers have acquired enough technical ability to maintain irrigation facilities constructed under the project including headwork, regulating gate, weir, and the main canal. During the

field study, the External Evaluator checked the records of daily inspection conducted at each facility as well as observation data including water level and discharge and concluded that data have been accumulated since the construction of irrigation facilities and adequate technique has been acquired.

At the field level, irrigation engineers at the Cambodian site have almost acquired necessary knowledge and technology about irrigation project. The design, estimation, and construction works of secondary and tertiary canals that Cambodian side was obliged to do have been implemented mainly by MOWRAM. Also through OJT at the TSC model site, MOWRAM irrigation engineers have acquired public participatory technique for rehabilitation of end canals directly irrigating farmlands.

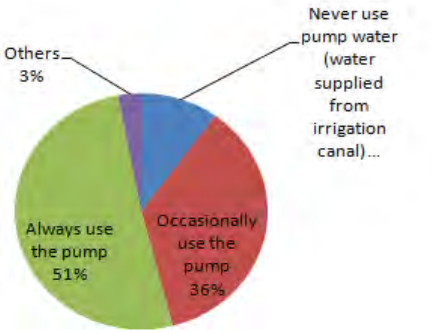

Figure 5: Current state of access to irrigation water
Source: Current beneficiary survey

Figure 5 shown right indicates the current state of access to irrigation water. According to the figure, only a limited number of farmers can obtain irrigation water directly from canals into their farmlands, and most farmers use pumps for irrigation. Since a pump requires extra cost including fuel, its use should be preferably minimized to reduce rice production cost. An effective solution for this is rehabilitation of end canals. As described above, the technique required for rehabilitation of end canals has been already transferred to the Cambodian side. A current issue, however, is that such technique has not been diffused beyond the TSC model site because of limited budget. In the TSC model site, end canals have been already rehabilitated in cooperation of local residents. The prevalence rate of double cropping in the model site is around 60% to 70%, which corresponds to almost half of the area for double cropping in the rainy season (339 ha) described above. At the planning stage of the project, the TSC model site was expected to play a role as representing field of double cropping in the rainy season. As end canals outside the model site are being rehabilitated, an opportunity to present the actual procedure of double cropping in the rainy season is expected to increase.

End canals (delivery canals) in the irrigated area (this canals can deliver irrigation water directly into the paddy field.)

Under such a circumstance, MOWRAM and PDA engineers receiving training through TSC started rehabilitation of end canals with the aid of local farmers as a part of the TSC3 project in April 2012. Further rehabilitation will be carried out in an area near the model site in FY 2012 and continued in an area of up to 450 ha every

year. The rehabilitation in the entire Project Area will be completed in three years. Lending of heavy equipment necessary for construction, their fuel cost, and labor cost of farmers (3$ per man per day) shall be borne by the project.

In the future, it is expected that promoted cooperation among farmers and transfer of technology will lead to the reinforcement of the organization for the entire Project Area.

3.5.3 Financial Aspects of Operation and Maintenance

The maintenance cost for main facilities constructed under the project as well as operation and maintenance cost for the project operation and maintenance office have been borne by NOWRAM as planned, and the budget has been properly arranged as shown in Table 9. During the field inspection, the External Evaluator checked each facility constructed under the project and found that repair work for which the Cambodian side was responsible had been properly conducted and no part was left damaged. Therefore the necessary maintenance budget is secured and used for the work at site.

Table 9: Annual maintenance cost borne by MOWRAM

	Operation and maintenance cost (US$)			
	2008	2009	2010	2011
Labor cost	7,200	7,200	9,600	9,600
Maintenance cost	12,000	12,600	13,600	14,000
Total	19,200	19,200	23,200	23,600

Source: Information provided by MOWRAM

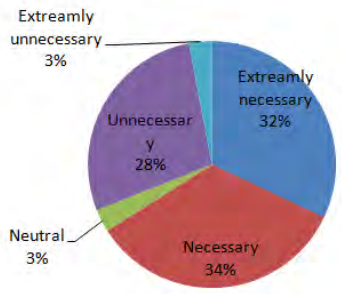

Figure 6: Necessity of irrigation service fee payment
Source: Current beneficiary survey

The maintenance cost for the main, secondary, and tertiary canals are currently borne by MOWRAM and it is clearly decided that this cost will be borne by NOWRAM until FWUC becomes an independently functioning organization. MOWRAM has also budgeted for reinforcement of FWUC and completed the establishment of FWUC, creation of draft community rules, and training of leaders so far. Figure 6 shows the result of the beneficiary survey concerning necessity of irrigation service fee payment. According to the survey, 66% of the respondents answered “necessary” while about 30% answered “not so necessary” or “not necessary at all”. Now, resident training including approach to such negative residents should be planned. Since the training budgets of the next and subsequent years are uncertain, a medium-term budget plan should be devised to secure adequate budget.

On the other hand, MOWRAM explains that it has collected irrigation service fee with great attention because people are liable to sensitively react to fee collection by the government due to influences of civil war and others. Thus the government should devise a scheme for collecting irrigation service fee while paying special attention so that people do not have any distrust. A successful example of irrigation service fee collection can be found in

the irrigation project in Takeo province. In this province, MOWRAM, in cooperation with the local administration (village head), started to collect irrigation service fee three years after the establishment of the organization, and then devised a scheme with which FWUC mainly conducted the maintenance of irrigation facilities with the collected irrigation service fees five years after the establishment. Now they can successfully manage the scheme. Further they decided a unit price of the irrigation service fee, which they thought the most important in devising the scheme to collect irrigation service fee, as well as collection method (payment in kind or by cash) in consideration of opinions of local residents.

Draft unit prices of irrigation service fee for this project are proposed in the Farmer Water User Community Regulation[10]. As the organization is developing, however, proper prices are to be decided through full discussion with farmers.

3.5.4 Current Status of Operation and Maintenance

The headwork, regulating gates, and weirs have been properly operated and maintained according to the operation manual, and no special trouble has occurred. The maintenance roads have been repaired as necessary, and properly maintained.

The main canal has a trouble; the concrete block lining of the slopes of the canal is uplifted and partially changed. (In the main canal, many cracks were discovered on the concrete block 3km upstream at the defect inspection, and repaired by the Japanese constructor.) It is thought this has been caused by the special soil texture behind the lining. Then, the field study by the Japanese and Cambodian sides has reached a conclusion that the main canal can function as irrigation canal even if the cement concrete lining panel is partially damaged and it is being considered that the executing agency will properly operate with the routine maintenance of the main canal in the future. Once the executing agency takes the responsibility for maintenance, MOWRAM will be technically prepared because MOWRAM has irrigation engineers who have received TSC trainings and been engaged in similar works. The External Evaluator also asked MOWRAM about the annual budget plan for the subsequent years and found the maintenance cost including the slope repair work was budgeted for 19,325US$ in total (of which 4,900US$ is for the main canal). Therefore MOWRAM will be financially prepared as long as damage scale is as same as before.

Though the Cambodian government intends farmers to play a main role in rehabilitation of secondary, tertiary, and end canals, MOWRAM is responsible for maintenance of secondary and tertiary canals at present. End canals have been properly maintained by farmers once these canals were rehabilitated in farmlands, as shown in the photo in page 18.

According to the beneficiary survey, only about 20% of farmers have been engaged in

[10] According to the Farmer Water User Community Regulation, draft unit prices are (1) 40,000 Riel (9.3US$)/ha per time for direct irrigation from end canals, (2) 20,000 Riel (4.7US$)/ha per time for direct irrigation from end canals + pumping, and (3) 10,000 Riel (2.3US$)/ha per time for pumping.

repair or clearing of canals. To help farmers operate and maintain secondary and tertiary canals rehabilitated by the Cambodian side as well as end canals to be rehabilitated with the aid of TSC3 in future, the Farmer Water User Community (FWUC) should be reinforced. For this reason, MOWRAM has already given FWUC leader trainings concerning water management and maintenance of canals as described above, and budgeted for the FWUC development cost for nine months in 2012. From the experience of the irrigation project conducted in the other province by MOWRAM, it is learned that an organization will start to function about three years after its establishment. Based on the experience of other projects, development of a resident organization with due care is expected.

Some problems have been observed in terms of the current structural/technical/financial aspects, therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is intended to rehabilitate existing irrigation facilities in the Kandal Stung irrigated area and provide stable supply of irrigation water in the rainy season. The objective of the project is relevant with the development plan of Cambodia “community livelihood improvement through agriculture production” and its development needs. Therefore, the relevance of the project is high. The rehabilitated irrigation facilities caused the discharge of the main canal to increase, which has promoted conversion to the irrigated agriculture in the area concerned. The cropping area, yield per hectare, and farm income have almost achieved their targets to be aimed for in four years after completion, and farmers are fully satisfied with agricultural water supply.

Since the rehabilitation of secondary and tertiary canals borne by the Cambodian side was delayed, however, the efficiency of the project is low. As for maintenance of facilities, a framework of farmer’s group for operation and maintenance has been organized, but further reinforcement is required for developing into an independently functioning organization. Therefore, the sustainability of the project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- For promotion of double cropping in the irrigated area, training about farming technology should be properly given to farmers. Therefore, further cooperation between the Ministry of Water Resource and Meteorology and the Ministry of Agriculture, Forestry and Fisheries is required.

- To develop the current Farmer Water User Community (FWUC) and Farmer Water User Group (FWUG) into independently functioning agriculture organizations, continuous support and instruction should be given to farmers. Therefore, a medium-term budget/action plan should be created and carried out.
- In the irrigated area, some farmers have farmlands with good access to irrigation water and others have farmlands with poor access to it. An elaborate scheme to collect irrigation service fee should be devised so as not to grow inequality within the irrigated area.

4.2.2 Recommendations to JICA

- The effect of the project will be maximized when reinforcement of the Farmer Water User Community by MOWRAM and rehabilitation of end canals by TSC3 are completed. Therefore, it is important for JICA to continuously monitor activities at the Cambodian side and provide support as necessary for the maximum effect of the project.

4.3 Lessons Learned

- Though the original plan assumed use of the counterpart fund as project cost to be borne by the Cambodian side, the project was largely behind the schedule from the start to the end of the construction due to delay of the budget approval by the Ministry of Economic and Finance. If a budget depending on the decision of the counterpart country such as counterpart fund is assumed as a project cost, the circumstances of the parties concerned including the Ministry of Economic and Finance should be thoroughly confirmed.
- In planning the project, an “actual irrigation area” was set as an indicator for quantitative effectiveness. An actual irrigation area represents a total area of lands in which the “proposed cropping system” is introduced, but its measurement involved great difficulty at the ex-post evaluation stage. This was partly because the proposed cropping system has not been shared with the Cambodian government, nor regarded as an indicator for the ex-post evaluation. Further, since the executing agency in charge of operation and maintenance of facilities was not required to record this data during normal daily operation, it was difficult to observe the data change over the past years and to grasp the current state. As for quantitative effectiveness, an agreement about an indicator monitoring plan should be made with the counterpart government, and further an indicator should be preferably selected among those data to be recorded during normal daily operation where appropriate so as to lessen the burdens imposed on the executing agency and related departments.

Republic of Ghana

Ex-Post Evaluation of Japanese ODA Grant Aid Project

The Project for Rural Electrification

External Evaluator: Jun Totsukawa, Sano Planning Co., Ltd,

0. Summary

This project aimed to improve basic living standards in areas without electricity such as the Upper Denkyira District in the Central Region, and the West Akim District in the Eastern Region through the provision of a stable power supply to residents of rural communities by enhancing the electrical grid. This aim is highly relevant as it was consistent with the policies and needs at the time of project planning and at the time of the ex-post evaluation. The procurement and installation of equipment and materials related to improving the electrical grid were implemented largely according to schedule, but while the project costs were within the initial plan, the project period was extended by around five months, and therefore the efficiency of the project is fair. However, the Japanese side procured and installed the 33/11 kV power distribution equipment for this project, and the Ghanaian side installed and connected meters to the final consumers. From the data collected in the present study, the electrification rate of the towns and villages and the household electrification rate within the area set at the time of planning exceeded the target, and positive impacts were seen such as a strengthened regional economy and improved health and hygiene services. In light of the above, it can be said that the project's effectiveness and impact are high. Similarly, there were no major items of concern in the organizational system and technical capabilities related to the maintenance of the Electricity Company of Ghana, and it can be evaluated that it will be possible to ensure a certain level of sustainability in future.

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

1. Project Description

Project Location

(Yellow section to the west: Upper Denkyira District in the Central Region,
Yellow section to the east: West Akim District in the Eastern Region)

Upper Denkyira District Facility Installation

1.1 Background

In the Republic of Ghana during the 1990s, there was a large population outflow from rural communities to urban areas, and with the expansion of urban slums poverty and economic disparity became increasingly severe. In response, the Ghanaian government aimed for sustainable economic growth and to reduce poverty, and in 1995 drew up a long-term development program of the "Vision 2020," as well as the 2003 "Ghana Poverty Reduction Strategy" Within these, the rural electrification scheme was a priority issue as an essential project to improve living standards and to reduce poverty in rural communities.

As a practical approach, the government formulated the National Electrification Scheme (NES) to promote rural electrification with the aim of supplying power to all settlements with a population of over 500 by 2020. It was decided that the electrification scheme would be advanced in six phases. Under Phases 1 & 2 (1991-1995 and 1996-2000 respectively), donors including Japan collaborated under the initiatives of the World Bank, and electrification was implemented in district capitals and key municipalities in rural areas, and the electrification in all district capitals (110 locations) was completed according to the plan. From Phase 3, it was intended to further strengthen approaches at domestic rural electrification such as by advancing the Self-Help Electrification Project[1] (SHEP) to parallel the electrification of key municipalities in rural areas.

However, the financial deficit of the electric power sector has become a serious problem due to the increased cost of electricity resulting from a fall in the Cedi (Ghana's currency), a surge in crude oil prices, and electricity tariff arrears, and this has impacted negatively on progress made by the NES. As a result, the electrification rate in rural communities has only risen gradually by an average of 20% (around 60% in the region of the national capital), and disparity between urban and rural areas has reemerged as a pressing issue. Amidst such circumstances, as part of the NES, the Ghanaian government planned to electrify two districts in the central-southern region of Ghana where electrification had been particularly delayed (the West Akim District in the Eastern Region and the Upper Denkyira District in the Central Region), and requested grant aid from Japan for the funding required to improve its power distribution network.

1.2 Project Outline

The objective of this project is to improve basic living standards through providing a stable power supply to residents of rural areas by enhancing the electrical grid in areas such as the West Akim District in the Eastern Region and the Upper Denkyira District in the Central Region.

[1] The SHEP was the form the project took in areas of remote, dispersed settlements not subject to the NES, and it aimed to promote electrification through local resident funding. The SHEP is designed to electrify municipalities that satisfy certain conditions, for example, i. it should be within 20km of preexisting power lines, ii. the local residents should bear the cost of low-voltage power distribution masts (wooden poles), and iii. over a third of residents should own a domestic wiring system and desire electrification.

Grant Limit/Actual Grant Amount		Phase 1: 678 million yen, Phase 2: 410 million yen/ Phase 1: 677 million yen, Phase 2: 408 million yen
Exchange of Notes Date		Phase 1: August 2006, Phase 2: August 2007
Implementing Agency		Ministry of Energy, Electricity Company of Ghana (ECG)
Project Completion Date		December 2008
Parties Involved with the Project	Main Contractor	(Materials & Equipment Procurement) Mitsubishi Corporation, Nishizawa Ltd., Inc.
	Main Consultant	Yachiyo Engineering Co., Ltd.
Basic Design		March 2006 - August 2006
Related Projects (if any)		• Phase 1 "The Project for Rural Electrification" (E/N 1989, 826 million yen) • Phase 2 "The Project for Volta Downstream Area Electrification" (E/N 1993, 1.068 billion yen, E/N 1994, 808 million yen) • Phase 3 "The Project for Asesewa Yeji Area Electrification" (E/N 1996, 507 million yen, E/N 1997, 605 million yen) • Phase 4 "The Project for Rural Electrification" (E/N 2002, 755 million yen, E/N 2003, 306 million yen)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa, (Sano Planning Co., Ltd)

2.2 Duration of Evaluation Study

The study was implemented as follows:

Duration of the study: November 2011 to August 2012

Duration of the field study: November 30, 2011 - December 22, 2011; May 06, 2012 - May 21, 2012

2.3 Constraints during the Evaluation Study

None in particular.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Ghana

(At project planning)

The Republic of Ghana formulated the "Vision 2020" as its national long-term program of general development with the goal of becoming a middle-income country by 2020, and therein, the rural electrification project is an issue of the utmost priority. The Plan's ultimate goal is to supply power to all citizens based on an economic and efficient power supply system, which can assist socio-economic development. Likewise, in one of the state's basic policies, the Ghana Poverty Reduction Strategy (GRPS I and GRPS II[4]), the rural electrification project is deemed an essential approach in improving the living standards of the residents of rural communities and eradicating poverty.

Furthermore, in terms of energy sector policy, further promoting rural electrification was set out in the "Strategic National Energy Plan (2006-2020)" drawn up in 2005.

(At the ex-post evaluation)

The Republic of Ghana's long-term program of general development, the "Vision 2020," is still a primary policy indicating the state's basic direction at the time of the post-project evaluation, and consistency was maintained with this policy. Similarly, as for the Ghana Poverty Reduction Strategy, the GSGDA[5] (2010-2013) was formulated after the GRPSII, and therein one crucial issue put forward among seven areas was "improving infrastructure, energy, and living environments." Within which, it is clearly stated that an electricity supply conducive to the industrial growth of rural communities and improvement of the living environment of local residents is crucial. On this point, the project's contents can be confirmed consistent with policy. Furthermore, the Strategic National Energy Plan has been unchanged, and kept the actions for promoting rural electrification as a crucial issue.

From the above, not only was the project consistent with the Republic of Ghana's development policy at the project planning time, but it is still in line with the crucial policies at the post-project evaluation.

3.1.2 Relevance with the Development Needs of Ghana

(1) Development needs at the time of project planning

Under Phases 1 & 2 of the NES (1991-1995 and 1996-2000 respectively), donors including Japan collaborated under the initiative of the World Bank, and electrification was implemented in district

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low
[4] GPRS: Growth and Poverty Reduction Strategy
[5] GSGDA: Ghana Shared Growth and Development Agenda

capitals and key municipalities in rural areas, and first of all, the electrification of all district capitals (110 locations) was completed in 2000.

When this project was planned in 2006, electrification of the remaining key municipalities in rural areas was progressing, and rural electrification approaches were also gaining strength, such as the simultaneously expanding SHEP which incorporated the concept of user charges. However, regardless of such government efforts, the electrification rate in rural areas where approximately 70% of the population reside is only around 20%, (the national electrification rate average is 43%), and it was recognized that further promotion of rural electrification is an important and pressing issue in order to improve living standards and the quality of public services such as medical and educational facilities in areas without electricity.

The electrification rate in the project sites of the West Akim District in the Eastern Region and the Upper Denkyira District in the Central Region were 6% and 7% respectively, which was remarkably low against the national average of 43%, and therefore the need of local residents for electrification was very high.

From the above, it can be said that this project is consistent with both the development needs of the Republic of Ghana and the project sites.

(2) Development needs at the time of the post-project evaluation

The Republic of Ghana has promoted rural electrification as one of the government's prioritized issues. The electrification rate on the basis of the municipalities is rising rapidly due to the recent donor assistance, with 66% of municipalities electrified according to the latest official statistics in 2009.[6]

This project is playing a part in this rapid improvement in the electrification rate, and can be said to be consistent with the Republic of Ghana's development needs.

As seen above, though the electrification scheme is basically showing sound progress, it is still only partway to achieving its objective of the total electrification of all towns and villages throughout the country by 2020. In light of this it can be said that support in the area of electrification is still consistent with the government's development needs.

3.1.3 Relevance with Japan's ODA Policy

Country Assistance Program for the Republic of Ghana (2006) in Japan, the basic development objective for support to Ghana was stipulated as, "continuing to improve the basic environment including human development and socio-economic foundations for independent economic growth." The plan proclaims "invigorating rural areas and communities" as a key development issue, and indicates assistance for "improving foundational living environments within poverty-stricken areas." Furthermore, from the viewpoint of "industrial growth," the plan indicates that assisting economic

[6] The estimated level as of 2011 was 72% (data from Ministry of Energy, the Republic of Ghana).

infrastructural improvements such as the energy sector is one element of encouraging "private sector development."

In light of the above points, this project to promote electrification in Ghana was consistent with the direction and content of Japan's ODA policy.

From the above, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[7] (Rating: ③)

3.2.1 Quantitative Effects

The quantitative effects that were the aim of this project were achieved as per the table below:

Table 1: Electrification Rate of Towns & Villages

	Figure at planning period (2005)	Target figure (2008/09)	Current figure (2011)
Eastern Region, West Akim District	16 towns & villages, 6%	47 towns & villages, 17% *Amount of net increase due to this project (31 towns & villages) + existing towns & villages	106 towns & villages, 40% *This project + other support
Central Region, Upper Denkyira District	15 towns & villages, 7%	31 towns & villages, 13% *Amount of net increase due to this project (16 towns & villages) + existing towns & villages	47 towns & villages, 22% *This project + other support

Source: Basic Design Study & ECG Materials

(Notes on the quantitative effects)

＊ The number of towns & villages electrified which was the target figure (2008/2009) for the quantitative effect cites the net increase in the number of towns & villages due to implementing this project (in sum 31/16 towns & villages respectively). On the other hand, the current number of towns & villages electrified includes the net increase performance of this project in addition to the number of towns & villages electrified with the assistance of other donors (China and the World Bank - as will be discussed later).

The electrification rate in towns & villages already greatly exceeds the target. This results from the effects of this project in addition to the electrification projects conducted by China and the World Bank. With assistance from China, 57 towns and villages in the West Akim District of the Eastern

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

Region were electrified from 2007-2008, and similarly the World Bank's assistance project (2009-2011) supported the electrification of two towns and villages in the area. Similarly, with assistance from China, 16 towns and villages in the Upper Denkyira District (2008-2011) have been electrified. Hence, electrification in the project site progressed more rapidly than initially expected.

On the other hand, the rate of electrification of households has also reached the target[8]. However, regarding the household electrification rate, since China's assistance projects focused on towns and villages in areas of low population, the effect to increase the figures is somewhat limited compared with the increase in the electrification rate of towns and villages.

Table 2: Rate of Electrification of Households

	Figure at planning period (2005)	Target figure (2008/09)	Current figure (2011)
Eastern Region, West Akim District	15%	35%	42%
Central Region, Upper Denkyira District	22%	44%	46%

Source: Basic Design Study & ECG Materials

Table 3: Increase in the Number of Electrified Towns & Villages and Households by Project (2006-2011)

	This project		China assistance project		World Bank assistance project	
	Number of towns & villages	Number of households	Number of towns & villages	Number of households	Number of towns & villages	Number of households
Eastern Region, West Akim District	31	8,171	57	3,025	2	105
Central Region, Upper Denkyira District	16	5,870	16	1,621	0	0

Source: ECG Materials

3.2.2 Qualitative Effects

Under this project, the effects of electrification on the local society were arranged as indirect rather than qualitative effects, and the circumstances through which these emerged are noted under the following items.

From the above, the effects of implementing this project emerged largely according to plan, and therefore its effectiveness is high.

[8] The total number of households in the region was not publicized by the Ghana National Census (conducted in 2010) at the time of the field survey, so the basic design study used a population estimate. Similarly, the rate of electrification of households is calculated based on the number of meters.

3.3 Impact

3.3.1 Intended Impacts

Implementing this project had the following impacts. Note that, when confirming the circumstances of these impacts, a beneficiaries survey[9] was conducted within the ex-post evaluation.

(1) Improvements in Health & Hygiene Services due to Electrification

In the targeted areas of this project, the introduction of electric medical equipment and fridges for pharmaceutical products became possible, and this was welcomed by local residents and clinic staff alike.

Table 4: Local Residents' Awareness of Improvements in the Medical Services Provided by Clinics (number of responses)

	Improved	Almost the same	Deteriorated	Uncertain	Total
West Akim	23	20	0	7	50
Upper Denkyira	20	19	0	11	50
Total	43	39	0	18	100

Source: Beneficiaries survey Results

Local residents particularly welcomed the fact that local clinics became able to handle vaccination campaigns, and that medical examinations could be conducted at night.

Similarly, the clinic staff themselves also referred to impacts coinciding with electrification such as an improved vaccine storage system, and the potential to improve the patient waiting room environment by purchasing electric fans and televisions.

(2) Invigorating the Local Economy

1) Increase in retail stores and extended business hours

While there were already small-scale economic activities in the project sites such as retail, catering, and beautification, after electrification, economic vitalization was seen whereby business hours were extended due to the use of electricity and electrical products, and the number and variety of retail stores increased.

The table below shows the local residents' awareness of the increase in the number of retail stores in the regions and opening hours.

[9] The recipient survey was conducted as a face-to-face questionnaire survey focusing on, i. general local people in the regions (50 in each region x2 = 100), ii. owners of retail stores in the regions (5 x2 = 10), and iii. clinics (5 - all clinics in the area).

Table 5: Local Residents' Awareness of the Change in the Number of Retail Stores in the Region

	Increased significantly	Increased	Almost the same	Decreased	Uncertain	Total
West Akim	15	21	11	1	2	50
Upper Denkyira	15	26	9	0	0	50
Total	30	47	20	1	2	100

Source: Beneficiaries survey Results

Table 6: Local residents' awareness of the change in opening hours of retail stores in the region (number of responses)

	Increased significantly	Increased	Almost the same	Decreased	Uncertain	Total
West Akim	21	18	9	0	2	50
Upper Denkyira	14	29	7	0	0	50
Total	35	47	16	0	2	100

Source: Beneficiaries survey Results

2) Decrease in Milling Costs

Before implementing this project, a high-priced diesel engine was used for grinding the staple food of corn, which put an economic burden on local residents. For this reason, though a reduction in the price of milling was expected due to electrification under this project, the impact are somewhat short of satisfying expectations, and in actual fact there were even some responses that milling prices had increased. It can be inferred that this not only relates to the price of milling, but reflects the general impression local residents have on commodity prices, which have been on the increase over the last several years.

Table 7: Local residents' Awareness of Milling Costs (number of responses)

	Major Decrease	Decreased	Almost the same	Increased	Uncertain	Total
West Akim	2	5	8	22	13	50
Upper Denkyira	4	12	4	3	27	50
Total	6	17	12	25	40	100

Source: Beneficiaries survey Results

(3) Effect of the reduced harmful influence of kerosene lamps

It was expected that with electrification kerosene lamp use would cease, and the ill effects on health caused by lamp smoke would reduce. However, in the Beneficiaries survey a relatively low number of local residents were aware of the effect of reduced smoke. The background of this result is conceivably that only a small number of local residents had paid attention or keenly aware of the harm to health by kerosene lamp smoke.

Table 8: Awareness of Change to Health (irritation of the eyes and throat) due to discontinuing the use of Kerosene Lamps (number of responses)

	Improved a great deal (eased)	Somewhat improved	Almost the same	Deteriorated	Uncertain	Total
West Akim	3	7	35	0	5	50
Upper Denkyira	1	2	23	0	24	50
Total	4	9	58	0	29	100

Source: Beneficiaries survey Results

(4) Others

It was expected in the basic design study that reducing the burden of fetching water from wells on local residents and women in particular would reduce labor. However, the majority of local residents still use the community well manually, and almost no electric pumps have been introduced.

3.3.2 Other Impacts

(1) Impacts on the natural environment

No positive or negative impacts on the natural environment were seen.

(2) Land Acquisition and Resettlement

No residents were resettled and no land was acquired.

(3) Others

1) Impact on the lifestyle of local residents

In addition to the above, this project had the following impacts on the lifestyle of local residents, and it is thought the positive impacts of this were major.

Table 9: Other Positive Effects due to Electrification (number of responses - multiple responses from 100 residents)

	Number of hours spent with the family increased	Children's study time increased	Robbers and thieves decreased	Information transmitted via television increased	Shopping became easier (because neighboring shops increased)	Young people became able to stay in their own towns*.
West Akim	38	32	11	34	28	24
Upper Denkyira	35	45	10	31	28	14
Total	73	77	21	65	56	38

Note: *In the past, leaving the town/village at night to go to nearby electrified towns was common
Source: Beneficiaries survey Results

Similarly, in addition to the responses in the table, it was noted that refrigerator usage became possible and it became safe to go out at night (dangers such as street-crime and snakes could be avoided)

On the other hand, the negative impacts are shown in the table below. In particular, homes experienced a major one-off financial strain due to the system of invoicing collectively for several months' electricity tariffs. Likewise, negative impacts were seen such as children spending more time in front of the television and less time helping in the home.

Table 10: Other Effects due to Electrification (number of responses - multiple responses from 100 respondents)

	The community became noisier (e.g. due to music and advertising)	Greater financial burdens	Young people started staying longer in shops (and the time helping at home reduced)
West Akim	22	16	14
Upper Denkyira	14	29	9
Total	36	45	23

Source: Beneficiaries survey Results

2) Overlap and relevance of other projects

There was no inefficient overlap between this project and that of China or the World Bank.

However, with the increase in consumers throughout the districts, occasional voltage drop was seen in some of the project sites (particularly in West Akim). The ECG is also aware of the voltage drop situation in the project area, and is considering either an 11 kV upgrade of the existing facility or constructing a new substation, though no specific conclusion has been reached.

The local residents' awareness of the voltage drop situation of this project is as per the table below:

Table 11: Local Resident Awareness of Voltage Drop (number of responses)

	Stable	Fairly stable	Fairly unstable	Unstable	Uncertain	Total
West Akim	24	13	10	3	0	50
Upper Denkyira	33	16	1	0	0	50
Total	57	29	11	3	0	100

Source: Beneficiaries survey Results

From the above, the project has had positive effects such as improving the everyday living environment, strengthening the local economy and improving health and hygiene services.

This project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

Under this project, the following materials and equipment were procured and installed in the target areas of the West Akim District in the Eastern Region and the Upper Denkyira District in the Central Region. All equipment and materials were procured and installed according to plan except for the emergency equipment targeted for Phases 1/2 in the West Akim District in the Eastern Region.

Table 12: Equipment & Materials Procured and Installed by this Project

No.	Item	Unit	Eastern Region, West Akim District	Central Region, Upper Denkyira District	Total
A.	Procurement and installation of equipment and materials for the 33 kV and 11 kV distribution lines				
(1)	33 kV distribution line				
	1) 33 kV/433-250 V transformers				
	a) 50 kVA	Unit	-	2	2
	b) 100 kVA	Unit	-	7	7
	2) Auto reclosers	Unit	-	1	1
	3) Load isolators	Unit	-	5	5
	4) Lightening arrestors	Unit	-	16	16
	5) Cutout switches with fuses	Unit	-	9	9
	6) Electrical wire: AAC 120 mm^2	Km	-	28.9	28.9
	7) Steel poles (11 m)	pole	-	275	275
(2)	11 kV distribution line				
	1) 11 kV/433-250 V transformers				
	a) 50 kVA	Unit	22	3	25
	b) 100 kVA	Unit	16	8	24
	c) 200 kVA	Unit	4	0	4
	2) Auto reclosers	Unit	1	0	1
	3) Load isolators	Unit	9	2	11
	4) Lightening arrestors	Unit	53	13	66
	5) Cutout switches with fuses	Unit	42	11	53
	6) Electrical wire: AAC 120 mm^2	Km	98.6	21.3	119.9
	7) Steel poles (11 m)	pole	1,108	233	1,341
(3)	Main distribution board (MDB)	set	42	20	
Procurement of equipment and materials for low voltage distribution lines					
(1)	Low voltage trunk distribution lines	Km	455.8	183.4	639.2
(2)	Pole fitting materials for distribution lines (such as insulators and terminals)	set	1	1	2
(3)	Procurement of maintenance tools and emergency spare equipment	set	1	1	2

Source: Basic Design Study

Difference between the Plan and Performance

The emergency distribution transformers (11 kV/433-250 V, 50kVA, 100kVA, and 3 units of 200kVA) planned to be procured for West Akim in the Eastern Region were not made. This was

because a write-down of approximately ¥5,065,000 was required as the foreign exchange rate saw the Yen weaken and Euro strengthen more than anticipated (4.7% stronger Euro). However, the Ghanaian side has already procured emergency spare equipment which has been deployed to the local branches.

Equipment Usage Situation

All the facilities and equipment were being utilized effectively except for the auto reclosers in the Upper Denkyira District of the Central Region.

The auto reclosers are not currently used by the project office because the Upper Denkyira District is susceptible to power blackouts due to interference from trees, wildlife and wind-borne debris. Auto reclosers are devices that function to automatically restart once debris causing the power blackout has been automatically removed (such as the wind causing objects attached to power lines to fall). However, it was judged that the devices would not be used in this region as there are frequent cases where interfering debris is not automatically removed. However, the West Akim District has comparatively less vegetation than the Upper Denkyira District, and the devices are being utilized without such issues.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project's planned expenses and performance are as per the table below, and the project costs were lower than planned.

Table 13: The Project's Planned Expenses and Performance

	Japanese side:			Ghanaian side:	Project Total: Japan/Ghana Share
Scheduled	Phase 1	Phase 2	Total		
	678 million yen	410 million yen	1.088 billion yen	344 million yen	1.432 billion yen
Performance	677 million yen	408 million yen	1.085 billion yen (Comparison with the plan 99.7%)	227 million yen (Comparison with the plan 65.9%)	1.312 billion yen (Comparison with the plan 91.6%)

Source: JICA materials & ECG materials

Note that the Japanese side was responsible for the procurement and installation of the 33/11 kV distribution facility in the regions subject to electrification, and also for the procurement of the low voltage trunk distribution equipment and materials. On the other hand, the Ghanaian side was responsible for, a) logging of trees along the route of the distribution line installation, b) procurement and installation of low voltage distribution equipment, c) procurement of power consumption meters

and connection to consumers, and the procurement and installation of circuit breakers, d) securing operating and maintenance staff, and e) operating and maintaining procured equipment.

Difference between Scheduled Project Expenses and Performance

Regarding Phases 1/2, as a result of adjusting the procurement of emergency spares described above, the project costs of the Japanese side were kept within the planned costs.

On the other hand, the items the Ghanaian side was responsible for, such as logging and the procurement of low voltage distribution equipment, were also kept within the initially planned project costs. The discrepancy between the share amount at the time of planning and actual performance resulted primarily from the fact that the cost of logging in the West Akim Region was lower than planned.

3.4.2.2 Project Period

The scheduled period and performance of this project are as per the table below, and slightly longer than planned.

Table 14: Scheduled Project Period and Performance

	Phase 1		Phase 2		Total	
	Scheduled	Performance	Scheduled	Performance	Scheduled	Performance
Japanese side:	11 months	14 months: Comparison with the plan: 127% (Feb 2007 - Mar 2008)	10 months	12 months: Comparison with the plan: 109% (Jan 2008 - Dec 2008)	Overall: 21 months	Overall: 26 months: Comparison with the plan: 123%
Ghanaian side:	29 months	32 months: Comparison with the plan: 110% (Feb 2007 - July 2009)	28 months	30 months: Comparison with the plan: 127% (Feb 2007 - April 2010)	Overall: 57 months	Overall: 62 months: Comparison with the plan: 108%
Project Total:	30 months	46 months: Comparison with the plan: 153%	38 months	42 months: Comparison with the plan: 110%	Overall: 78 months	Overall: 88 months: Comparison with the plan: 114%

Source: JICA materials & ECG materials

Difference between the Planned Project Period and Performance

The construction period was extended. This can be attributed to the delay in manufacturing the procured equipment and a delay in transporting the equipment. In Phase 1/2, the equipment and materials arrived around three months later than planned, and similarly around two months later than planned in Phase 2/2. As a result, around five additional months were needed for the construction period the Japanese side required for the project overall. The Japanese side's delays in completion caused the start-date of the Ghanaian side's share of the construction to be delayed, and the

completion date was delayed somewhat as a result. However, the construction period required for the items which were the responsibility of the Ghanaian side went according to plan[10].

From the above, though the project's cost was within the plan, the project period was exceeded, therefore efficiency of the project is fair.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

It is thought a largely adequate organizational framework has been laid down that will sustain the facilities and equipment installed by this project.

The ECG's has jurisdiction over the project in six districts of southern Ghana, and is comprised of a head office, regional offices, and district offices, and employed 5,390 staff at the end of 2009. This means a 10% personnel increase on the 4,889 staff at the time of planning (2005), and it is clear that this personnel increase parallels an expanded array of activities. Likewise, an organizational shakeup has begun at the head office, and the organizational framework continues to strengthen through such actions as making the ICT section independent and reinforcing the Strategy Division.

On the other hand, it is believed that within district offices which routinely manage and maintain the project's equipment, a sustainable framework has been improved, and personnel have been increased in divisions performing key routine duties.

Table 15: Change in the Number of Engineers in Focus Business Offices

Region	Business Office	Engineers		Meter Reading Staff		Customer Service	
		2008	2011	2008	2011	2008	2011
West Akim	Asamankese	5	8	2	6	1	3
	Nsawam	3	5	4	7	6	8
Upper Denkyira	Dunkwa	3	6	3	4	1	3
	Sefi	3	5	7	13	2	3

Source: ECG Materials

Note that in terms of the system of customer service, changing the collection method from house-to-house collection to a card system was considered. However, there is no plan to introduce this in the near future because constructing a network in rural areas is problematic in terms of cost, and in fact meter-reading staff visits are preferable as they deter surreptitious electricity usage.

[10] The Ghanaian side's responsibilities vis-à-vis this project included connection to consumers, and hence their responsibilities were scheduled for a further 18 months after the Japan side completed its share of the project. Because the project completions of the Japanese side were delayed by three months and two months respectively, as a result the Ghanaian side's share of the work was also delayed by three and two months respectively.

3.5.2 Technical Aspects of Operation and Maintenance

Almost all the equipment installed under this project is similar to that already used by the ECG, and hence its management and maintenance does not require new skills or a particularly high level of technical competence, and therefore technically it is believed to be of largely adequate sustainability.

Note that the ECG's engineers are obliged to undergo training at ECG's Tema Training Center[11] before their field assignment. Engineers are as a rule assigned to the field after they have mastered a certain level of skills related to operating the equipment and routine maintenance. The training center also has an established refresher course with a training system set up for intermediate level technicians. In light of the above points, it is believed that the technical capabilities of ECG's engineers are assured at certain level.

3.5.3 Financial Aspects of Operation and Maintenance

The equipment and materials procured by this project are basically maintenance free, though spares must always be readily available to replace expendables and deteriorated parts necessary to operation. As per the table below, the ECG has a fixed budget secured as annual maintenance costs, and even though operations within the region have expanded greatly, maintenance costs per unit are largely maintained at the previous level. On the basis of such performance, it can be assessed that maintaining a largely capable level to perpetuate the effect of this project is possible in terms of financial sustainability.

Table 16: Cost of Maintaining Power Lines

	Region	Eastern Region		Central Region	
	Unit/Year	2004	2010	2004	2010
Existing distribution lines	Km	1,708	4,121	888	2,298
Annual maintenance budget	Million Cedi	2,832	6,985	2,444	5,924
Per Km of distribution lines	Million Cedi/Km	1.66	1.69	2.75	2.58

Source: ECG Materials

Likewise, the ECG has been in the black financially over the last four years, except for 2009.[12]

[11] As of May 2012, the center had four full-time instructors, and a further 20 registered instructors are dispatched according to the course details. New trainees are obliged to take a total of a one year course consisting of six-months at the training center and six-months OJT. Intermediate staff also accord with the personnel program, and are obliged to undergo 2-3 weeks refresher training. The training center also accepts third-nation trainees from countries such as the Gambia, Liberia, and Sierra Leone.

[12] There have been financial years to date when the ECG's income and expenditure was in the red (2006 and 2007). The main causes were the national policy that ensures electricity tariffs are kept low, and the tendency of government related organizations to delay payment. Recently, the ECG has been in the black as payments from government

Furthermore, ECG announced at the annual meeting that it will continue to focus management effort on improving the future financial situation. Specific targets were raised, such as, i. reducing distribution losses, ii. introducing a prepaid card system in urban areas, iii. throughly collecting tariffs, and iv. utilizing ICT effectively[13]. Until now, distribution losses in recent years have hovered from around 24% to just under 27%, so the ECG is particularly inclined to improve non-technical losses by further enhancing customer service (it is estimated that among the distribution losses, the majority of non-technical losses result from surreptitious electricity usage). On this note, a certain level of income and expenditure improvement can be expected by thoroughly reinforcing meter reading, and it can be said the system is being strengthened by increasing meter reading staff.[14]

Table 17: Changes in the ECG's Business Income & Expenditure (Unit: 1,000 Cedi)

		2008	2009	2010	2011
Income	Electricity Tariff Income	598,770	616,079	967,112	1,190,381
Expenditure	Purchasing Electricity and related Costs	495,205	541,332	825,977	1,010,801
	Transmission Costs	15,842	23,369	29,974	41,109
	Personnel Costs	51,970	77,673	81,940	111,887
Other Income and Expenditure	Exchange Profit & Loss	3,483	6,107	17,051	3,653
	Loan Interest	-24,838	-15,717	-4,695	-17,439
	Dividends of Affiliated Companies	163	170	448	-
	Other Income	11,213	10,413	9,344	10,634
Business Income & Expenditure		25,774	-25,321	51,369	23,432

Note: Figures for 2011 are provisional
Source: ECG Annual Report

Table 18: The ECG's Distribution Losses

	2006	2007	2008	2009	2010
Technical Losses	10.9%	10.8%	11.5%	11.7%	12.0%
Non-technical losses	13.3%	13.2%	14.1%	14.3%	14.6%
Total	24.3%	24.0%	25.6%	26.0%	26.6%

Source: ECG Materials

related organizations have been made relatively smoothly.

[13] Liquidity ratio is said to indicate the short-term financial health of corporate bodies, and at 186% (as of 2008) is well clear of the standard of 150% or higher that is normally judged preferable. Note that 150% is only one benchmark, and apparently the liquidity ratio of heavy industries with major debts often falls below 150% (according to the 2011 Ministry of Economy, Trade and Industry Basic Survey of Industry).

[14] Note that technical losses and non-technical losses cannot be clearly distinguished, so the ECG regards 45% of losses as attributable to technical losses, and the remaining 55% as non-technical losses. Incidentally, it is estimated that the majority of technical losses are accounted for by losses related to primary/distribution power transformers.

3.5.4 Current Status of Operation and Maintenance

The current status of operation and maintenance is good. In the ex-post evaluation survey, the opinions of the engineers of the district offices were that the equipment and materials of this project had not suffered a major breakdown to date and are of very high quality even compared with that of other projects (all four offices gave similar opinions).

Note that replacement equipment that must be purchased is available at local agencies, and no particular problems were seen in acquiring spare parts.

From the above, the materials and equipment of this project can be assessed as possessing a high potential to be used sustainably in future.

From the above, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project aimed to improve basic living standards through the provision of a stable power supply to residents of rural communities by enhancing the electrical grid in areas without electricity such as the Upper Denkyira District in the Central Region, and the West Akim District in the Eastern Region. This aim is highly relevant as it was consistent with the policies and needs at the time of project planning, and at the time of the ex-post evaluation. The procurement and installation of equipment and materials related to improving the electrical grid were carried out largely according to schedule, but while the project costs were within the initial plan, the project period was extended by around five months, and therefore the efficiency of the project is fair. However, the Japanese side procured and installed the 33/11 kV power distribution equipment for this project, and the Ghanaian side installed and connected meters to the final consumers. From the data collected in the present study, the electrification rate of the towns and villages and the household electrification rate within the area set at the time of planning exceeded the target, and positive impacts were seen such as a strengthened regional economy and improved health and hygiene services. In light of the above, it can be said that the project's effectiveness and impact are high. Similarly, there were no major items of concern in the organizational system and technical capabilities related to the maintenance of the Electricity Company of Ghana, and it can be evaluated that it is possible to ensure a certain level of sustainability in future.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

In order to establish the ECG's financial situation, further effort is required to reduce distribution losses and thoroughly reinforce the collection of tariffs.

Regarding the usage methods of the auto reclosers, the advanced settings inside the device need to be re-verified for effective material and equipment usage. The device settings such as the degree of sensitivity causing the devices to close can be altered in several ways according to various local usage conditions, so effective usage is possible through readjusting the calibrations. Accordingly, personnel in charge need to be trained in the appropriate methods of using these devices.

4.2.2 Recommendations to JICA

None in particular.

4.3 Lessons Learned

The Japan side was responsible for procuring and partially installing the distribution equipment and materials for this project, and the Ghanaian side was responsible for the connection and distribution to the final power consumers. For the government of the recipient country to take responsibility for approaches in the final stage entails a certain level of risk. However, in this case, from looking at the performance from past grant aid projects, an appropriate scope of responsibilities were shared with Japan and Ghana, over scrutinizing implementing capability of the project implementation body, degree of difficulty of the project overall, and ability to cost share.

It can be said that sharing an appropriate level of responsibility between both countries based on the past performance is effective for project planning in terms of project efficiency.

Republic of Ghana

Ex-Post Evaluation of Japanese Technical Cooperation Project
"Project for West African Centre for International Parasite Control"

External Evaluator: Jun Totsukawa, Sano Planning Co, Ltd

0. Summary

This project aims to implement capacity building in parasitic diseases control of the member countries in the West African sub-region by WACIPAC. In terms of the necessity of parasite control, this objective is relevant with the country's policy and needs at the time of the project planning and of the ex-post evaluation. However, in terms of sustainable management of the centre, its relevance is only at fair level because the sustainable management is not clearly defined within the development policy of the government of Ghana. The efficiency of the project is fair because the project was carried out as per the original plan and it was completed within the planned period, but the project total budget exceeded the original plan. The effectiveness and impact of the project is at fair level because within the project period it achieved the project objective of WACIPAC's playing the role of capacity building for integrated parasite control activities of the member countries in the West African sub-region through frequent international capacity building workshops and follow-up visits, but the overall goal has not been fully achieved because the activity of WACIPAC is of limited scope after the project period. Sustainability of the project effects is low because there are large challenging issues in the government's policy background to support the institution despite sufficient technical level acquired throughout the project.

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

1. Project Description

Project Locations

Putei elementary school of the model site

1.1 Background

At the 1997 Denver Summit of the G7 countries, Ryutaro Hashimoto, then the prime minister of Japan, advocated the importance of international co-operation in parasitic diseases control. At the subsequent G8 meeting in Birmingham in 1998, Japan submitted a report titled “International Parasite Control in the 21st century”, declared the intention to help developing countries strengthen their human and information network for parasitic diseases control based on its achievement in succeeding to put intestinal parasites under control in Japan. Following this declaration, the government of Japan decided to establish three regional centres in Thailand, Kenya and Ghana. Asia Centre of International Parasite Control (ACIPAC) was established at Mahidol University in Thailand in 2000. Then the Eastern and Southern Africa Centre for International Parasite Control (ESACIPAC) was established at Kenya Medical Research Institute, Kenya in 2001. In Ghana, Noguchi Memorial Institute for Medical Research (NMIMR), University of Ghana was selected as the Centre for promoting Global Parasite Control Initiative in West Africa. As NMIMR carried out Infectious Disease Control Project supported by JICA from 1999 to 2003, third country training programme was introduced to initiate GPCI and some related activities to parasite control were also incorporated into the Infectious Disease

Control Project. With aid of previous experiences and preparatory work, the Project for the West African Centre for International Parasite Control (WACIPAC) was launched in January 2004 for the duration of five years to build capacity of various level of target group such as policy makers and programme managers for parasite control and to promote network among relevant personnel and Centres for International Parasite Control (CIPACs).

1.2 Project Outline

Overall Goal		Parasitic diseases control programmes of the member countries in the West African sub-region are implemented by the capacity built by/at WACIPAC.
Project Objective		WACIPAC performs the role of building capacity for integrated parasite control activities of the member countries in the West African sub-region.
Output(s)	Output 1	Institutional capacity of WACIPAC is strengthened
	Output 2	A model for school health based intervention for parasite control is developed through field research activities in Ghana.
	Output 3	Policy makers and programme managers of the member countries acquire knowledge and skills concerning school health based intervention for parasite control through the international training courses and follow-up.
	Output 4	WACIPAC functions as a hub for information network within the member countries, and promotes networking among three CIPACs. (CIPAC: Centre for International Parasite Control*)
	Output 5	Supporting countries start activities on school health based intervention for parasite control.
Inputs		Japanese Side: 1. 25 experts 7 for Long-Term、18 for Short-Term 2. 14 persons for counterpart training (12 in Japan, 2 in Japanese universities for long-term) 3. 4 persons for training of third-country trainees 4. Provision of equipment 34.6 million yen 5. Local Cost 158.36 million Yen 6. Others (1) Construction of a project office building and a field

	experiment room. (2) Capacity building for project management 4 times, Interim evaluation 1 time, Terminal evaluation 1 time. Ghanaian Side: 1. 16 appointed counterparts for WACIPAC 2. Procurement of equipment 3. Provision of land and training facility Project office, Seminar auditorium, electricity and water charge 4. Salaries of counterparts
Total cost	663.21 million yen
Period of Cooperation	January 2005 – December 2008
Implementing Agency	Noguchi Memorial Institute for Medical Research (NMIMR), University of Ghana, Ministry of Health, Ministry of Education
Cooperation Agency in Japan	Keio University, Nagasaki University, Tokyo Medical and Dental University, Ministry of Health, Labor and Welfare, International Medical Centre of Japan, Japan Association of Parasite Control
Related Projects (if any)	Third Country Training (International Parasite Control) (JFY2001-2003), Grant Aid for NMIMR (P3 Laboratory, Conference Hall, etc)

* Member countries are: Ghana, Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Mali, Niger, Nigeria, Senegal, Togo. Ghana, Benin and Niger are the most intensively supported countries.

1.3 Outline of the Terminal Evaluation

1.3.1 Prospect for the achievement of Overall Goal at the time of terminal evaluation

It was evaluated as "It is highly possible that the parasite control program will be implemented within member countries with the initiatives of the international training participants." Moreover, the project has left a visible impact, such as the full or trial implementation of de-worming program not only in the most intensively supported countries of Ghana, Niger, Benin, but also in some other member countries.

1.3.2 Achievement of Project Objective

The project activity was accelerated in the latter half of the project period and it was evaluated as "The Project Purpose is likely to be achieved by the end of the Project". For each indicator, ①: Capacity building, ②: Heightening of recognition level of WACIPAC, ③: Establishment of information networks, ④:

Strengthening of policy framework and programmes on parasite control and school health in the Supporting countries, it is evaluated as “satisfactory”.

1.3.3 Recommendations

Three recommendations were:

1) In order to ensure its sustainability as a regional centre, WACIPAC makes up and submits the solid proposal to WAHO for earlier authorization, and makes efforts to sustain solid collaboration with member countries.

(2) WACIPAC continues playing a leading role in operational research, and publishes scientific articles in peer-reviewed journals by making use of the study results at the model sites.

(3) WACIPAC closely monitors the planned activities of projects in the most intensively supported countries, aiming for further outcomes.

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa, Sano Planning Co, Ltd

2.2 Duration of Evaluation Study

Duration of the Study: November, 2011 – August, 2012

Duration of the Field Study: November 30, 2011 – December 22, 2011

May 06, 2102 – May 21, 2012

2.3 Constraints during the Evaluation Study

In this evaluation study, questionnaires were sent to WACIPAC member countries, but four member countries (Benin, Cameroon, Côte d'Ivoire; and Mali) did not respond to the questionnaire. Thus, the impact evaluation is performed based on the answers from the five countries which responded to the questionnaire.

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

3.1 Relevance (Rating: ②[2])

3.1.1 Relevance with the Development Plan of the Republic of Ghana

(1) At the time of the project initiation

In September 2000, the Millennium Development Goals (MDGs) was adopted as the 21st century objectives of the international community. It provides a common

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

[2] ③: High, ② Fair, ① Low

goal for development policies of the countries in the world. MDGs are comprised of eight chapters (main goals), one of which is "Goal 6: Combat HIV/AIDS, malaria, and other diseases". A concrete target of the Goal 6 is "Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases". The whole world is targeted, but the West African region was the most important target area because of its high incidence of malaria and other parasitic diseases. Given the above mentioned circumstances, this project's aim of parasitic diseases control in the West African region is considered to be relevant to the international community's common development policy.

However, at the time of the inception of this project, there was no policy document of the Republic of Ghana which clearly shows its political will to launch the regional center which widely serves the West African region.

(2) At the time of the termination of the project

This project is considered to have remained relevant to the international community's common development policy, because the project's completion year of 2008 was at the middle toward the MDGs target year of 2015[3]. However, we have not found any policy document of the Republic of Ghana which clearly declares its intention to make contribution to the West African region and to construct the regional centre.

As a whole, this project has consistently been relevant to the international community's common development policy in terms of the importance of parasitic diseases control. However, there has been no firm commitment (more concretely, the standing point of the center within the development policy and the plan to achieve it) on the side of the Republic of Ghana throughout the project period to launch the regional center and take actions for its sustainable management. This lack of clear policy supports to WACIPAC has appeared as the weakness in policy aspect of sustainability evaluation of this study.

3.1.2 Relevance with the Development Needs of the Republic of Ghana

(1) At the time of the project initiation (Needs for parasitic diseases control)

The West African region including Ghana is plagued with various parasitic diseases. Approximately 2 billion people, mainly in developing countries, are infected with intestinal tract parasitic worms, such as roundworms, and blood flukes. The West

[3] The United Nations assessed the achievement of MDGs in September, 2010, and ascertained to accelerate the activities for the goal. The assessment shows the Sub Sahara Africa's performance as "no progress or deteriorated".

African region is no exception. A high incidence especially among school children in the region is reported. As a persistent serious infection with intestinal parasitic diseases causes anemia and malnutrition, which then leads to poor learning performance, implementation of stool analysis and de-worming for all school children is recognized as an important issue in education sector.

However, in the past parasitic diseases control of member countries, there was no alignment between the Health sector and the Education sector and thus both sectors have been implementing parasitic diseases control independently. Unlike such antecedents, this project has promoted collaboration between the two sectors and has aimed for capacity building of policy makers and program officers. Therefore, the project is considered to be relevant to development needs of the member countries.

(2) At the time of the termination of the project (Needs for parasitic diseases control)

According to the data of WHO in 2010, which is close to the completion year of the project, nine out of the ten member countries (except Ghana) are ranked as "the most needed" in rankings of "necessity of parasitic diseases control". Incidence rates and the number of patients of soil spread parasitic diseases and blood flukes diseases are presumed to be different across countries, but general needs for further promotion of parasitic diseases control is estimated to have remained high.[4]

Given the above, this project is considered to be relevant to development policy needs. On the other hand, the following issues appear as to the needs for the establishment of the center.

(Background for the establishment of the center − from the viewpoint of relevance with the needs.)

What is notable in the background for the establishment of the center is the fact that, as was mentioned above and will be mentioned below, from the Hashimoto initiative in 1998, to "Japan's Action Plan in Combating Infectious Diseases in Africa" in 2006, Japan promised its support for parasitic diseases control to the international community, and took actions for its implementation by establishing

[4] Because of the characteristic features of its symptoms (it does not directly lead to death and carriers of parasites often do not recognize his/her infection and thus do not see doctors.), it is difficult to have correct numbers of patients. Thus, only the data of the number of patients in very limited areas, which was collected by out-reach activity, are available, but there is no nation-wide data. Even Ghana, known as a leading country for data collection, lacks nation-wide figures.

centers for the execution of the objectives in the East African region, the West African region and the South-East Asia. The center in the West African region was Noguchi Memorial Institute for Medical Research (NMIMR), to which Japan extended its support for long time thorough various aid modalities including grant-aid and with which Japan conducted various projects.

It is presumed that WACIPAC was established as an institute within NMIMR because Japan needed to launch an execution center for parasitic diseases control in the West African region while NMIMR judged that it can make contribution in terms of the relevance of its mission and its expertise[5]. Moreover, at the time of project planning, prior to the start-up of this project, Japan, in collaboration with NMIMR, was carrying out third-country trainings "parasitic diseases control" program. Such existing projects may have prompted the above decision.

The expected role of WACIPAC was capacity building and network promotion, which have been included as the main outputs in the PDM. As ex-post development of the project, an attempt was made so that WACIPAC may be recognized as an official institute of the University of Ghana, but was given up because the recognition was subject to clear funding resources to finance the center's management. Subsequently, an attempt has been made to keep WACIPAC's activities through its incorporation into West Africa Health Organization (WAHO) of Economic Community of West African States (ECOWAS)[6]. (An attempt to incorporate WACIPAC into WAHO is still on-going.)

3.1.3 Relevance with Japan's ODA Policy

This project started with the objective of capacity building for parasitic diseases control, based on International Parasite Control Initiative (Hashimoto Initiative) agreed in G8 summit meeting in Birmingham in 1998. In 2005, Japan made public "Health and Development" Initiative in the context of enhancing support for health problems in developing countries. In 2006, Japan, targeting Africa, announced "Japan's Action Plan in Combating Infectious Diseases in Africa". The action plan clearly mentions the promotion of training of medical sector employees and researchers, information exchanges and studies of international level, and also the promotion of parasitic diseases control through school healthcare model of WACIPAC.

Given the above, a support for parasitic diseases control is Japan's commitment to the international community, and therefore this project is relevant to Japan's ODA

[5] NMIMR sets the mission: 1) research, 2) education and training, and 3) extension (contribution to society).

[6] WAHO was established in 1987.

policy.

Concluding the above, while there have been some negative factors such as the lack of clear statement in Ghana's development policy about the launch of the regional center or its commitment to the project, the project is highly relevant both in development policies and needs of parasites control, therefore, its relevance is fair.

3.2 Effectiveness and Impact[7] (Rating: ②)

3.2.1 Project Outputs

3.2.1.1 Project Output

1) Output 1: Institutional capacity of WACIPAC is strengthened

Institutional capacity of WACIPAC was strengthened through international training workshops and planning/management of field researches. In the latter half of the project period, WACIPAC well managed and implemented international training workshops and follow-up visits to the member countries. Thus, the output 1 was mostly achieved. "Mostly" instead of "Fully" comes from the incompletion of the integration plan to West Africa Health Organization (WAHO), which corresponds to the indicator ①.

In terms of the indicators, despite its failure to achieve the indicator ①, management meetings and job seminars were held regularly in every week, thus the indicator ② is fully achieved. As to the indicator ③: WACIPAC staff acquire skills and knowledge for operational research and training management, the skills and knowledge on data management methods, arrangement of training workshops, and research protocol were transferred through practice learning and became solid working knowledge of participants.

2) Output 2: A model for school health based intervention for parasite control is developed through field research activities in Ghana.

The output 2 is considered to have mostly been achieved. "Mostly" instead of "Fully" comes from the fact that scientific evaluation of "Efficiency of ‘school to community’ approach" in the indicator 3 was partly infeasible before the end of the project. In the project, model sites (three elementary schools in Dangme East) were built and teacher training methods and the IEC materials were developed using these three model sites. After the interim evaluation study, the model sites accelerated field research and carried out school health based parasitic control activities. Moreover, through the field research, knowledge and skill on data

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

management and cost management were effectively transferred.
In terms of the indicators, eleven kinds of "IEC materials" of the indicator ① have been made. As to the indicator ②:School children and communities in the model project sites acquire their knowledge of parasite control and take preventive actions, the growing number of school children started to wash their hands regularly and stopped drinking worm-contaminated water. Regarding the indicator ③, the output was not achieved within the project period as mentioned above, but it is worth mentioning that a scientific study was completed and published in the end after the project termination.

3) Output 3: Policy makers and programme managers of the member countries acquire knowledge and skills concerning school health based intervention for parasite control through the international training courses and follow-up.
The output 3 is considered to have been fully achieved. Judging from the fact that the member countries' efforts in parasites control yielded various outputs such as the school education general assembly or the revision of the guidelines of school health, the participants' acquisition of knowledge and expertise are considered to be good. Its achievement can also be confirmed from the indicators. As to the indicator ①: At least 100 personnel from 10 member countries are trained through the international training courses, two meetings of policy makers and five workshops of program managers were held, making the number of total participants reach 137. Regarding the indicator ②:The participants of international training courses acquire experiences and confidence in practicing parasite control in the fields, training participants are making use of what they learned when practicing parasite control in their own countries. Some examples are; Burkina Faso held a school education general assembly which incorporates the concept of school health; Nigeria made the school health policy and the implementation guidelines.

4) Output 4: WACIPAC functions as a hub for information network within the member countries, and promotes networking among three GPCI International Centres (CIPACs)
The output 4 was mostly achieved. The project bolstered information exchanges among the international training participants, development partners, and CIPACs through various communication tools (phones, e-mails). Communication and public relations of WACIPAC is done by newsletters, web sites, and domestic and international academic conferences. Especially, the number of access to the web site has drastically increased after the opening of the French version. Closet to the

end of the Project period, 140 accesses per day were counted on average. However, the creation of database on parasitic diseases in the West African region was not completed, being hindered by various factors (difficulties in the disclosure permission of epidemiologic information and in IT infrastructures), which corresponds to the indicator ①. Thus, the achievement is evaluated as “mostly”.
Although the database was not completed (the indicator ①), the other indicators were satisfied. The indicator ②: Website based information sharing system is well realized as the contents of the website were expanded and the number of access increased. The Newsletters have already published 29 issues at the time of this ex-post evaluation (the indicator ③), aiming for dissemination of information to the member countries. As to the indicator ④: Two presentations at scientific conferences and at least five articles, three presentations at international scientific conferences and five presentations at domestic scientific conferences were done and one article in a peer-reviewed journal was published within the project period.

5) Output 5: Supporting countries start activities on school health based intervention for parasite control
The output 5 was largely achieved. In the most intensively supported countries (Benin, Niger, Ghana), parasite control activities were carried out vigorously with the support of WACIPAC, and these activities evolved into the national de-worming plan. Describing more in detail, a school based de-worming model was created in Benin and the government of Benin extended the de-worming to nation-wide activity. In Niger, school self-evaluation sheets for sanitary environment were made and empirical studies were done. In Ghana, in collaboration with UNICEF, national de-worming programmes were implemented involving 14,000 schools and 5,500 thousand students.
As to the indicators, the indicator ① is well attained as mentioned above. The indicator ②: At least 30 frontline officers are trained in the supporting countries, was satisfied as the 326 teachers in Benin participated in the trainings and the regional education officers and school supervisors participated in the trainings in 27 elementary schools in Niger.

Overall, although some parts of the outputs were not fully achieved, but the essential parts of the outputs were largely achieved at high levels.

3.2.1.2 Achievement of Project Objectives
Project objective: WACIPAC performs the role of building capacity for integrated

parasite control activities of the member countries in the West African sub-region.
This project has largely achieved its objectives, therefore its effectiveness is high, as WACIPAC played the role of building capacity for parasite control, as shown by the indicator achievements below.

1) Indicator 1: 60% of target personnel involved in parasite control and school heath programmes (policy makers, managers) of the member countries successfully receive training.

   (Status of achievement)

   Compared with the planned number of participants of 100, there were 137 participants. During the project period, two trainings for policy makers (40 participants) and five trainings for project managers (97 participants) were implemented.

2) Indicator 2: Recognition level of WACIPAC in the member countries as a training centre of parasitic disease control is heightened.

   (Status of achievement)

   According to the responses of programme managers and other donor agencies to the questionnaire surveys done at the terminal evaluation, it is clear that WACIPAC was recognized not only as a training centre but also as an information centre and a field research institute.

3) Indicator 3: Communication among personnel working on parasite control is stimulated by WACIPAC.

   (Status of achievement)

   According to the responses of programme managers to the questionnaire surveys done at the terminal evaluation, about 40 % of contact persons communicate at least once a month with telephone, e-mail, and meetings. It is judged that, during the project period, WACIPAC stimulated communication among the concerned personnel by the information dissemination through their website, which was opened in January 2005 and counted 140 accesses per day on average, and 29 issues of the newsletters.

4) Indicator 4: Policy framework and programmes on parasite control and school health in the Supporting countries are strengthened by WACIPAC.

   (Status of achievement)

   WACIPAC supported activities of the most intensively supported countries through what they call “follow-up visits” on regular basis. In the visits, project

experts and the member countries' personnel, collaborated each other, made presentations of project activities and outputs to each country's policy makers and development partners, aiming to incorporate their activities into each country's policy framework or programmes. As a result, in Benin and Niger, both most intensively supported countries, IEC materials and various tools developed in the project have been reflected in both countries' parasite control and school health programmes. More in detail:

- Benin: Based on the project activities, the national de-worming programme has been initiated.
- Niger: Based on the project activities, an activity casebook, a school health activity guide, and a manual for the use of self-evaluation sheets were made.

Concluding from the above, this project has largely achieved its objectives, therefore its effectiveness is high.

Additionally, given the nature of the aid modality of 'technical assistance' of this project, the knowledge and skill transfer by this project can be summarized as: strengthening of management ability of trainings, creation of field research methods and research protocol, a making know-how of IEC materials, effective implementation of follow-up visits. These outputs, while playing an important role in the project objective of a training centre in the West African region, implanted the related knowledge and skill to NMIMR.

3.2.2 Impact

3.2.2.1 Achievement of Overall Goal

Overall Goal: Parasitic diseases control programmes of the member countries in the West African sub-region are implemented by the capacity built by/at WACIPAC.

* It is mentioned in the PDM that this overall goal is to be evaluated in 3 to 5 years after the end of the 5 years project. Given this ex-post evaluation is being done in three and a half years after the end of the project, we evaluate the achievement status of the overall goal.

1) Indicator 1

School-based Parasitic Control programmes are actively implemented in the member countries.

(Status of achievement)

It is found that four, which excludes Togo, out of five countries which responded to the questionnaire survey, are practicing parasite control activities. In many cases, it seems that distribution of de-worming drugs and enlightenment activities in collaboration with NGOs or International Organizations, are being done. To the contrary, Togo responded that parasite control activities are withering in their country after the end of the project.

NB) As of March 2012, we received answers from five WACIPAC member countries (In total, nine responses were received from Burkina Faso, Niger, Senegal, Togo, Nigeria). We have no information on the four countries from which we failed to obtain answers (Benin, Cameroon, Côte d'Ivoire, Mali).

Though these activities were carried out with supports of NGOs and International Organizations as described in the following table, the participation of the WACIPAC trainees in these programmes indicates that WACIPAC made a contribution to the currently on-going parasite control activities.

Table 1 Parasite control activities of WACIPAC member countries after the project

Country	Items	Description
Burkina Faso	Period	2008 - present
	Programme name	Health and School Nutrition Programme in Ten Year Plan for Elementary Education Development
	Main activities	De-worming of all students of the project area
	Number of people treated	Approximately 800 thousand students
	Supporting organization	Consortium of NGOs (Helen Keller Institute: HKI, Foundation for Community Development: FDC, Catholic Relief Service : CRS)
Niger	Period	2009 – present
	Programme name	National campaign for the Neglected Tropical Diseases
	Main activities	Drug distribution, Enlightenment, Case investigation of dropsy and elephantiasis
	Number of people treated	All students of age 5 to 14 (students of elementary education) and non-school-attending children
	Supporting organization	WHO, Service Civil Int'l, RISEAL(Réseau International Schistosomiases Environnement et. Lutte), USAID, Carter foundation, etc.
Senegal	Period	2011
	Programme name	Nutrition enhancement program
	Main activities	Programs against anemia for school children, De-worming for school children
	Number of people treated	Approximately 840 thousand students
	Supporting organization	World Bank, World Food Organization, United Nations World Food Programme, Plan International, Deworming the World

Nigeria	Period	2009 - present
	Programme name	School de-worming program
	Main activities	Advocacy to concerned ministries, Community Enlightenment Teacher and health worker training Distribution of de-worming drugs
	Number of people treated	17 out of the total 36 states
	Supporting organization	PCD, Deworming the World, UNICEF, Sightsavers International

Source: Ex-post evaluation study, Answers of questionnaire surveys

2) Indicator 2

80 % of target personnel involved in parasite control and school health programmes in the member countries successfully receive training at WACIPAC.

(Status of achievement)

Under the circumstances, which will be mentioned in the sustainability analysis below, the activities of WACIPAC are very limited after the project. Concretely, WACIPAC's activities are almost limited to the international parasite control workshops with financial supports by an international NGO, PCD[8] (partly funded by JICA) (the host country for 2009 and 2010, the participation as lecturers in 2011 workshop, which was held in Kenya). Thus, the achievement level so far is not satisfactory.

The indicator says "80 % of target personnel involved … receive training", but there is no mention neither on the total number of target personnel nor on the institutions those target personnel belong to. In this respect, this indicator remains ambiguous. However, even if we take a position of making a favourable evaluation, forgetting about this ambiguity, the number of participating countries of four and participants of 12 in a workshop by NMIMR in 2010 in comparison with the 137 participants from all the ten member countries during the project period (simple average of 27 participants per year) shows how limited the ex-post activities are.

However, on the other hand, given the fact that parasite control methods are not something which evolve very quickly day by day, the numbers of above-mentioned participants for annual workshops can be thought sufficient. In

[8] PCD : Partnership for Child Development. It is an NGO with its headquarter office in the United Kingdom, which aims for improvement of education, health and nutrition of children. In 2009 and 2010, with financial support of PCD (partly funded by JICA) WACIPAC carried out a school health training course whose components includes parasite control. A training course is planned to be implemented every year with venues interchangeably in the East Africa and the West Africa every two years.

fact, in order to avoid a diminishing interest of participants due to repetition of the same topics, a new topic such as the relation with HIV-AIDS was added in the agenda (Put it differently, the number of participants decreases, if the same topics continue).[9] Moreover, the number of people in the field of parasite control is not larger than the ones in other infectious diseases. Taking these points into consideration, although WACIPAC declares a continual capacity building activity as one of its missions, in terms of frequency of workshops, the current level is deemed realistic. (However, because ex-post evaluations are supposed to make evaluation, closely sticking to the indicators set at the inception of projects, the evaluation itself of this ex-post evaluation study is not changed.)

Concluding the above, the overall goal was largely attained in terms of the indicator 1, but not achieved in terms of the indicator 2.

Summarizing the Effectiveness and Impacts, the project largely achieved its project objectives, while, in terms of the overall goal, the continual capacity building activities are limited.

In light of the above, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Inputs	Plan	Actual performance
Japanese side		
Amount	380 million yen	663 million yen
Project duration	January 2004 ～ December 2008 (5 years)	January 2004 ～ December 2008 (5 years)
Experts	2 for long-term 3 for short-term/year	7 for long-term, 27 for short-term (among which 9 short-term inter-CIPACs experts
Trainees received	3 per year	14 (12 in Japan, 2 in Japanese universities for long-term)
Third-Country	Not mentioned	4 (2 – Thailand, 2 – Kenya)

[9] Interviewed at NMIMR.

Training Programs		
Provision of equipment	Parasite tests, Materials for international training and public health activities, Vehicles	Ditto (291 items)
Local cost	130 million yen	158 million yen
Others	Construction of a project office	Ditto
Ghanaian Side		
Preparation of counterparts	NMIMR, Persons in charge at the Ministry of Health and the Ministry of Education, Persons in charge of health and education in model districts	Ditto
Facilities	Land for project office, Training venues, Offices in model districts, Test rooms, etc.	Ditto
Local cost	Local staff salaries, Utility costs for offices, Maintenance cost for the provided equipments	Ditto

Sources: JICA documents

3.3.1.1 Elements of Inputs

The inputs of equipment is as originally planned and is judged as appropriate amount to achieve this project's outputs. Most of the equipment is parasite test kits and vehicles for transport and were utilized effectively during the project period. As to the office appliance, the inputs have been continuously reviewed and have been minimized in the latter half of the period, thus achieving the rationalization of the inputs.

As to the trainees received, the project received in Japan trainees in the fields of the parasite control methods, the know-how for experiments, and the school heath. Two trainees are received in Japan with the aim of obtaining PhD degree in immunology study of parasites.

The knowledge and skills earned in these trainings were reflected into the implementation of international training courses or technical advice to the most intensively supported countries. Therefore, the inputs were effective. Moreover, the dispatch of trainees to the other parasite control centres in Kenya and Thailand was effective since it has given an opportunity of observing centre management and activities in different regions.

The fields to which experts were sent were reasonably chosen, leading to the achievement of outputs. Especially, from the middle of the project period, the concerned personnel of the project recognized the necessity of improving the quality of research activities and thus sent short-term experts targeting the research quality upgrading. Consequently, the quality of the research activities was enhanced, which made a direct contribution to output achievement, such as presentations in scientific conferences and article publications (related especially to the output 2 and 4). The dispatch of experts from the parasite control centres in Kenya and Thailand, which share similar functionality and experience with WACIPAC, was efficient input in terms of not only the training of technical aspects but also the sharing of experience. On the other hand, there appeared a problem stemming mainly from human relations among some experts, negative effects of such a problem on the project outputs were eschewed by efforts of project personnel after the interim evaluation study.

3.3.1.2 Project Cost

The disbursement amount was significantly higher than planned.

The main reason is the increase of long-term experts' inputs. While two long-term experts are planned originally, four long-term experts were dispatched in different sectors from the first year of the project. Considering that this project involves many activities and requires coordination works among many countries, it can be said that the original plan was not realistically set.

3.3.1.3 Period of Cooperation

The cooperation was completed exactly as originally planned. It started in January 2004 and ended in December 2008 without any extension.

Concluding the above, although the period of cooperation was within the plan, elements of inputs were partially inappropriate and project cost exceeded the plan, therefore efficiency of the project is fair.

3.4 Sustainability (Rating: ①)

3.4.1 Related Policy towards the Project

Parasite control matches the needs of the West African region even at the time of this ex-post evaluation study and is considered to be an important issue in development policies. On the other hand, as to the prospects of sustainable activities of WACIPAC, the following can be said in terms of policy/institutional aspects.

As already mentioned above, because WACIPAC failed to be incorporated into the University of Ghana as an official institute of the University, at the end of the project, it made its original self-sustaining development plan, WACIPAC Sustainability Plan, to be a regional centre of the West African region by integrating itself into West Africa Health Organization (WAHO) of Economic Community of West African States (ECOWAS). Namely, it aimed to retain its sustainability in terms of policy/institution by its incorporation into WAHO. This is because WACIPAC considered that WAHO's jurisdictional activity range and mission resonates with their own. For this objective, NMIMR made requests to the Ministry of Health of the government of Ghana, but there is no progress until this moment partly due to the changes of the Ministers of Health. Given the presidential election being slated in the end of 2012, it is highly likely that there will be limited progress on this attempt. As described above, integration into WAHO requires huge political efforts and thus may face many difficulties toward its realization.

Under the above mentioned circumstances, the policy sustainability of WACIPAC is not high as of now. Moreover, since the government of Ghana did not declare until now its intension to keep the regional centre by its own budget, we have to say that the chance of policy sustainability by the initiatives of the government of Ghana is unclear.

The fact that WACIPAC faces difficulties in its institutional sustainability because of the unsuccessful attempt of its integration into WAHO indicates that the main cause of this doom was the lack of 'exit strategy' the project must have envisaged at its planning stage. The ex-ante project study simply says "it is expected that the institutional sustainability in the future will be guaranteed through NMIMR's requests to other donor organizations for financial supports". It seems that the project was launched without sufficient imagination on the future of WACIPAC. Consequently, WACIPAC had to go hither and thither between the University of Ghana and WAHO and the future of WACIPAC became unstable.

While only the negative aspects were described above, it is worth mentioning that NMIMR's continuous attempts for its integration into WAHO and fund raising, although not yielding fruits yet, might work to improve its sustainability in the future. It should be added that the current national development policy of Ghana, in its paragraph on health care infrastructures, mentions an establishment of infectious disease control centre in the strategy, and thus there might be a chance of WACIPAC being utilized as parasitic diseases control centre.

3.4.2 Institutional and Operational Aspects of the Implementing Agency

At the time of the terminal evaluation study, WACIPAC exists only as a conceptual 'function' and owns no physical facilities, such as independent offices. Because institution/department as WACIPAC is not established, it is fair to say that a permanent organizational system does not exist. (When being requested from outside for a project activity, employees of the NMIMR as main actors worked to pursue the mission of WACIPAC as the West African regional centre, e.g., international workshops for parasite control in 2009 and 2010.)

However, the persons who have worked for the project are still being employed by NMIMR, and thus the human resources for trainers are secured within NMIMR. It is also possible that, for the planning and management of trainings, WACIPAC receives management support from the management department of NMIMR. Therefore, with the condition of 'subject to requests', the system for training implementation is basically still maintained.

Meanwhile, the functionality of the technical aspect of information network has dwindled after the project because the staffs, mainly employed by Japanese side, during the project duration, have left NMIMR after the project. Currently, the function as the hub of information network – the function of being the focal point of information exchange through WACIPAC's website and newsletters – is practically in idle. There is no human resource to deal with this situation. Thus, the sustainability in this respect is low. In addition to that, the lack of francophone personnel needed for efficient information network and exchange is another problem from institutional and operational aspects. On the other hand, in the model sites established in Dangme East district, parasite control projects of school health based approach are still implemented by the district personnel, and thus the sites are maintained as training facilities.

3.4.3 Technical Aspects of the Implementing Agency

Judging from the achievement of implementing international workshops for parasite control as the main organizer in 2009 and 2010, it can be concluded that the implementing agency owns knowledge and skills for lectures, implementation and management needed to achieve the role as "capacity building institution for parasite control".

3.4.4 Financial Aspects of the Implementing Agency

As a record for external fund raising after the project, the parasite control workshop sponsored by PCD is worth being mentioned. The workshops have been implemented every year with venues interchangeably in the East Africa and the West Africa every

two years. (JICA partly funded the activity with the scheme of 'follow-up cooperation'.) Currently, PCD and NMIMR are conceiving a new middle-to-long-term joint activity. Depending on its progress, a sustainable activity which serves widely to certain areas may be feasible even without the integration into WAHO. PCD, as an international NGO, intends to expand its activities on school health and parasite control in Africa and envisages to appoint its proper staff within NMIMR.

As mentioned above, the financial sustainability highly depends on the fate of the joint activity plan with PCD. Thus, judging from the records in the past, in case the plan fails, the financial sustainability will be quite limited[10][11].

3.4.5 Sustainability aspects of the effects

At the time of the ex-post evaluation study, the most feasible implementation system is the joint activity with PCD with financial support of PCD. However, as mentioned above, the prospect of the joint activity cannot be verified at this moment.

Because sufficient ability is observed in terms of operational and technical aspects, as long as financial and political supports are guaranteed, WACIPAC can keep playing its role as capacity building agency not only by the joint activity with PCD but also by collaboration with other organizations or by its own.

As such, there are some positive aspects for evaluation. However, the sustainability of the effects of this project is highly dependent on the availability of financial supports. Therefore, it is fair to judge that the sustainability of the effects of this project is low.

Concluding the above, major problems have been observed in the policy background and financial aspects of the executing agency, therefore, sustainability of the project effects is low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aims to implement capacity building in parasitic diseases control of the member countries in the West African sub-region by/at WACIPAC. In terms of the necessity of parasite control, this overall goal is relevant with the country's policy and needs at the time of the project planning and of the ex-post evaluation. However, in terms of sustainable management of the centre, its relevance is only at fair level because the

[10] Comparing with as of termination period of the Project, when there were no prospects of financial assistance, the current situation that keeps tight relation with PCD and approaches to Gates Foundation, is indicating the significant accomplishment by NMIMR.

[11] It was reported that the MOU with PCD was signed in August, 2012, though; a certain period must be necessary to see the effectiveness and its actual implementation of the MOU.

sustainable management is not clearly defined within the development policy of the government of Ghana. The efficiency of the project is fair because the project was carried out as per the original plan and it was completed within the planned period, but the project total budget exceeded the original plan. The effectiveness and impact of the project is at fair level because within the project period it achieved the project objective of WACIPAC's playing the role of capacity building for integrated parasite control activities of the member countries in the West African sub-region through frequent international capacity building workshops and follow-up visits, but the overall goal has not been fully achieved because the activity of WACIPAC is of limited scope after the project period. Sustainability of the project effects is low because there are large challenging issues in the government's policy background to support the institution despite sufficient technical level acquired throughout the project.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

① To secure the sustainability, stable supports of policy background and financial resources are indispensable. In this respect, the integration into WAHO is still a good option and thus should be pursued by NMIMR. Simultaneously, efforts to materialize the joint activity plan with PCD are called on because it will be an effective option to maintain the function of WACIPAC.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

① It seems that this project was initiated without clearly defining the intension and responsibility on the part of Ghana, which affected negatively this project's sustainability, especially in terms of policy background. In fact, hosting a regional centre requires substantial human resources and financial resources. Thus, for sustainable management of the centre, a supportive policy background on the side of Ghana, a clearly defined position of the centre and a plan for its implementation are indispensable. In this respect, we should learn from this experience of having started the project without a firm verification of mid-to-long-term intension of Ghana.

② Moreover, in parallel to the verification of Ghana's intension, the prospect of how to sustain ex-post project activities should have been shared among the persons

involved in the initiation decision of this project.

③ It is imaginable that a region-wide project such as this requires a substantial amount of work for ex-post monitoring activities than a usual domestic project. It was necessary to terminate the project by drawing up a detailed monitoring plan instead of an abstract description as “WACIPAC performs”.

④ For a region-wide project in which two different languages are used as in this project, the sustainability of institutional activities highly depends on whether the project can secure bi-lingual personnel in long term. Moreover, for promotion of information networking, it is important not to out-source technical works such as website management but to internalize the work through technology transfer and/or employment of appropriate staff.

The Republic of Nicaragua

Ex-Post Evaluation of Japanese ODA Grant Aid Project

"Project of General Hospital Construction in the Department of Boaco"

External Evaluator: Jun Totsukawa, Sano Planning Co, Ltd

0. Summary

This project aims to enable Boaco general hospital to properly function as a core hospital and thereby improve its medical services for citizens in the department of Boaco and its neighbouring departments by re-constructing the hospital and providing it with relevant equipment. This objective has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy. On the other hand, although the project was implemented as planned, both the project cost and the project period slightly exceeded the plan, therefore efficiency of the project is fair. Based on the data collected in this ex-post evaluation study, all the indicators for effectiveness, including the number of outpatients and inpatients, or the number of surgical operations, show dramatic increases and there appeared some impacts such as the improvement of patient services or the motivations of the hospital staff. Judging from these findings, effectiveness and impacts of this project are high. Sustainability of this project is also high as there is no major concern either in its operation and maintenance system working in collaboration with the Ministry of Health or in its handling of technical and financial aspects, which thereby guarantees its sustainability into the future.

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

1. Project Description

Project Location

Boaco General Hospital

1.1 Background

As of 2004, the level of medical system of Nicaragua lagged behind the neighbouring countries such as Honduras or Costa Rica, as was seen in its infant mortality rate (32 out of 1,000 births) and the maternal mortality rate (120 out of 100,000) compared with Honduras (32/1000, 100/100,000) and Costa Rica (9/1000, 29/100,000). Thus, a further improvement on medical health sector was needed.

Under such a circumstance, the government of Nicaragua, partitioning the whole nation into 17 health administrative regions and establishing a local public health centre in each region as an affiliate of the Ministry of Health, initiated a medical health reform plan which aims to provide fair and efficient medical care services to its citizens. At the same time, in the national policy on medical health, it planned to modernize the country's 32 regional centre hospitals. Under such backgrounds, the Ministry of Health of Nicaragua, the executing agency of this project, designated seven hospitals as those needing urgent refurbishment, and chose Boaco general hospital as the one with the highest priority. All the hospitals suffered from acute dilapidation, but Boaco general hospital had many functional problems because its facilities were those which were originally storage facilities and were temporarily transformed into the hospital facilities, and as a result, the hospital was facing difficulties in providing patients with sufficient and safe medical services. The government of Nicaragua requested a grant aid for the implementation of the hospital refurbishment plan with the construction of facilities and provision of medical equipment in order to modernize the hospital function to the government of Japan, which already had various cooperation records to the government of Nicaragua, such as grant-aid for construction of medical facilities, such as Granada hospital construction plan (150 beds, total surface area of 7,500 m^2 ; completed in 1998), and for provision of medical facilities and equipment, as well as technical cooperation for "Project for Strengthening of the Local System of Integral Health Care of Granada" (2000 – 2004).

1.2 Project Outline

The objective of this project is to enable Boaco general hospital to properly function as a core hospital and thereby improve its medical services for citizens in the department of Boaco and its neighbouring departments by re-constructing the hospital and providing it with relevant equipment.

Grant Limit / Actual Grant Amount	1,412 million yen Detailed design: 94 million yen Main: 1,318 million yen / 1412 million yen Detailed design: 94 million yen

	Main: 1,318 million yen
Exchange of Notes Date (/Grant Agreement Date)	Detailed design：January 2006, Main：May 2006
Implementing Agency	The Ministry of Health, Republic of Nicaragua
Project Completion Date	October, 2008
Main Contractor(s)	Hazama Corporation
Main Consultant(s)	Nihon Sekkei, Inc. / Fujita Planning Co., Ltd.
Basic Design Study Period	April 2005 - September 2005
Related Projects (if any)	The Project for Construction of Granada General Hospital (1996-1998) The Project for Strengthening of the Local System of Integrated Health Care (SILAIS) of Granada (2000 - 2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun Totsukawa, Sano Planning Co, Ltd

2.2 Duration of Evaluation Study

Duration of the Study: November 2011 – August 2012

Duration of the Field Study: 29 February 2012 – 22 March 2012, 9 June 2012 – 28 June 2012

2.3 Constraints during the Evaluation Study (if any)

None in particular.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Nicaragua

(At the time of the project planning)

Nicaragua drew up "National Healthcare Plan (2004 - 2015)" with the objective of provision of

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

[2] ③: High, ② Fair, ① Low

qualitatively and quantitatively sufficient medical services, and further made "National Healthcare 5-year plan (2005 - 2009)" as a mid-term project toward the objective. This 5-year plan includes improvements on access to health-care services and on quality of medical services through the amelioration of the referral hospitals in the condition of dilapidation or of inability to provide sufficient services in seven departments (Boaco, León, Chinandega, Ocotal, San Carlos, Puerto Cabezas, Managua). Among the seven departments, the Boaco General Hospital is mentioned in the 5-year plan as one of the hospitals in the most urgent needs of reconstruction partly because the hospital is considered to be able to make an important contribution for national health-care improvement as a centre-hospital in Boaco and its neighbouring departments, in which poverty rates are high, and partly because the functional problems of Boaco hospital are strikingly obvious, as is mentioned below in the section on “Relevance with the Development Needs”.

(At the time of the ex-post evaluation study)

The above-mentioned "National Healthcare Plan (2004 - 2015)" remains as the pivotal policy for the Health sector of Nicaragua. At the time of this ex-post evaluation study, the reconstructed Boaco General Hospital is providing higher quality medical services than before and thereby is making a clear contribution to the objectives set in the National Healthcare Plan. The on-going "National Healthcare 5-year plan (2011 - 2015)" aims for sufficient medical facilities in all the levels of medical services to provide the same healthcare services to its citizens, thus its basic policy remains unaltered from the time of the planning of this project.[3]

3.1.2 Relevance with the Development Needs of Nicaragua

(1) Development needs at the time of project planning

Boaco General Hospital is a referral hospital of the primary medical facilities (seven health centres and 27 healthcare posts) and is a national referral medical facility covering its own department and the Eastern region. Its functionality as a referral hospital was considered to be substantially important because it can be most easily accessed from the Eastern region in which the use of referral hospitals are relatively difficult. However, despite such an importance, the hospital was devastated by the hurricane “Juana” in 1988, and the medical services were continued using the facilities converted from storage facilities and offices of the energy public corporation into hospital use as a temporary solution. Such a situation has been causing various problems in safety and sanitary issues, calling for an immediate improvement.[4] It is in this context that Boaco General Hospital was chosen by the Ministry of Health as the first priority hospital to be reconstructed among the seven hospitals in urgent needs.

[3] There is a one year time lag between the end of the previous plan and the start of the on-going "National Healthcare Plan (2011 - 2015)". However, the core policies remain unchanged. One point which may worth being mentioned is its emphasis on community-based healthcare activities featuring the placement of healthcare promoters in the communities.

[4] In addition to the scarce surface areas of the buildings, there were various problems, such as the crossing of the lines of flows of patients and visitors due to the structural characteristics of the buildings.

(2) Development needs at the time of the ex-post evaluation study

The reconstructed hospital is sufficiently playing its functional role as a referral hospital covering the department of Boaco and its neighbouring departments, providing medical services to a large number of patients. Incoming patients are not only from the department of Boaco, but a large number of patients also come from the neighbouring departments of Matagalpa and the Autonomous Region of North Atlantic and the Autonomous Region of South, within which the hospital is recognized as the most equipped, highest-quality medical service providing hospital. And thanks to the better facilities, the hospital newly opened urological section and paediatric surgery section, and thereby meets the regions' needs.

As above, this project has been highly relevant with the country's development plan in terms of the regions' needs for medical services at the time of the project planning and remains relevant even now as of this ex-post evaluation study.

3.1.3 Relevance with Japan's ODA Policy

Japan's Country Assistance Program to Nicaragua (October 2002) raises "Healthcare and medical services" as one of the most important assistance areas, among which it says "In consideration of Nicaragua's difficult social welfare status, Japan promotes its cooperation to Nicaragua, placing emphasis on the provision of social infrastructures and equipment in healthcare and medical services and enhancement of maintenance management abilities, for the objective of welfare improvement of Nicaragua. In this respect, this project is consistent with Japan's ODA policy to Nicaragua.

Thus, this project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[5] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

The project has substantially raised the achievement level of each indicator set at the time of the project planning, and thus is considered to have attained the quantitative effects.

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

Table 1 Evolution of the status of achievement of quantitative effects[6]

Items	2004 (Before the project)	2011
Increase of referred patients from lower tier hospitals (primary healthcare facilities)	2,602/year*	3,879/year
Increase of the number of outpatients (specialized sector, emergency)	20,519/year	56,957/year
Increase of the number of inpatients	22,953 person-day/year	44,482 person-day/year
Increase in the number of surgeries	3,262/year	4,222/year

Note: Since the incumbent president of the hospital told us that the numbers in 2004 when the project was planned are not comparable with the current numbers and thus are not suitable for comparison purpose due to the differing definitions of the two, we took the numbers of 2007, which are comparable with the current numbers.

The numbers of inpatients and outpatients of Boaco General Hospital are drastically increasing with the good reputation as a well-equipped hospital. Moreover, as it has been equipped with new surgery rooms and its related equipment and has received newly appointed surgeons, the number of surgeries is rising. The addition of urological section and paediatric surgery section to the existing sections can be raised as a contributing factor to the increase of the patients.

The urological section started its operation in August 2009, while the paediatric surgery section in January 2010. Since there is no other hospital in the department of Boaco and its neighbouring departments which have a urological section, the reputation of Boaco General Hospital is even high.

3.2.2 Qualitative Effects

Currently, Boaco General Hospital is expanding the education of doctors and nurses. In 2011, it received eight medical interns, 37 supporting operation doctors, 155 nurse interns, 29 supporting nurses[7]. Thus, "Implementation of practical training activities", one of the qualitative effects this project expected, is considered to be steadily carried out. Namely, before the reconstruction the hospital were receiving nurse interns only, but the new facilities enabled to receive various kinds of interns. Especially the programme of medical interns started in 2011 should be especially mentioned as it raised the status of the hospital (Usually, medical -interns are appointed only to hospitals in medium or large cities)

In essence, the renewed facilities eventually caused various positive effects such as training activities or enhancement of staff capacity building.

Within-hospital trainings are usually done on regular basis for the hospital staff and interns with some doctors serving as trainers before the opening hours of the hospital. In addition to this, group studies among interns or lectures by visiting personnel from the Ministry of Health are

[6] "To increase" was set as the target of this project, and any concrete absolute number was not set as targets.
[7] The supporting nurses are staff whose task is to support the nurses, while nurse interns are undergraduate students of nurse schools.

being done when necessary.

Table 2 The number of interns at Boaco General Hospital

	Before the project	After the project		
	2004	2009	2010	2011
Medical interns	0	0	0	8
Nurse interns	12	32	53	155
Supporting operation doctors	0	16	16	37
Supporting nurses	0	59	22	29

Source: Documents of Boaco General Hospital

On the other hand, as to the status of disposal of medical waste, which was instructed by the soft-component program, it is so far being implemented in compliance with the disposal method the soft-component instructed. However, the degree of compliance varies across the sectors within the hospital. To address such a situation, "Hospital patrol team" composed by the hospital's president, the vice-president and others, is undertaking weekly check-ups. In an observation without preliminary notice by the ex-post evaluation study team, we have witnessed that injection needles, hazardous waste and ordinary wastes are collected into disposal boxes, red-plastic bags, and black-plastic bags respectively, thus the disposal method is largely in compliance with the method instructed. The following table shows the result of the concerned persons' self-evaluation conducted as “beneficiary survey” under this ex-post evaluation study.

Table 3 Situation of waste disposal (Self-evaluation by Boaco Hospital personnel)

	1)	2)	3)	4)	5)	6)	7)	Total
	Always follow the rule	Mostly follow the rule	Sometimes fail to follow the rule	Follow the rule in less than half of the cases	Mostly fail to follow the rule	Do not know	Others	
Doctors	11	4	0	0	0	0	0	15
Nurses, Assistants	13	17	5	0	3	0	0	38
Total	24	21	5	0	3	0	0	53
Percentage	45.3	39.6	9.4	0	5.7	0	0	100

Source: Beneficiary survey

3.3 Impact

3.3.1 Intended Impacts

This project yielded the impacts mentioned below. To study the status of the impacts, we

conducted a beneficiary survey to patients, doctors, and nurses.[8]

(1) Improvement of patients services (in terms of "hard" infrastructure)

All the facilities, including the waiting spaces and the consultation rooms, the hospitalization buildings, are clean and spacious and receive high reputation from outpatients as well as inpatients. As in the following table, the beneficiary survey shows that all the respondents answered that the hospital improved in both aspects. (For further information, the result of the survey to the doctors, nurses and assistants is also given below).

Table 4 Recognition on cleanliness of the new hospital

	1)	2)	3)	4)	5)	6)	7)	Total
	Became very clean	Became clean	Not changed much (It has been clean since before the project.)	Not changed much (It is still not clean.)	It has worsened (It became unclean.)	Do not know	Others	
Patients	40	8	1	0	1	0	0	50
Doctors	14	1	0	0	0	0	0	15
Nurses, Assistants	19	16	5	0	0	0	0	40
Total	73	25	6	0	1	0	0	105
Percentage	69.5	23.8	5.7	0	1.0	0	0	100

Source: Beneficiary survey

Table 5 Image about the spaces of the new hospital

	1)	2)	3)	4)	5)	6)	7)	Total
	Became very spacious	Became spacious	Not changed much (It has been spacious since before.)	Not changed much (It has been small since before.)	It has worsened (It became less spacious.)	Do not know	Others	
Patients	49	1	0	0	0	0	0	50
Doctors	15	0	0	0	0	0	0	15
Nurses, Assistants	21	18	0	1	0	0	0	40
Total	85	19	0	1	0	0	0	105
Percentage	81.0	18.1	0	1.0	0	0	0	100

Source: Beneficiary survey

[8] The beneficiary survey was done by a face-to-face questionnaires survey to the doctors (15 persons), nurses and assistants (40 persons) who have been working since the old hospital before the reconstruction, and outpatients (50 persons) who have been treated at the old hospital.

(2) Improvement of patients services (in terms of "soft" infrastructure)

The results of the beneficiary survey reveal that a large majority of patients recognize that the services by doctors and nurses are also improving in addition to the factors related to the hard infrastructure. In addition to the trend of answers below, many favorable statements are heard, such as "Procedural time for hospitalization has been shortened.", "Waiting time has been shortened.", "The number of staff has increased."

Table 6 Changes in medical services by doctors

	1)	2)	3)	4)	5)	6)	7)	Total
	Became very good	Became good	Not changed much (It has been good since before.)	Not changed much (It has been bad since before.)	It worsened	Do not know	Others	
Patients	27	11	11	1	0	0	0	50
Doctors	10	5	0	0	0	0	0	15
Total	37	16	11	1	0	0	0	65
Percentage	56.9	24.6	16.9	1.5	0	0	0	100

Note: In the questionnaires to patients, we asked the respondents what they feel about changes, such as "Change in the quality of medical services - I could receive simple treatments before, but now receive treatments using various medical equipment and doctors' services got better.". We asked doctors to answer as self-evaluation about changes in medical services attributable to the renewal of the hospital.

Source: Beneficiary survey

Table 7 Changes in medical services by nurses

	1)	2)	3)	4)	5)	6)	7)	Total
	Became very good	Became good	Not changed much (It has been good since before.)	Not changed much (It has been bad since before.)	It worsened	Do not know	Others	
Patients	22	12	14	2	0	0	0	50
Doctors	9	2	3	0	0	0	0	14
Nurses, Assistants	15	15	7	2	1	0	0	40
Total	46	29	24	4	1	0	0	104
Percentage	44.2	27.9	23.1	3.8	1.0	0	0	100

Note 1: One special field doctor did not answer.

Note 2: In the questionnaires to patients, we asked the respondents what they feel about changes, such as "Change in the quality of medical services - I could receive simple treatments before, but now receive treatments using various medical equipment and doctors' services got better.". We asked the questions to doctors as supervisors and to nurses and assistants as self-evaluation.

Source: Beneficiary survey

(3) Improvement of motivation

The new facilities and equipment contributed to the improvement of the motivation of doctors and nurses and other staff. Opinions such as "I can work with positive minds because of the clean and spacious workplace.", "A mindset of keeping the new hospital clean causes positive effects not only to the good maintenance of the facilities but also to the equipment management and the waste disposal.", are heard. Some doctors answered that the new medical treatment, which has been enabled by the use of new equipment such as defibrillator or laparoscopy, contributed not only to the practical improvement of medical services but also to the motivation of the doctors.

Table 8 Change in motivation of respondents themselves

	1) (Motivation) has increased much	2) Has increased	3) Not changed much (It has been high since before.)	4) Not changed much (It has been low since before.)	5) It has decreased.	6) Do not know	7) Others	Total
Doctors	14	1	0	0	0	0	0	15
Nurses and assistants	19	16	3	1	1	0	0	40
Total	33	17	3	1	1	0	0	55
Percentage	60.0	30.9	5.5	1.8	1.8	0	0	100

Note: We asked the question "How has the workplace environment of the new hospital changed the motivation of your own.

Source: Beneficiary survey

3.3.2 Other Impacts

(1) Impacts on the natural environment

In the waste water disposal system, the neutralization tank which processes the medical examination waste water, is currently out of order and thus not working. On the other hand, as to the infectious waste water and the domestic waste water, the sterilization tanks and septic tanks are working, and thus they are properly disposed. Currently, the maintenance management staffs of the hospital dilute the medical examination waste water by manually adding water into the tank, and pour the waste into the septic tanks for the final treatment. It will be required to implement a test of waste water and a change of pumps. It is not clear at this moment if the treatment by the dilution is sufficient enough (if the extent of the dilution is enough) because a test of the quality of the liquid is not being done.

As to the sterilization tanks, CEMED (Medical Equipment Maintenance Centre: Centro de Mantenimiento de Equipos Médicos), an executing agency of the Ministry of Health, whose mission is the maintenance of medical equipment, attempted a repair but eventually found that the replacement of the pump by the new one is necessary and is considering its procurement.

(2) Other impacts

The old hospital facilities were not dismantled and are being utilized as general clinics and maternal clinics. It is located 5 to 10 minutes drive from the city of Boaco. The wider options of medical services from the clinics with easy access and the reconstructed Boaco General Hospital are appreciated by citizens.

In light of the above, this project largely achieved its objectives, therefore its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

【Hospital buildings】: It is designed with structures, wards, and rooms in the following table. Although there was a slight change such as in connecting corridors, the basic facility contents were constructed as per the original plan.

Table 9 Facility contents of this project

Ward	Functional sector	Composition of rooms
Central and outpatient ward	Outpatient (Specialized medical treatment sector)	Internal department, Surgical department, Orthopedic surgery department, Obstetrics and gynecology department, Paediatrics / Newly born babies
	Outpatient (emergency medical treatment sector)	Emergency medical treatment, Triage
	Examination sector	Radiology/Blood/Biochemical/Bacteriological examinations
	Childbirth sector	Delivery related rooms, Newly born babies rooms
	Surgery sector	Surgery related rooms
Medical treatment ward	Medical treatment sector (111 beds)	Internal department, Surgical department, Orthopedic surgery department, Obstetrics and gynecology department, Paediatrics / Newly born babies, Room with additional charges, Special care units
Management ward	Office and administration sector	Office, Training room, Library, Pharmacy
Service ward	Service sector	Kitchen/ dining hall, Cleaning room
Machinery ward	Energy supply sector	Electricity room, Self-generation room, Water tank room, Pump room
Connecting corridors		
Structure: Steel reinforced concrete construction, One-story		

Currently, all the facilities are fully utilized. The specification of the facilities have almost no problems, but only the limited number and space of storage facilities for documents, drugs, and other stuff is pointed out. It is impossible to secure further spaces because the storage facilities already utilize even the spaces up to the ceiling to maximize its capacity. Thus, the hospital is making a request of construction of new storage facilities within the hospital site to the Ministry

of Health.[9]

In terms of the frequencies of use, in addition to the medical ward and the administration ward, the service ward is always in operation to serve meals and cleanings for inpatients and hospital staff, thus the facilities are fully utilized at their maximum.

【Equipment】: Equipment are installed as per the table below.

The equipment was procured after a careful checking of the conditions of the existing equipment and thus the necessity of the replacement by the new ones, thereby almost all the equipment was fully in use. Two pieces of equipment, the fetus heartbeat detector and the transfusion pumps, are in repair or applied for repair. On the other hand, only one piece of equipment, the nebulizers, is utilized with a low frequency. This is because the nebulizers procured in this project are not designed for infusion of medical agents and thus not compatible with the other existing nebulizers.

Table 10 Main medical equipment procured in this project

Classification	Name of equipment
Radiology	X-rays apparatus, Mobile X-rays apparatus, Ultrasonic diagnostic equipment, Kits for accessories of X-rays, X-ray film developers, X film illuminator (large)
Examination	Electrocardiograph
Examination	Microscope, Refrigerator, Dry heat sterilizers, Vertical pressure steam sterilization autoclave, Pipette shaking apparatus, Horizontal shaking apparatus, Electronic balance, Constant temperature water tank, Centrifuge, Freezer, Distilled water manufacturing equipment, Stirrer, Blood cool box, Hematocrit centrifuge
Material chamber	High-pressure steam sterilization equipment (A), High-pressure steam sterilization equipment (B)
Surgery	Operating table, Patient monitoring system, Washing equipment (for three persons), Washing equipment (for two persons), Instrument kits for cesarean section, Minor surgery instrument kits, Electric cautery, Surgery light（Ceiling）, Surgery light (Mobile), Anesthesia apparatus, Surgery instrument set, Instrument set tracheotomy, Mayo stand
Newly born babies	Beds for newly born babies, Light therapy equipment, Incubator
Common to all sectors	Shaukasuten (small), Tabletop steam sterilizer, Defibrillation equipment, Scales for newborns, Infant warmer, Oxygen box, Treatment table for a newborn, Examination table, Laryngoscope (For newborn), Fetal heart detector, Screening units, Cryosurgical instrument, Pulse Oximeter, Resuscitator (For adults), Resuscitator (For children), Resuscitator (For newborn), Aspirator (small), Aspirator (large), Height weight scale, Transfusion pump, Syringe pump, Beds (For adults and children), Orthopedic bed (for adults), Delivery table, Stretcher, Treatment bed, Round car, Emergency cart, Screen, Stethoscope (for adults), Stethoscope (for children), Stethoscope (for newborn), Oxygen flowmeter, Shelf, Examination Lamps, Instrument table, Bed head units, Over bed table, Nebulizer, Ear glasses, Infusion stand, Cast cutting saw, Wheelchairs, Sphygmomanometer (for adults), Sphygmomanometer (for newborns), Cast forceps

[9] The lessons learned from Granada General Hospital (A grant aid project in 1996-1998) were reflected in the construction of the facilities.1) Installation of drugs storage facilities, 2) Expansion of rooms for newly born babies, 3) other specification of finish (such as the adoption of durable washing face bowl).

Classification	Name of equipment
Maintenance	Tools for electronics, Multimeter
Furniture, etc.	Chairs for the doctor、Desks for doctors, Round chairs, Benches, Desks for training, Chairs for training, Drug shelf, Bed for duty

【Difference between the plan and the final】

The total surface area became 5,529.8 m² mainly due to the reduction of the surface area of the connecting corridors. (210.1 m² down from the original plan)

The installation of rooms with additional charges was cancelled because of a change in the medical service system of Nicaragua. The corresponding rooms are instead used as sleeping rooms for newly born babies and expectant mothers. There is no change for medical equipment from the original plan.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The planned and the actual project costs are as per Table 11. The actual costs slightly exceeded the plan.

Table 11　The planned and the actual project costs

	Japanese side			Nicaraguan side	Project total Japan and Nicaragua
Plan	Detailed design	Main components	Total		
	94 million yen	1,318 million yen	1,412 million yen	61 million yen	1,473 million yen
Actual	94 million yen	1,318 million yen	1,412 million yen (100% of the planned)	88 million yen (144% of the planned)	1,500 million yen (101.8% of the planned)

Source：JICA documents and Boaco Hospital documents

The Japanese side was to be in charge of the construction of the main building and the procurement of equipment and furniture, while the Nicaraguan government was to be in charge of a) the creation and the levelling of ground, b) the installation of drainage system, c) the installation of water supply system, d) the installation of electricity and telephone lines, e) the road pavement, f) the installation of walls, g) the procurement of ordinary furniture and fixtures, h) the cost of the hospital relocation, i) the cost of construction work for some parts of facilities.

【Difference between the plan and the actual】

Because the first tender of the project failed due to the sharp increase of the construction materials, the detailed design was revised with re-tender, and thereby the cost sharing between Japan and Nicaragua was revised. As a result of the revision, Nicaragua bore the expenses for a hospital morgue, ambulance parking, guard offices, and outer channel construction, and thus the

costs borne by Nicaragua increased in comparison with the original plan. Nicaragua also implemented the originally planned tasks.

3.4.2.2 Project Period

The project period was longer than the planned one as shown in Table 12. The part of the project on the side of Nicaragua was also terminated within the same project period.

Table 12　The planned and the actual project period

	Plan	Actual
Detailed design and tender support	7 months	10 months : 142% of the planned （March 2006－January 2007）
Construction and construction management	15 months	19 months ：126% of the planned （April 2007 – October 2008）
Total period	Total: 22 months	Total: 29 months ：131% of the planned

Source：JICA documents

【Difference between the plan and the actual】

The failure of the first tender is considered to be the major reason of the prolonged period for the detailed design and tender support.

The period for the construction became longer than planned because of several reasons such as, a delay in the procurement of basic construction materials and equipment, a strike of delivery companies, the longer-than-expected period for securing enough workers.

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

3.5 Sustainability (Rating: ③)

3.5.1　Structural Aspects of Operation and Maintenance

Boaco General Hospital employed 90 more workers than at the time of the planning. Consequently, the number of the staff reaches 308 at the time of this ex-post evaluation study. Out of these staff, currently 8 full-time employees (engineers) (including one staff employed in 2012) belong to the Operation and Maintenance section, which is to be compared with 1 full-time employee at the time of the planning. Thus, a sufficient number of staff is assigned to the operation and maintenance. It can also be said that the continuous service by five engineers who received soft-component trainings is reinforcing the system.

As mentioned above, the number of staff of the hospital has been gradually increased. However, facing an even increasing number of outpatients and inpatients, the hospital is making a request for further increase of the workforce to the Ministry of Health. As to the fiscal year 2012, the

employment of nine new staff (three doctors, six for the management section (among which one for operation and maintenance)) was approved. The hospital considers that the number of doctors has reached a sufficient level, while there is still a shortage in nurses, and thus it needs to be solved.

As to the maintenance of special medical equipment, the system of regular preventive maintenance and repairs is established.[10]

(For reference)

In comparison with some other hospitals, it is found that Boaco hospital has the largest number of staff for the operation and maintenance despite its smallest size, which indicates how well equipped Boaco hospital's operation and maintenance section. Precisely speaking, Matagalpa hospital in the table is a regional hospital and thus even larger than department hospitals.

Table 13 Comparison with some other hospitals

	Boaco	Granada	Matagalpa
Number of beds	116	159	335
Total number of staff	308	450*	800*
Number of staff for operation and maintenance	8	7	5

Note: The number of staff of Granada and Matagalpa are rough numbers at the time of hearing by the ex-post evaluation team.
Source: Boaco Hospital documents and the hearings by the ex-post evaluation team

3.5.2 Technical Aspects of Operation and Maintenance

The staff of the operation and maintenance section is composed mostly by workers with more than five years of experience with the chief engineer having the longest experience. For the staff who has less experience or needs refresh trainings, trainings at the national technology institute or the Nicaragua-German experts training centre[11] are available. In 2011, an engineer in charge of electrical facilities received a training of medical equipment course. Judging from the practical experience they earned in their workplace and the training they received when needed, the technical aspects of operation and maintenance are considered to be largely at fully sustainable level.

On the other hand, the system of repairs by CEMED of special medical equipment is well established and in work. So far, the incinerator, the emergency electricity system, and the generator were repaired by CEMED. CEMED also performs regular maintenance of the important and expensive equipment (Equipment in X-ray department, High pressure sterilizer,

[10] CEMED is in charge of the repairs of the expensive and technically complicated equipment, such as X-rays apparatus, Ultrasonic diagnostic equipment, pressure steam sterilizer, and of the large-sized refrigerators and washing machines. Upon request, it can also repair inexpensive facilities. (see Table 14)

[11] The formal name of each institute is Instituto Nacional Tecnológico (INATEC) and Centro de Capacitación Profesional Nicaragüense Alemán (CECNA)。

etc.) as “preventive maintenance”.

Table 14 Records of preventive maintenance and repairs by CEMED (2009 – 2011)

	Preventive maintenance	Repairs	
		Record	Repaired equipment/parts
Emergency electricity generator	Yes	Yes	Change of battery terminal and others
Pressure steam sterilization autoclave	Yes	-	-
X-rays apparatus	Yes	-	-
Clothes dryer	Yes	Yes	Repair of motor axis and others
Incinerator	- （Non applicable）	Yes	Repair of within-furnace combustion appliance and others
Emergency electricity system	- （Non applicable）	Yes	Connection to X-ray apparatus

Source: Boaco hospital documents

As described above, based on the assumption that the hospital alone cannot deal with all the repairs, the hospital established the role sharing with CEMED and by so doing has managed well the operation and maintenance system. Thus, technical sustainability is considered to be largely secured.

3.5.3 Financial Aspects of Operation and Maintenance

Boaco hospital, a national hospital under the direct control of the Ministry of Health, is financially supported fully by the Ministry of Health. Its budget has increased year by year as is shown in Table 15.

Only a few years being passed since its reconstruction, there was no large-scale reparation so far. However, some reparation such as a change of floor of the kitchen, or additional installation of air-conditioners, was carried out according to the operation and maintenance plan made by the hospital.

Moreover, the Ministry of Health recognizes an increasing number of patients and is showing its intension to positively deal with the hospital’s requests for increase of the staff and the budget.

Given the above, it can be concluded that the financial sustainability for operation and maintenance is so far high.

Table 15 Budget of Boaco General Hospital (Córdoba)

	2004	2009	2010	2011	2012
Ministry of Health	11,868,000	38,856,000	42,930,000	48,591,000	56,575,000
Others	838,000	0	0	0	0
Total	12,706,000	38,856,000	42,930,000	48,591,000	56,575,000

Source: Boaco hospital documents

Table 16　Expenditure for Operation and Maintenance by Boaco General Hospital　(Córdoba)

	2007	2008	2009	2010	2011
Facilities	0	1,800	16,500	756,087	565,610
Medical equipment	9,027	74,720	46,944	23,466	235,911

Source: Boaco hospital documents

3.5.4　Situation of operation and maintenance management

Regarding the method for operation and maintenance management, recordings of the status of the facilities and equipment on regular basis are being done using the equipment inventory account book and the maintenance account book guided and made by the soft-component program. In the inspection by this study team, it was confirmed that the tracking record of the status and the repairs is readily available from the account book, and thus it is largely being implemented well.

The other facilities and equipment are utilized without any problem. Also, defects in the washing machine and an anticorrosive painting of the delivery beds in the service section, which were pointed out in the ex-post status-quo study in 2010, were already duly dealt with. Re-painting of the walls of the inpatient ward and a construction of new storage facility are scheduled in 2012.

As mentioned above, most equipment is duly utilized, but the equipment currently out of order are:

① Fetus heartbeat detectors (3 out of order, 1 in operation)
② Transfusion pumps (1 out of order, 1 in operation)
③ Neutralization tank pump

Out of these equipment, ① and ② needs replacement of parts, but the parts are not available in Nicaragua. Thus, a budget for its purchase needs to be secured. For ③ Neutralization tank pump, replacement by a pump available in Nicaragua is being considered.

If we raise a potential problem, it is the following issue. Medical equipment is mainly imported from abroad. Thus, depending on the sorts of defects, it might be necessary to directly purchase from agents or from abroad. Since CEMED is exclusively serving the maintenance of all the medical equipment in Nicaragua nationwide, whether it can readily respond to requests of repairs or of purchase of parts from various hospitals depends on the importance and the substitutability of the equipment and the priority in the budget of CEMED. Under such circumstances, it is possible that the priority by CEMED is low for a case such as the one of fetus heartbeat detectors, in which one detector is still in operation.

In light of the above, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aims to enable Boaco general hospital to properly function as a core hospital and thereby improve its medical services for citizens in the department of Boaco and its neighbouring departments by re-constructing the hospital and providing it with relevant equipment. This objective has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy. On the other hand, although the project was implemented as planned, both the project cost and the project period slightly exceeded the plan, therefore efficiency of the project is fair. Based on the data collected in this ex-post evaluation study, all the indicators for effectiveness, including the number of outpatients and inpatients, or the number of surgical operations, show dramatic increases and there appeared some impacts such as the improvement of patient services or the motivations of the hospital staff. Judging from these findings, effectiveness and impacts of this project are high. Sustainability of this project is also high as there is no major concern either in its operation and maintenance system working in collaboration with the Ministry of Health or in its handling of technical and financial aspects, which thereby guarantees its sustainability into the future.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Because the neutralization tank is not in operation, the PH of the examination waste water may not be properly managed. It is required that examination of waste water from the hospital done, and then proper chemical administration be implemented as a temporary solution. In the middle term, it is needed to purchase replacement pumps and regain the previous system of stable PH management.

4.2.2 Recommendations to JICA

None in particular.

4.3 Lessons Learned

One of the most important factors which contributed to this project's sustainability is the initiative on the staff's mind-set change led by the president and the high ranking personnel of the management section. In short, it is "Hospital patrol". It is worth mentioning that the president's regular visits to each section for checking and discussion/consultation instead of unilateral messages by letters urged the staff's proper disposal of medical wastes and proper handling of facilities and equipment, and eventually yielded positive changes. We can learn from this, in addition to the importance of the leadership, regular visits by the organization's upper echelon are very effective to enhance sustainability.

Republic of Nicaragua

Ex-Post Evaluation of Japanese ODA Grant Aid Project

Project for Reconstruction of Primary Bridges on the National Road No.7

External Evaluator: Jun TOTSUKAWA, Sano Planning Co., Ltd.

0. Summary

The objective of this project is to ensure safe and steady traffic and transport on Route-7 by reconstructing the dilapidated Las Limas Bridge, Oconqua Bridge, Quinama Bridge, and Muhan Bridge and constructing access roads to them in Boaco Department and Chontales Department, thereby contributing to improvement in convenience of local residents. This objective was relevant with Nicaragua's development policies and development needs at the time of planning and is still relevant at the time of ex-post evaluation, and therefore the relevance of the project is high. The bridges subject to this project have been reconstructed as planned and both project cost and project period were within the plan, and therefore the efficiency of the project is high. Further data collected at the ex-post evaluation study show the targets concerning reduction of weight limit of vehicles passing over bridges, increase of traffic, and increase of average drive speed specified at the time of planning have been all achieved, and safety of pedestrian has been ensured. Therefore the effectiveness of the project is high. No major problems have been observed in the operation and maintenance system as well as financial basis of both Ministry of Transport Infrastructure and Road Maintenance Fund (FOMAV), and a certain level of sustainability will be guaranteed in the future. Therefore the sustainability of the project is high.

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

1. Project Description

Project Location

(Route-7 is shown as the bold line stretching laterally in the center.)

Las Limas Bridge

1.1 Background

The Republic of Nicaragua is situated in the center of Central America, facing the Caribbean Sea on the east and the Pacific Ocean on the west, and has a population of 5,630,000 as of 2004. In Nicaragua, road transport accounts for about 90% of the transport of passengers and goods, and is the most important mode of transport. Nevertheless, Nicaragua was apparently lagging behind in building infrastructure such as roads and bridges in the area on the Atlantic Ocean side, which resulted in delay of regional development. Consequently, more people lived in poverty compared to those in the area on the Pacific Ocean side. The economic gap between two areas had become a big social problem in Nicaragua. To solve this problem, the Nicaraguan government identified renovation of the El Rama port and restoration of Route-7 connecting the El Rama port and Managua, the capital of Nicaragua, as key measures, aiming at economic development through trade with the United States based on the El Rama port on the Atlantic Ocean side and promotion of regional development in the area on the Atlantic Ocean side.

Route-7 itself had been improved with the aid of several donors, while dilapidated bridges on Route-7 had not be sufficiently reconstructed, which interfered with the passage of large vehicles. Further once renovation of the El Rama port was completed, the traffic of large and heavy vehicles was expected to increase as more goods were handled at the renovated port. For this reason, bridge reconstruction on Route-7 was given higher priority.

Under such a situation, the Nicaraguan government requested the Japanese government to provide grant aid in July 2003 for reconstructing four bridges on Route-7 that are under unsafe environment and faces the limited weight of passing vehicles due to their structural problems, damages, and narrow road widths.

In reply to this request, the Japanese government dispatched a preliminary study team in November 2004 concerning the relevance of the project to confirm the necessity of urgently reconstructing these four bridges. Then after various subsequent studies, the relevance of the project to be conducted as Japan's grant aid was confirmed through importance of the road network, wide area to gain benefit and urgency, and then implementation of this project was approved.

1.2 Project Outline

The objective of this project is to ensure safe and steady traffic and transport on Route-7 by reconstructing the Las Limas Bridge, Oconqua Bridge, Quinama Bridge, and Muhan Bridge and constructing access roads to them in Boaco Department and Chontales Department, thereby contributing to improvement in convenience of local residents.

E/N Limit /Actual Grant Amount	1,004 million yen (Detailed Design: 43 million yen, Main: 961 million yen) /1,004 million yen

		(Detailed Design: 43 million yen, Main: 961 million yen)
Exchange of Notes Date		Detailed Design: August 2006, Main: June 2007
Implementing Agency		Ministry of Transport Infrastructure, Nicaragua
Project Completion Date		March 2009
Cooperation Agency in Japan	Main contractor	Fujita Corporation
	Consultant	Central Consultant Inc.
Basic Design Study		August 2005 to June 2006
Related Projects (if any)		• Project for Reconstruction of Bridges on Nejapa–Izapa Road (1994–95) • Project for Reconstruction of Bridges on Main Routes (1995–96) • Secondary Project for Reconstruction of Bridges on Main Routes (1998–2000) • Project for Construction of Facilities Associated with the Rio Negro Bridge (2000) • Project for Reconstruction of Bridges on Major Roads (1999–2001) • Project for Reconstruction of the Guasaule Bridge (2000–02)

2. Outline of the Evaluation Study

2.1 External Evaluator

Jun TOTSUKAWA, Sano Planning Co., Ltd.

2.2 Duration of Evaluation Study

The evaluation study was conducted as follows:

Duration of the Study: November 2011 – August 2012

Duration of the Field Study: February 29, 2012 – March 22, 2012, June 9, 2012 – June 28, 2012

2.3 Constraints during the Evaluation Study (if any)

None in particular.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Nicaragua

(At the time of project planning)

In the "National Development Plan (2003)[3]," the Nicaraguan government identified the importance to alleviate the economic gap between the east and west parts of the country through development of the area on the Atlantic Ocean side, and economic development through trade with the United States based on the El Rama port. Then, the plan ranked the renovation of the El Rama port and the restoration of Route-7 connecting the capital city, Managua and El Rama as key measures.

Further, the Ministry of Transport Infrastructure devised the "National Transport Plan (PNT)" in which the 10-year project for constructing access roads starting in 2000 was thought important for promotion of development in the area on the Atlantic Ocean side. Especially, restoration of Route-7 leading to Managua was given priority.

In light of above, this project has been highly relevant with Nicaragua's development policy.

(At the time of ex-post evaluation)

The National Development Plan described above is still Nicaragua's valid primary policy. In the "National Human Development Plan (PNDH: Plan Nacional de Desarrollo Humano, September 2009)" enacted after the planning of this project, the Nicaraguan government also identified development of infrastructure including roads and bridges as key measures for reduction of poverty[4].

Therefore, this project was relevant with Nicaragua's development plan at the time of planning and is still regarded as key measures at the time of ex-post evaluation.

3.1.2 Relevance with the Development Needs of Nicaragua

(1) Development needs at the time of planning

Since Nicaragua has mountains to reach the area on the Atlantic Ocean side, development of roads and bridges had not advanced so considerably compared to the other area, leading to delay of local development. Further, this resulted in a higher ratio of poor people compared to that in the area on the Pacific Ocean side. Consequently, the local development on the Atlantic Ocean side had been regarded as an important nationwide issue.

Route-7 to be improved under this project is a major road connecting the capital city Managua and

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

[2] ③: High, ②: Fair, ①: Low

[3] The National Development Plan is a 25-year plan, and an operation plan was devised to embody the implementation of the plan in 2004.

[4] However, an actual plan determining the target schedule for improvement of the entire Route-7 has not been created so far. Actually, the Ministry of Transport Infrastructure has reconstructed or rehabilitated bridges with higher priorities, considering its available budget and support situation by donors.

the area on the Atlantic Ocean side, and had been restored by several donors since the 2000's. However, middle- to large-scaled bridges were not covered by such donors' aids, and had not been restored or reconstructed for a long time. The Nicaraguan government faced problems to be solved for smooth vehicle traffic and prevention of accidents[5].
Therefore, improving efficiency and safety of traffic and transport through reconstruction of bridges on Route-7 has been relevant with the development needs of both Nicaragua and local community.

(2) Development needs at the time of ex-post evaluation
Through improvement of roads and bridges under this project and others, networking of major roads has been established on Route-7. Though other three bridges additional to this project are currently being reconstructed on Route-7 as Japan's grand aid project at the time of ex-post evaluation, reconstruction of middle to large-scaled bridges on Route-7 will be almost completed by this current project. After the on-going project ends, the major works in charge by the Ministry of Transport and Infrastructure will be shifted towards rehabilitation works on deteriorated roads and small to middle-scaled bridges.

Therefore, this project was important from viewpoints of economic development and safety aspects at the time of planning, and is still relevant with the development needs of Nicaragua at the time of ex-post evaluation.

3.1.3 Relevance with Japan's ODA policy
At the time of planning, one of the key fields in the assistance plan for Nicaragua was "improvement of road and traffic infrastructure (improvement of economic development basis)". This project was intended to ensure safe and steady traffic and transport by reconstructing dilapidated bridges on Route-7, a main road connecting Managua and the area on the Atlantic Ocean side. Therefore, the project has been consistent with Japan's ODA policy.

In light of above, this project has been highly relevant with the Nicaragua's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[6] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)
The quantitative effects to be aimed at by this project have been achieved as below.

[5] Since bridges to be improved under this project had a narrower road width than roads before and after them, cars had to temporarily stop before or after them, which prevented smooth traffic.
[6] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 1 Achievement State of Quantitative Effects

Indicator name (unit)	Figure at planning period (in 2005)	Target (in 2009)	Actual (in 2009)	Ex-post evaluation (in 2011)
Relaxation of weight limit regulation of vehicles passing over bridges (t)	24.5	40.9	40.9	40.9
Increase of traffic (vehicles/day)	Las Limas bridge 2,300 (including 775 large vehicles) Other 3 bridges 700 (including 306 large vehicles)	Increase	Las Limas bridge 3,752 (including 1,255 large vehicles) Other 3 bridges 1,031 (including 391 large vehicles)	Las Limas bridge 4,345 (including 1,668 large vehicles) Other 3 bridges 1,042 (including 370 large vehicles)
Increase of average drive speed (km/h)	30	60	Over 60	Over 60

Source: Data from the Ministry of Transport Infrastructure

All quantitative effects have been achieved. As for “Relaxation of weight limit regulation of vehicles passing over bridges”, the bridges were reconstructed based on the design in consideration of 25% overweight, which is the American Association of State Highway and Transportation Officials (AASHTO) (HS20-44) agreed in Central American Integration System, and the target value 40.9 ton has been achieved.

“Increase of traffic” was found in the bridges reconstructed under this project. Especially the traffic over the Las Limas Bridge has increased more than the other three project bridges because this bridge is located halfway from Managua to Chontales, the capital of Chontales Department as well as to Boaco, the capital of Boaco Department. Further Route-9 connecting Boaco Department and Managua and Route-25 connecting Chontales, Rio San Juan Department and Managua located on the south join Route-7, which with the Santa Fe Bridge construction will become an international route that leads to the new southern border with the neighboring country of Costa Rica . The Las Limas Bridge is located just at the joining point. On the other hand, the increase of traffic over the other three project bridges has been relatively small compared to the Las Limas Bridge because they have no such joining major roads.

The average drive speed is currently 60 km as planned or over 60 km because a line of vehicles waiting in front of a bridge has diminished and smooth traffic has been realized.

3.2.2 Qualitative Effects

As qualitative effects, pedestrians' safety was intended. Compared to the previous condition in which no side walk was provided, the side walk with adequate-width has been provided so that pedestrians can walk in safety. Local residents now realize improved safety[7]. However, there is no house and are actually few people walking near the Oconqua Bridge and Quinama Bridge, though there are some people near the Las Limas Bridge and the Muhan Bridge.

Further, reconstruction of bridges under this project was expected to decrease the number of car accidents. However, its effect cannot be verified because local police has no available data for comparison and the Ministry of Transport Infrastructure has statistics in a generalized manner by department and not necessarily in the specific areas of the bridges. r.

This project has largely achieved its objectives, therefore its effectiveness is high.

3.3 Impact

3.3.1 Intended Impacts

Implementation of this project has caused the following impacts.

(1) Stabilization of distribution and reduction of local residents' poverty in the area depending on Route-7

Implementation of this project has caused the load bearing capacity of the project bridges to increase and safe and steady traffic roads to be secured. Further anxiety that bridges shutdown to traffic due to swollen rivers in rainy season has diminished, leading to increased reliability of transport and traffic in the area concerned.

Steady infrastructure has also contributed to stabilization of distribution in the livestock industry, the key industry in the area. It can be assumed that this indirectly contributes to reduction of poverty among local residents. As an example regarding stabilization of distribution in the livestock industry, the export of cattle (export of living cattle) to the Republic of Venezuela has been increased since 2008. The transport route associated with this export includes project bridges and the El Rama port[8].

(Reference)

Since a cause-and-effect relation between stabilized distribution and reduced poverty under this project can only be obtained indirectly and cannot be verified actually, the change of poverty level in the area concerned is shown in Table 2. In Nicaragua, there is no data about gross regional production and poverty index for each department, and thus only comprehensive data showing the

[7] According to the results of the field hearing study by the study team

[8] The export reached about 6,000 cattle in 2011, compared to about 600 cattle in 2008. (Source: Ministry of Transport Infrastructure)

state in a very wide area are available. Nevertheless, the table indicates the percentage of households living in poverty decreased in the “central rural area” including the area concerned at a higher rate than the national average.

Table 2 Ratio of households living on two dollars or less a day (%)

	2005	2009	Decrease rate*
National average	31.6	21.0	10.6
Urban area average	15.9	9.8	6.1
Rural area average	51.4	35.7	15.7
Managua	8.9	6.5	2.4
Urban area on the Pacific Ocean side	18.8	10.8	8
Rural area on the Pacific Ocean side	41.0	26.7	14.3
Central Urban area	24.4	14.0	10.4
Central Rural area	59.2	40.7	18.5
Urban area on the Atlantic Ocean side	20.9	13.6	7.3
Rural area on the Atlantic Ocean side	56.7	41.2	15.5

Note: A decrease rate is a difference between the percentage of households living on two dollars or less in 2005 and that in 2009, and is an item added by the study team.
Source: Living Standard Survey (National Development Agency, May 2011)

(2) Management of the increased amount of freight to be handled due to renovation of the El Rama port

The amounts of both freight handled at the port and traffic of ship sailing in or out have been increased since the construction of a new pier at the El Rama port in October 2005. This project has contributed to stable distribution enough to manage such increase of transport by improving the load bearing capacity of the project bridges.

Judging from the fact that Route-7 is the only major road connecting the El Rama port and Managua, it can be assumed distribution traffic associated with export and import activities at the port passes over project bridges. (Actually, there is a possibility that a route other than Route-7 is used for distribution because the major road joins at a point beyond the Oconqua Bridge, that is, the Las Limas Bridge.)

Table 3 Change of the Amount of Freight Handled at the El Rama Port (in ton)

		2005	2006	2007	2008	2009	2010	2011
El Rama	Import	4,408	8,564	10,716	19,399	11,904	15,553	21,577
	Export	2,283	3,787	8,426	11,077	16,994	16,604	18,262
	Total	6,691	12,351	19,142	30,476	28,898	32,157	39,839
National	Import	2,120,431	2,353,948	2,446,200	2,346,283	2,347,740	2,317,301	2,782,685
	Export	386,623	352,664	492,107	456,319	484,027	691,851	655,066
	Total	2,507,054	2,706,612	2,938,307	2,802,602	2,831,767	3,009,152	3,437,751

Source: Marine General Department, Ministry of Transport Infrastructure

3.3.2 Other Impacts

(1) Impacts on the natural environment

Neither positive nor negative impact on the natural environment has been found. Since this project had been classified as Category B according to JICA's Guidelines for Environmental and Social Considerations, the Initial Environment Examination (IEE) was conducted at the preliminary study to confirm that there was no possibility of causing a problem.

(2) Land acquisition and resettlement

At the start of this project, nine households that illegally occupied land around the Muhan Bridge were resettled. The resettlement was completed by the municipal government before the start of the reconstruction, and no confusion arose with the resettlement. The resettlement place is the land owned by Villa Sandino city which has jurisdiction over the relevant land, and resettlement was conducted after explanation to the residents concerned.

(3) Unintended positive/negative impact

Disassembled bridge parts were not disposed of, but effectively utilized as parts for other bridges through the efforts of the Nicaraguan side. The "I" beams disassembled from the project bridges were utilized to construct one bridge in Boaco Department and three bridges in Chontales Department on the branch road of Route-7. The construction of these bridges is attributed to the effects of the Nicaraguan side, and not connected to direct assistance from the Japanese side, though, from the viewpoint of effective use of resources derived from this project, this should be noted as one of impacts and it constitutes an added value to the effects of the project.

This project has largely achieved its objectives, therefore its effectiveness and impact are high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Under this project, four bridges on Route-7 in Boaco Department and Chontales Department were reconstructed. All of them were reconstructed with the same structure and specifications as their original designs.

Table 4 Outline of the Bridges Reconstructed under this Project

	Las Limas Bridge	Oconqua Bridge	Quinama Bridge	Muhan Bridge
Bridge facility	New construction of a bridge	New construction of a bridge	New construction of a bridge	New construction of a bridge
Bridge length	32m	65m	39m	65m
Total bridge width	9.7m	9.7m	9.7m	9.7m
Superstructure format	PC simple T beam	PC3 span connecting post-tension T beam	PC2 span connecting post-tension T beam	PC3 span connecting post-tension T beam
Access road	Left bank:11.4m Right bank: 11.3m	Left bank: 8.0m Right bank: 14.4m	Left bank: 188m Right bank: 132m	Left bank: 7.8m Right bank: 8.1m

Source: Data from JICA

3.4.2 Project Inputs

3.4.2.1 Project Cost

Given below are the original and actual project costs of this project. The project cost was lower than planned.

Table 5 Original and Actual Project Costs

	Japanese side			Nicaraguan side	Total project cost Borne by Japan and Nicaragua
Original	Detailed design	Main	Total		
	43 million yen	961 million yen	1,004 million yen	18 million yen	1,022 million yen
Actual	43 million yen	961 million yen	1,004 million yen (100% compared to the original)	6 million yen (33.3% compared to the original)	1,010 million yen (98.8% compared to the original

Source: Data from JICA and Ministry of Transport Infrastructure

The Japanese Government side bore the costs of reconstructing or constructing project bridges and new access roads, arranging, importing and transporting construction materials, as well as building and removing temporary facilities (material/equipment yard, office, etc.). The Nicaraguan side, on the other hand, bore the costs of a) environmental consideration (resettlement and land acquisition),

b) moving telephone poles and distribution lines, c) moving water pipelines, d) leveling the temporary facility yard, e) traffic control, and f) removing the existing Quinama Bridge.

【Difference between original and actual project costs】

The actual project cost borne by Nicaragua was largely lower than the planned. This was mainly because the labor cost associated with traffic control, that occupied the large part of the project cost, was lower than the estimated one and moving of water pipelines was unnecessary due to a newly discovered water resource nearby.

Another reason for the reduced project cost in yen at the Nicaraguan side was that the yen exchange rate against the dollar had risen by about 30% in December 2008, compared to that at the time of project cost calculation in December 2005.

3.4.2.2 Project Period

Given below are the original and actual project periods of this project. The project period was as planned. The Nicaraguan side have carried out and completed their works.

Table 6 Original and Actual Project Periods

Item	Original	Actual
Design for execution and aid for bidding	12 months	12 months : 100% compared to the original (October, 2006－September, 2007)
Implementation and implementation management	18 months	18 months : 100% compared to the original (October, 2007－ March, 2009)
Entire project	30 months in total	30 months in total : 100% compared to the original

Source: Manuals from JICA

【Difference between the original and actual project periods】

The project period was as planned. Though works were somewhat delayed due to heavy rains and effects of strikes within Nicaragua in the middle of the project, the entire project was completed as planned thanks to the efforts of the constructor and fewer rainy days in the dry season.

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

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

Nicaragua has established the operation and maintenance system for roads and bridges where both

Ministry of Transport Infrastructure and the Road Maintenance Fund (FOMAV: Fondo de Mantenimiento Vial) are supposed to take responsibility. The Ministry of Transport Infrastructure is in charge of middle to large-scaled reconstruction, while FOMAV is in charge of small-scaled reconstruction as well as daily operation and maintenance. Roads and bridges to be reconstructed shall be determined through an Inter-institutional Agreement established as Maintainable Road Network through an Annual Maintenance Plan between Ministry of Transport Infrastructure and FOMAV. A bridge or road with an estimated reconstruction cost exceeding 10% of the construction cost shall be assigned to the Ministry of Transport Infrastructure, and that with an estimated reconstruction cost below 10% shall be assigned to FOMAV.

At the time of ex-post evaluation, the Ministry of Transport Infrastructure has 61 members at the road and bridge maintenance department, of which 39 members are engineers. On the other hand, FOMAV has currently 50 members, of which 15 members are engineers. Judging from the fact that the number of FOMAV staff has been increased to 50 compared to 15 at the time of planning of this project, FOMAV has almost reached a solid organization enable to manage their duties as a planning and coordinating agency. The Ministry of Transport Infrastructure has almost same number of staff at the maintenance-related department as at the time of planning of this project, though it is difficult to make a strict comparison between these two times because of the changed organizational structure.

Both organizations are mainly engaged in plan and coordination, and subcontract all actual operation and maintenance works to private companies. Therefore, it can be said that they have sufficient number of staff and organizational structure as planning and coordinating agencies.

3.5.2 Technical Aspects of Operation and Maintenance

As for “planning” operation and maintenance, a certain level of technical capability has been acquired. The Ministry of Transport Infrastructure has an established sequence of steps for a road or bridge of which reconstruction or improvement is requested by each department, including document screening within the ministry, field survey by engineers, creation of an inventory, ordering based on the construction method and estimation, and application for budget.

As for “doing” regular operation and maintenance, actual works have been subcontracted to private companies and local residents’ cooperative unions through discussion between the Ministry of Transport Infrastructure and FOMAV, as described above.

One of the main daily operation and maintenance works is sweeping gutters, which requires no special technique. Further the project bridges do not require rust proofing treatment or re-painting of railings because they are made of concrete, which also requires no special technique in operation and maintenance. Access roads are to be re-paved at regular intervals, but the private company having considerable experience in construction in Nicaragua can undertake this job.

In light of above, sustainability of the project is high from the technical aspects of operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

The budget for running FOMAV that is responsible for operation and maintenance in this project is based on gasoline tax, and therefore its stability is very high. Now, 16 cents (USD) per gallon of gasoline tax are allocated to FOMAV, and an application for further allocation to FOMAV is being filed this year. The allocation of gasoline tax to FOMAV was originally set to six cents in 2006, and has been gradually increased to 16 cents since then (therefore, FOMAV revenue has been also increased until now)[9].

The FOMAV Establishment Law stipulates that the management cost (such as labor cost and study cost) should be within 4% of the total expenditure. The remaining of the expenditure shall be allocated to actual operation and maintenance works.

Table 7 Actual Revenue and Expenditure of FOMAV (Unit: 1000 Cordoba)

		2009	2010	2011
Revenue		634,755	1,116,659	886,357
Expenditure	Management cost	18,491	26,341	31,861
	Project cost	405,628	1,238,609	716,221
	Others	15	11	1,221
	Total	424,133	1,264,961	749,304

Note: The year 2010 is different from normal years because of loan provided.
Source: Data from FOMAV

The Ministry of Transport Infrastructure, which is in charge of large-scaled reconstruction, is not expected to be involved in this project for the meantime because they are constructed very recently. However, as reference, the budget of the Ministry of Transport Infrastructure is shown below. As shown in Table 8, the budget of the Ministry of Transport Infrastructure has been also increased in recent years.

[9] Now, an application for increase to 20 cents/gallon is being filed (according to the interview with the Planning Technical Department of the Road Maintenance Fund - FOMAV).

Table 8 Budget of the Ministry of Transport Infrastructure (Unit: million Cordoba)

	2010	2011	2012
Ministry of Transport Infrastructure	2,622	2,893	2,905
Road& Bridge Maintenance Department	303	389	581
Share of the total ministry budget	11.6%	13.4%	20.0%

Source: Data from the Ministry of Transport Infrastructure

3.5.4 Current Status of Operation and Maintenance

At present, all of the four project bridges are effectively utilized and no major problems have been observed in the operation and maintenance system.

Actual operation and maintenance works have been conducted by FOMAV according to the work schedule proposed by the Japanese side, as shown below. No repair work has been conducted on revetment or bed protection because of no damage detected.

Table 9 Operation and Maintenance Work Schedule for the Project Bridges

Item / Year	2009		2010		2011	
	Plan	Actual	Plan	Actual	Plan	Actual
Operation and maintenance of gutters	Yes	Yes	Yes	Yes	Yes	Yes
Operation and maintenance of road safety facilities	No	No	Yes	Yes	No	No
Operation and maintenance of access roads	Yes	Yes	Yes	Yes	Yes	Yes
Inspection and repair of revetment and bed protection facilities	No	No	Yes	Yes	No	No

Source: Basic Design Report of this project as well as Data from the Ministry of Transport Infrastructure and FOMAV

Currently, daily operation and maintenance works including sweeping of gutters are subcontracted by FOMAV to two private companies (one company for the Las Limas Bridge and one for the other three bridges). The subcontract with each of these private companies amounts to 1.06 million Cordoba (equal to 3.70 million yen) annually, and they cover 67 km (corresponding to the Las Limas Bridge) and 50 km (corresponding to the remaining three bridges) respectively. Actually, the ex-post evaluation study team saw a team of uniformed workers weeding and clearing on and around the roads on several occasions and judged their working state to be almost favorable.

One of the actual reconstruction works conducted is the repair of the asphalt pavement of the access road to the Las Limas Bridge. This work was conducted by FOMAV's subcontracting private company (at a cost of about 8,000 Cordoba = about 28,000 yen, estimated value by FOMAV)).

No major problems have been observed in the operation and maintenance system, therefore, the

sustainability of the project effects is high.

4. Conclusion, lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to ensure safe and steady traffic and transport on Route-7 by reconstructing the dilapidated Las Limas Bridge, Oconqua Bridge, Quinama Bridge, and Muhan Bridge and constructing access roads to them in Boaco Department and Chontales Department, thereby contributing to improvement in convenience of local residents. This objective was relevant with Nicaragua's development policies and development needs at the time of planning and is still relevant at the time of ex-post evaluation, and therefore the relevance of the project is high. The bridges subject to this project have been reconstructed as planned and both project cost and project period were within the plan, and therefore the efficiency of the project is high. Further data collected at the ex-post evaluation study show the targets concerning reduction of weight limit of vehicles passing over bridges, increase of traffic, and increase of average drive speed specified at the time of planning have been all achieved, and safety of pedestrian has been ensured. Therefore the effectiveness of the project is high. No major problems have been observed in the operation and maintenance system as well as financial basis of both Ministry of Transport Infrastructure and Road Maintenance Fund (FOMAV), and a certain level of sustainability will be guaranteed in the future. Therefore the sustainability of the project 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

At present, the Ministry of Transport Infrastructure and FOMAV cooperate to implement the operation and maintenance system of roads and bridges effectively and efficiently, and no major problems have been observed so far. In Nicaragua, however, there are still some bridges and roads to be improved on major roads. Thus both Ministry of Transport Infrastructure and FOMAV are expected to continue their efforts. In this respect, it is recommended that they should more clearly recognize the state of each major road and devise a comprehensive mid- to long-term reconstruction plan that represents when and where reconstruction is to be conducted. Such a plan can be expected to help both organizations conduct reconstruction works efficiently as well as to play a role as guidepost for promotion of common understanding when the Nicaraguan government receives support from an external financial organizations.

4.2.2 Recommendations to JICA

None in particular.

4.3 Lessons Learned

The existence of FOMAV with gasoline tax set as financial resources is a great driving force in guaranteeing financial sustainability of this project. That is, a situation in which budget can be secured constantly allows for implementation of a workable operation and maintenance plan.

In establishment of FOMAV, the FOMAV Establishment Law was enacted to clearly formulate a rule that FOMAV should allocate most of the expenditure to operation and maintenance of roads and bridges, which is the major mission of FOMAV. This law proved effective in clarifying an organization policy of FOMAV and preventing expansion of the organization through the appropriate number of staff in accordance with the policy (the Establishment Law defines the labor cost should be within 4% of the total expenditure). Though similar organizations are found in other Central American countries, FOMAV is worth proposing as an effective approach for guaranteeing sustainability to countries eligible for Japan’s grant aid in other continents or areas.