Ex-Post Project Evaluation 2010: Package IV-4
(Sri Lanka, Bangladesh)

November 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

OPMAC Corporation

Mitsubishi UFJ Research & Consulting Co., Ltd.

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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.

November 2011
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.

Sri Lanka

Ex-Post Evaluation of Japanese ODA Loan
"Kalu Ganga Water Supply Project for Greater Colombo"

External Evaluator: Hajime Onishi
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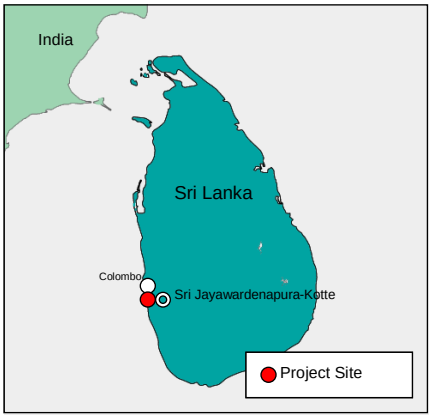
0. Summary

This project is highly consistent with government policies, and no problems with operation and maintenance (O&M) systems can be found. Although slight concern remains about the financial sustainability of the implementing agency (the National Waster Supply & Drainage Board, NWSDB) itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities relating to this project steadily expanding. Major indicators such as population served, percentage of population served, amount of water supplied, and facility utilization rate have exceeded 80% of the target value, and there is no particular problem with the quality of the treated water produced. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Location Map

Water Treatment Plant

1.1 Background

As of 1997, Kelani Ganga was the only source of water supply in Colombo, the commercial capital of Sri Lanka, and there were concerns over the expected shortage of water supply capacity in the future and the problem of salinity intrusion during the drought.

The water treatment facilities in Greater Colombo Area available at that time consisted of two systems: 1) the old and new Ambatale Water Treatment Plants located about 10 km east of Colombo (water treatment capacity: 468,000 m^3/day; a repair project completed in 1995 with grant assistance from Japan); and 2) the Kalatuwawa and Labugama Water Treatment Plants (water treatment capacity: 150,000 m^3/day). On the other hand, according to the preliminary study (Special Assistance for Project Formulation, SAPROF) conducted by the Japan International Cooperation Agency (JICA) (then the JBIC), water shortage was predicted for 2003 and after, and the gap between supply and demand was estimated at 45,000 m^3/day for 2005 and 314,000 m^3/day for 2008.

In addition, as of 1997, water supply and drainage facilities had not been established in many poor residential areas in Greater Colombo (there are said to be about 5,000 poor

residential areas), where extreme poor living conditions were causing sanitary and health problems such as waterborne diseases. No water charge was collected for the use of water from communal taps dotting the poor residential areas, a situation that was contributing to the high rate of non-revenue water (50% for Greater Colombo). In addition, the lack of cost-consciousness among residents was resulting in the wasteful use of water. In view of these circumstances, the government of Sri Lanka set forth a policy to reduce the number of communal taps and promote the introduction of household water supply systems in poor residential areas.

Under these circumstances, the most pressing tasks for the Sri Lankan government were to develop new sources of water supply and eliminate the gap between water supply and demand in Greater Colombo Area, while addressing the issue of salinity intrusion in Kelani Ganga. In this regard, there was a need for the early implementation of a water supply project using Kalu Ganga, which had not been utilized, as a new water source. In addition, the establishment of a water supply and drainage system in poor residential areas was urgently needed, as the improvement of living conditions in those areas was necessary.

1.2 Project Outline

The objective of this project is to meet the increased demand of water and to secure the stable water source, even during the dry season in the Greater Colombo area by constructing new water supply system which utilize the Kalu Ganga River as a new water source, thereby contributing to the improvement in public health and business environment in the target area.

In addition, a supplementary component to the project, household water connections and drainage facilities in the selected poor residential areas were constructed with the participation of beneficiary residents.

Loan Amount / Disbursed Amount	11,278million yen / 11,107million yen
Exchange of Notes / Loan Agreement Signing Date	June 1997 / August 1997
Terms and Conditions	Interest Rate: 2.1% Repayment Period: 30 years (Grace Period:10 years) Conditions for Procurement: General Untied
Borrower / Executing Agencies	Democratic Socialist Republic of Sri Lanka / National Water Supply and Drainage Board (NWSDB) and Ministry of Housing and Urban Development
Final Disbursement Date	August 2008
Main Contractors (over 1 billion yen)	China GEO Engineering Corporation (China)
Main Consultant (over 100 million yen)	Nihon Jogesuido Sekkei (Japan) / NJS Consultants Co., Ltd. (Japan) (JV)
Feasibility Studies, etc.	1994 Feasibility Study (by JICA) 1997 Special Assistance for Project Formulation (SAPROF, by former JBIC)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Onishi (Mitsubishi UFJ Research & Consulting)

2.2 Duration of Evaluation Study

Duration of the Study: December, 2010 – November, 2011

Duration of the Field Study: March 9, 2011 – March 24, 2011 / July 10, 2011 – July 16, 2011

2.3 Constraints during the Evaluation Study

None.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Sri Lanka

Relevance with the national policies

At the time that project appraisal was carried out in 1997, the Sri Lankan government had set a state objective of "Safe Water for All by 2010" and was working on expanding the water supply network. In addition, under the "Six Year Development Programme" (1999-2004), concrete targets had been set for the development of water supply facilities and the provision of safe drinking water, such as: (1) The supply of safe drinking water under a socially reasonable tariff system, (2) The development of water facilities capable of 24-hour supply, (3) The facilitation of private investment, (4) The decentralization of water services to the municipality, (5) The efficient utilization of water resources, and (6) The establishment of sustainable operation and management system.

Meanwhile, the administration of Mahinda Rajapaksa that came into power in 2005 sought to correct regional income disparities and wealth inequalities through infrastructure development, as well as promote priority investment in growth centers in each region, through the "Mahinda Chinthana (Mahinda Vision)" announced at the time of inauguration, as well as the policy framework for turning this vision into reality, "Creating Our Future. Building Our Nation: The Economic Framework of the Government of Sri Lanka." Specifically, (1) Development of road networks, (2) Expansion of electric power supply capacity, (3) Development of ports, and (4) Water and sewerage sector investment, are set as priority areas for investment. In addition, at the Sri Lanka Development Forum held in January 2007, the Ten Year Horizon Development Framework 2006-2016, which sets promotion of basic infrastructure development in regions, including water supply infrastructure, as a priority strategic area, was enacted and announced under President Rajapaksa's strong initiative.

Therefore, for both program planning and ex-post evaluation, investment in infrastructure development, especially the promotion of investment in the water supply and sewerage sector, has been assigned high priority in higher-level national policies, and consistency of national policy even through changes of administration has been secured. Thus, consistency between this project's objective of "improving public health through stable supply of water" and national policy is very high.

Relevance with the sector policies

At the time of appraisal in 1997, the Public Investment Program 1997-2001 that set the Sri Lankan government's plan for public investment had an allocation of LKR 23.525 billion planned for the water and sewerage sector, equivalent to 6.9% of the total investment amount, and continuous capital investment into that sector was declared as a fundamental policy.

As of 2011 as well, the National Policy on Drinking Water announced in June 2009

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

[2] ③: High, ② Fair, ① Low

continues to hold up the "sustainable supply of safe water" to urban and rural areas as a mission of the utmost importance. In addition, the National Policy on Drinking Water Supply and Sanitation (2004) formulated by the project implementing agency National Water Supply & Drainage Board (hereafter NWSDB), sets the following two targets for water supply development: (1) Percentage (penetration rate) of safe water of 85% by 2015, and 100% by 2025, and (2) Percentage of drinking water supplied by water piping of 100% in urban areas and 75% in non-urban areas by 2015.

Therefore, for both program planning and ex-post evaluation, a certain level of ongoing investment in the water and sewerage sector has been clearly stated in the basic objectives for sector policy, and water supply development in greater metropolitan areas continues to be emphasized.

3.1.2 Relevance with the Development Needs of Sri Lanka

Development needs of this Project

In 1997, water shortage was predicted for 2003 and after, although two water supply systems, i) the old and new Ambatale Water Treatment Plants (water treatment capacity: 468,000 m^3/day) and ii) the Kalatuwawa and Labugama Water Treatment Plants (water treatment capacity: 150,000 m^3/day), were located in Greater Colombo Area. Specifically, the construction of water supply facilities in the southern part of Greater Colombo such as Moratuwa, Panadura, Bandaragama and Horana was not proceeded, and the prompt implementation of a water supply project for the purpose of drastically closing the supply-demand gap was desired at that time.

Table 1: Water Demand and Supply in the Southern Part of Greater Colombo Area

Unit: 10,000 m^3 / day

Year	Maximum Daily Water Supply a	Daily Water Demand		Demand - Supply Gap b-a
		Maximum b	Average	
2006	0.4	9.3	8.3	8.9
2007	6.4	9.8	9.0	3.4
2008	6.4	10.1	9.3	3.7
2009	6.4	10.3	9.5	3.9
2010	6.4	10.9	9.9	4.5
2015 1)	*9.9*	*11.9*	*10.8*	*2.0*
2020 2)	*18.5*	*12.9*	*11.8*	*-5.6*

Source: Answers to the questionnaire to NWSDB

Note 1: Planned (for daily water supply) and forecasted (for daily water demand) figures by NWSDB

Note 2: The operation of the project facilities started in October 2006.

As shown in Table 1, water supply capacity has been significantly strengthened from 4,000 m^3/day to 64,000 m^3/day in the maximum water supply volume (an increase of 15 times), as a result of the October 2006 start of operation of facilities related to this project, including water treatment plants. On the other hand, maximum daily demand for water has increased an average of 4.0% after 2006, resulting in 109,000 m^3/day in 2010. The demand-supply gap that had once been mitigated by this project is again expanding.

Maximum demand is predicted to reach 119,000 m^3/day in 2015, and supply of safe water through expansion of water supply capacity continues to be a pressing task. Had this project——which achieved substantial increase of water supply capacity and greatly contributed to bridging the supply-demand gap——not been implemented, the current supply-demand gap was projected to have widened more than it has.

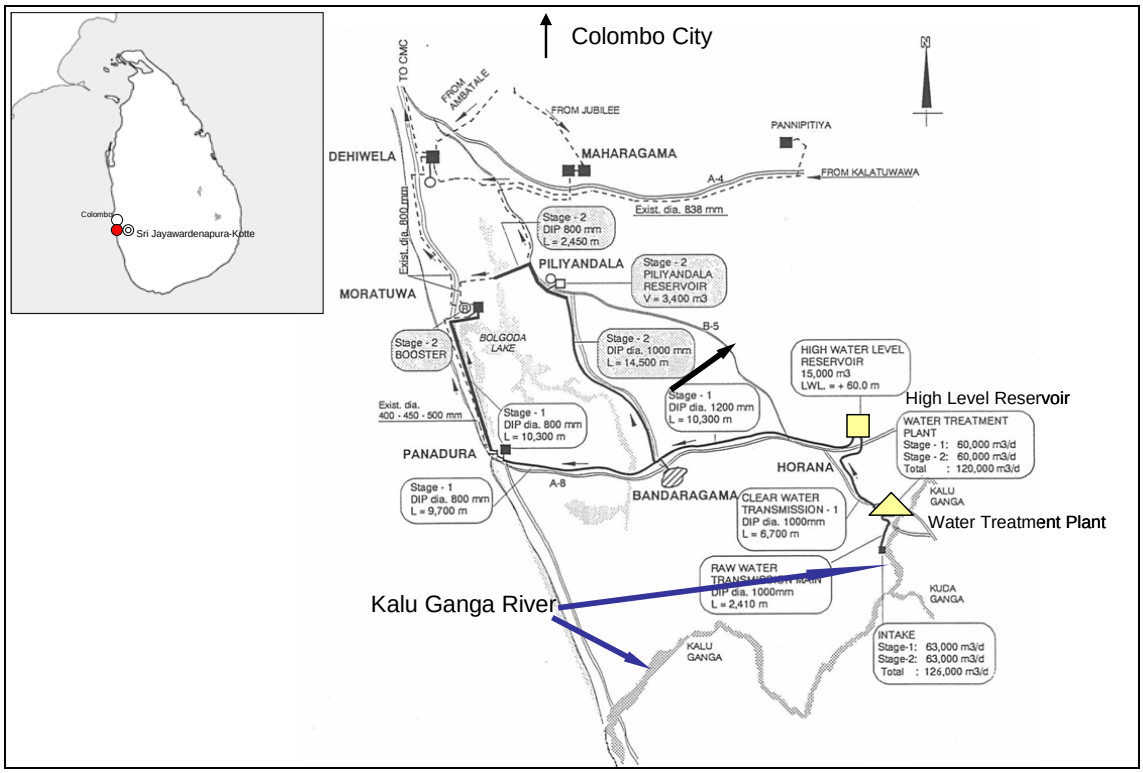


Figure-1: Location of the Project Site ("Stage-1" refers to the facilities of this project)

Water supply needs in poor residential area

In 1997, water supply and drainage facilities were had not been developed in many poor residential areas in Greater Colombo Area, where extreme poor living conditions were causing sanitary and health problems. There is still a high level of needs to establish household water supply system and to develop drainage facilities in the poor residential areas,[3] mainly caused by the situation that the construction of water supply and drainage facilities is still on-going in those areas. The government of Sri Lanka set forth a policy to reduce the number of communal taps[4] and facilitate the provision of household water supply systems in poor residential areas, so the installation of communal taps in the "Shanty Town"[5] are currently limited.

3.1.3 Relevance with Japan's ODA Policy

Under the policy of implementing yen loans to Sri Lanka in 2001 at the time of the appraisal, Japan was taking a course of assisting Sri Lanka that centered on water supply development programs in urban areas with urgent water demand, based on the recognition that water utilities are social infrastructure that contribute to the improvement of public health and the living environment, and that particularly in urban areas they are infrastructure that is indispensable to carrying out economic activities. Therefore, this project was extremely consistent with Japan's aid policies.

[3] Source: Results of interview with USDA (Urban Settlement Development Authority) which is in charge of housing development at poor residential districts in urban areas

[4] There still exists about 8,000 communal taps in the target areas of this project, which includes Moratuwa, Panadura, Bandaragama and Horana districts. (Source: Results of interview with NWSDB Regional Support Center (RSC) - Western South)

[5] **Shanty Town:** The residential colonies where the poor people built a shanty/hut without any authorization. In Colombo, those town is normally located in the public areas in the vicinity of rivers, railway track and swamp/marshland. (Source: JICA(2001) "Greater Colombo Flood Control and Environment Improvement Project: Third Party Evaluation Report – Resettlement and Improvement in Living Environment")

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 Efficiency (Rating: ②)

3.2.1 Project Outputs

Comparison of outputs planned and actual performance is shown in Table 2 below. There is no major change for the following three outputs: i) Intake capacity of water intake facilities, iii) Treatment capacity of water treatment facilities, and vi) Reserve capacity of high level water reservoir. As for ii) raw water transmission facility, the location of water intake facility was shifted nearer to treatment plant during the Detailed Design (D/D) stage, so the total extension of raw water transmission main was reduced to one tenth of what was originally planned. In the same way, plan revisions during the D/D stage also led to the gravity flow pipes of iv) clear water transmission main being made a little shorter than originally planned.

Other changes include: a significant widening of the scope of v) water distribution facility; and revisions to the specification of clear water pump in the component of iv) water transmission facility. Outlined below are the reasons why the scope was changed substantially.

- ✓ **Water distribution facilities:** The Sri Lankan rupee depreciated against the yen, so there was forecast to be a surplus amount of loan approved. In the wake of this, it was decided to expand the water distribution area to take into account the supply needs of regions close to the target area of this project. Parts of the Panadura East and Raigama areas were chosen as targets for further water distribution network development due to their status as areas not yet supplied by the distribution network. The total length of water distribution pipes were extended by considerably more than originally planned in accordance with the steps outlined above.

- ✓ **The pump stations of water transmission facilities:** Necessary revisions to specifications/quantitative changes (increasing the number of pumps or increasing the size of pump station buildings) were carried out as part of this project, in view of the subsequent "Water Sector Development Project II" (stage 2 of this project, see Table 3 for details).

Table 2: Changes in Output

Project Components	Original	Actual	Differences
i) Water Intake Facility			
· Intake Capacity	126,000 m³/day	The same	As planned
· Raw Water Pumps	63,000 m³/day	The same	As planned
ii) Raw Water Transmission Facility			
· Raw Water Transmission Main	From intake to treatment plant, 2,140 m	217.5 m	10% of original plan
iii) Water Treatment Plant			
· Treatment Capacity	60,000 m³/day	The same	As planned
iv) Water Transmission Facility			
· Clear Water Pump	29.2 m³/min.X2 units	20.8 m³/min.X4 units	Two (2) units
· Clear Water Transmission Main	From treatment plant to high level reservoir, 6.7 km	6.35 km	Mostly as planned
· High Level Water Reservoir	15,000 m³/day	The same	As planned

Project Components	Original	Actual	Differences
· Water Transmission Mains			
➢ High Level Reservoir to Bandaragama	10.3 km	8.832 km	86% of original plan
➢ Bandaragam to Panadura	9.7 km	9.515 km	Mostly as planned
➢ Panadura to Moratuwa	10.3 km	7.903 km	77% of original plan
v) Water Distribution Facility			
· Distribution Pipelines	150 km in total	245.96 km in total	164% of original plan
vi) Water Supply Equipment			
· Domestic Water Meters, Connection Materials and Bulk Meters	20,000 sets in total	The same (16,000 were installed.)	As planned
vii) Others	Office building, Staff accommodations, etc.	Mostly as the same	Mostly as planned
viii) Additional Components	n.a.	The following items were added to the original scope. · Construction of district office buildings · Construction of Water towers (for follow-up project) · Procurement of chlorine neutralization equipment (1), Generator (2), Transformer (1), etc.	
ix) Consulting Services			
· Consulting Service M/M	496M/M in total (Foreign:116M/M, Local: 380M/M)	640.71M/M in total (Foreign:86.75M/M, Local: 553.96M/M)	129% of oriinal plan
· Consulting Service TOR	Detailed Design (D/D), Bidding support, Construction supervision, Decision of distribution areas, etc.	In addition to the left, detailed design of Water Sector Development Project (II)	

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

✓ **Water supply equipment:** 20,000 domestic water meters and connection materials (procured as a set of the two items) were procured as part of this project, as was originally planned. 12,926 of these were installed at the time of project completion. Around 3,000 sets have subsequently been installed up to now and the remaining 4,000 sets are scheduled to be installed in line with the increase in the number of household connections.[6] The number of bulk flow meters was increased in response to requests from departments in charge of operations and maintenance, who regard these meters as essential equipment to help reduce non-revenue water (NRW) rate.

[6] Source: Results of interview with NWSDB RSC - Western South

Table 3: Overall Plan of Water Supply Projects in the Southern Part of Greater Colombo Area (including this project)

Phases	Target Year	Treatment Capacity	Note
Phase-I Stage-I Phase-I Stage-II	2006 2010	60,000 m^3/day 60,000 m^3/day	This project Water Sector Development Project (II) (the follow-up stage of this project)
Phase-II Stage-I Phase-II Stage-II	2015 2020	90,000 m^3/day 90,000 m^3/day	

Source: Prepared from JICA internal documents

Regarding ix) consulting services, consultant input also rose significantly over the original estimate, with the reason that the increase in work hours of local consultants in charge of construction management that came along with the extension of project implementation period[7]. As to the terms of reference (TOR) of the consultant, detailed design (D/D) of the follow-up stage of this project, which is Water Sector Development Project (II), was added to the original scope.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost was longer than planned.

The total cost of the project was originally 13,268 million yen (the Japanese ODA loan share was 11,278 million yen) but the actual project cost was 13,225 million yen (the Japanese ODA loan share was 11,107 million yen), which was equivalent to 99% of the original plan.

Foreign currency portion (about JPY 6.4 billion) was almost at the same level as the original plan at the time of project appraisal, but the local currency portion (about LKR 6.7 billion) greatly exceeded the original plan of about LKR 3.3 billion. Causes of the increase of the local currency portion included: (1) Increase in consultant costs accompanying the delay in construction, and (2) Sudden rise in construction material[8] and construction worker personnel costs due to tsunami reconstruction after December 2004[9]. At the same time, due to the impact of the depreciation of the Sri Lankan rupee, which exceeded inflation rate, overall project cost decreased slightly.

As already stated in the Output section above, the scope of the project was expanded because there was forecast to be a surplus amount of loan approved, due to the depreciation of the Sri Lankan rupee (LKR) against the Japanese yen.

Table 4: Comparative Table of Project Cost

Item	Original	Actual
Total Project Cost	13,268 million yen	13,225 million yen
Foreign Portion	6,418 million yen	6,460 million yen
Local Portion	3,277 million LKR	6,681 million LKR
Yen Loan	11,278 million yen	11,107 million yen

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

[7] For local consultants, who cost less than foreign consultants, there have been cases of increases in employment volume after project commencement, and a similar situation can be seen as having occurred this time.

[8] For example, compared to the 11.5% rise in wholesale prices overall in 2005, the wholesale prices in the same year for investment commodities, including construction materials, rose by 36%, and 30% in 2006. (Source: Central Bank of Sri Lanka Annual Report, etc.)

[9] The breakdown of expense item in local portion was: LKR 5.61 billion for civil works, LKR 0.59 billion for consulting services, LKR 0.02 billion for land acquisition, and LKR 0.46 billion for others (including administrative costs). Civil works costs and consulting service costs were severely increased compared to those of the original plan (100% and 225% increase, respectively).

3.2.2.2 Project Period

The project period was longer than planned.

The project was scheduled from August 1997 to June 2003, a period of 71 months, but it extended to 111 months, from August 1997 to October 2006[10], which was equivalent to 156% of the original plan.

The main reasons for the delay included: (1) Delay in starting the selection of consultants (two years and a half delay, compared to the estimation at the time of project appraisal), and (2) Prolonged construction works. It took five years and seven months to complete the civil works whereas two years and six months were originally estimated. At the same time, the construction of major facilities was completed in October 2006, as mentioned in Table 5.

Regarding the detailed reasons for the delay in starting the selection of consultants, i) it took long to prepare the shortlist and to fix the terms of reference (TOR) of the consultant (which caused 18 months' delay)[11], and ii) offical approval of these documents and others before starting the selection process required a fair amount of time[12].

Table 5: Comparative Table of Project Periods

Task	Original Schedule (months)		Actual (months)		Differences (months)
Consultant Selection	Aug. 1997 – Sep. 1998	(14.0)	Jan. 2000 – Feb. 2001	(14.0)	0.0
Detailed Design (D/D)	Oct. 1998 – Jul. 1999	(10.0)	Feb. 2001 – Feb. 2002	(13.0)	3.0
Pre-Qualification and Tender	Feb. 1999 – Jul. 2000	(18.0)	Feb. 2002 – Jan. 2003	(8.0)	10.0
Civil Works[1)]	Aug. 2000 – Jan. 2003	(30.0)	Feb. 2003 – Aug. 2008	(67.0)	- 37.0
Inspection and Training	Feb. 2003 – May 2003	(4.0)	Jul. 2006 – Oct. 2006	(4.0)	0.0
Commissioning	Completed in June 2003		Completed in October 2006		- 40.0
Total[2)]	Aug. 1997 – Jun. 2003	(71.0)	Aug. 1997 – Oct. 2006	(111.0)	- 40.0

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

Note 1: Although the civil works was completed in August 2008, the operation of the constructed facilities started in October 2006, just after the completion of the commissioning process activities of water treatment plant and other related facilities. Auxiliary works such as i) construction of new district office buildings in the target distribution areas, ii) construction of water supply facilities in the target areas of Water Sector Development Project (II), the follow-up stage of this project, and iii) procurement of additional equipment, were carried out in the period from October 2006 to August 2008.

Note 2: Project commencement was defined as the date of L/A conclusion (August 1997). For the definition of the date of project completion, refer to the Footnote-10.

In the process of selecting the contractor for a portion of the construction work, the bidder offering the lowest price withdrew, and, as a result of this and other factors, the start of that portion of the work was delayed by nine months. In addition, due to the delay in the construction of the access road to the site of the above construction work (construction of a 19-km road by the Road Development Authority (RDA) of Sri Lanka, not covered by this project), which was supposed to be completed before the start of said work, the construction period was extended by about 10 months.

Other causes of delay include difficulty in procuring certain construction materials (particularly pipe-related material) and in hiring construction workers, due to the reconstruction activities after the tsunami disasters as mentioned above.

At the time of the evaluation of this project, it was pointed out that, "In the Towns East of the Colombo Water Supply Project (SL-P19), it took more than two years to select the

[10] Although the loan completion date for this project was August 2008, as shown in Table 4, the majority of construction was completed in October 2006, and all of the related facilities began operating in October 2006. Since from that time onward, water was supplied throughout the target area and project effects began to appear, it is considered reasonable to set project completion to the above date of start of operation.

[11] Source: JICA internal documents

[12] More precisely, approval process of Cabinet Appointed Tender Board and Technical Evaluation Committee was delayed. (Source: Results of interview with JICA Sri Lanka Office)

consultants, and as a result, the disbursement date under the L/A was extended. Although the slowness in procurement procedures is a structural problem in Sri Lanka, human factors also often cause delay in procurement procedures. Supervision is needed to ensure the smooth running of procurement procedures." In this connection, JICA had been taking measures to expedite the procurement procedures for ODA loan projects in Sri Lanka.[13] As things turned out, almost the same situation as mentioned above occurred for this project (it took more than two years to start the selection of the consultants, which was the main cause of the substantial delay in the project implementation period). When implementing similar projects in the water sector in Sri Lanka in the future, particular attention needs to be paid to time management when hiring consultants.

Although the project cost was lower than planned, the project period was longer than planned (156% of the original plan), therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators [14]

(1) Population served, average water supply per capita and percentage of population served

Population served by this project: As of the end of March 2011, the population served by this project within the target areas reached to 300,000 people (refer to Table 6), and it exceeded the post-scope reduction revised target of 267,800 which covers Panadura East and a part of Raigama.

Table 6: Achievement Rate of Main Indicators

Operation and Effect Indicators	Baseline Data (1997, at the time of appraisal)	Target Value (2003, expected completion year) a	Forecasted Value (2010, seven years after completion) a'	Actual Value (As of 2011) b	Achievement Ratio (%) b/a or b/a'
Population Served	210,300[1)]	Not known	267,800[4)]	307,688[1)]	115%
Percentage of Population Served[1)]	Not known	Not known	50.5%[5)]	52.3%	104%
Average Water Supply per Capita	154 liter/day[2)]	180 liter/day[2)]	189 liter/day[4)]	126 liter/day[2)] [6)]	66%
Water Supply Volume (to be added by the Project)					
Maximum Daily Supply	n.a.	60,000 m^3/day	Not known	58,000 m^3/day	97%
Average Daily Supply	n.a.	Not known	58,500 m^3/day[4)]	56,000 m^3/day	96%
Rate of Facility Utilization [3)]	n.a.	Not known	97.5%	93.3%	96%
Water Supplied Hours[1)]	Not known	24 hrs/day	Not known	24 hrs/day	100%

Source: Prepared from answers to the questionnaire to NWSDB, results of interviews with NWSDB, Project Completion Report, NWSDB Annual Report, etc.

Note 1: Values for the target areas of this project

Note 2: Values for Greater Colombo Area including the target areas of this project (Note: 126 liter/day is the actual value as of 2010)

Note 3: Rate of facility utilization = Average daily water supply / treatment capacity

Note 4: Forecasted value of 2010 by JICA feasibility study (which covers the target areas of Phase-I, Stage-II)

Note 5: Target value of 2011 as one of the Key Performance Indicators (KPIs) set by NWSDB RSC – Western South

Note 6: Actual value for the target areas of this project is 118 liter/day.

[13] For example, Project Director of the specific project (selected through competitive application) has been invested with centralized decision-making authority and efforts have been made to improve awareness and expedite procurement process through, for example, the holding of a Project Director's Forum that brought together Project Directors from several different sectors, including the water sector.

[14] Clear target values were not set out during the appraisal stage of this project, so attention was paid to the resetting of target values when quantitatively analyzing effectiveness. For details, see Appendix 1 "Resetting target values for evaluating effectiveness."

After completion of facilities related to this project, various work aimed at increasing connections led by the NWSDB Regional Support Centre – Western South (RSC Western South) has succeeded, and the number of households connected to the distribution network has been steadily growing since 2007, with 6.6% annual increase on average.

Percentage of population served: The percentage of population served in the target areas has reached 52.3% as of 2011, due to the abovementioned steady growth of the population served by this project. This figure achieved more than 50.5%, which is one of the Key Performance Indicators (KPIs) of NWSDB. In addition, facilities related to Water Sector Development Project (II), which is a follow-up to this project, are scheduled to begin operations in December 2011, and percentage of population served is expected to improve further.

Average water supply per capita: The per capita water volume supplied for Greater Colombo, which includes the area in this project, was 126 liters/day (converted with an average of 4.4 persons per household) as of 2010, falling far short of the target value of 180 liters/day in 2003 when the project was originally expected to complete. Two main factors are thought to be behind the shortfall from the target value: (1) The increase in water tariff in 1999, 2002, 2005 and 2009, and (2) The awareness activities such as the water conservation campaign developed nationwide by the NWSDB.

(2) Water supply volume, rate of facility utilization and water supplied hours

Due to the abovementioned steady increase in the population served by this project, the water supply volume target of 58,500 m^3/day, which takes account of the scope expansion, has been mostly achieved in 2011. The degree of facility utilization rate attainment is likewise high.

As for hours of water supplied per day, all the districts/areas in the target areas of the project have achieved the target value of 24 hours per day. Since many poor people live in the rural areas in Bandaragama and Horana (which are both the target districts of the project), it is imagined that the significant increase in hours of water supplied per day is contributing to the improvement of the living environment for the poor. Especially in Bandaragama, as described below in the Impact section, the accessibility to safe drinking water was significantly improved, compared to the situation before the project implementation.

(3) Water quality

This project's water quality monitoring at water intakes is being carried out at laboratories set up in the water treatment plant site and at the test facility at NWSDB Headquarters. To date, no serious problems with water quality have been confirmed[15].

(4) Target and status of non-revenue water rate

At the time of appraisal in 1997, it was widely recognized that monitoring of the financial status and sustainability of NWSDB was one of the important issues for the supervision of the project, especially the status of i) reduction of non-revenue water (NRW) rate and ii) formulation of appropriate water tariff policy. In line with this recognition, the NRW reduction component was planned to implement for NWSDB under the JICA's "Project for Reduction of Non-Revenue Water", where the loan agreement was concluded in 1999. Given this, no component regarding reduction of NRW

Water Intake Point of the Treatment Plant

[15] Source: Results of interview with a quality inspector of the laboratory inside the water treatment plant

was included in this project[16], and thus no NRW rate targets were set at the time of project appraisal.

The NRW rates in the southern part of Greater Colombo, which is under the jurisdiction of NWSDB RSC Western South, are 33% in 2008 and 34.9% in 2010 (shown in Table 7), respectively. This level did not achieve the target value of 32.0% in 2010, which is one of the Key Performance Indicators (KPIs) of RSC Western South.

Table 7: NRW Rate in the Jurisdiction of NWSDB RSC Western South (in 2010)

Districts	NRW rate
Kalutara	33.8%
Panadura / Horana	30.4%
Towns South Colombo[1)]	36.5%
Average in RSC Western South	34.9%
Target Value of RSC Western South (for 2010)	**32.0%**
National Average in Sri Lanka	**31.6%**

Source: Data provided by RSC Western South and results of interviews

Note: This district consists of Dehiwala, Mt.Lavinia, Ratmalana and Moratuwa in the southern part of Greater Colombo Area. Moratuwa is one of the target districts of this project.

As for measures to reduce NRW, in line with the Corporate Action Plan drawn up by NWSDB Headquarters, unique countermeasures are being adopted under the leadership of each regional support center. Although some measures have been implemented, NRW rate level is still relatively high in areas under the jurisdiction of NWSDB RSC Western South, as shown in Table 7. Various measures aimed at NRW reduction (including the replacement of old distribution pipes with PVC ones) are still being carried out through the Corporate Action Plan 2007-2011, and continuing implementation of these measures, especially those for water leakage, will be desirable.[17]

3.3.1.2 Results of Calculation of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

FIRR figures were recalculated with several conditions described in Table 8 below.

The result of recalculating FIRR was minus 4.11%, which was lower than the 7.9% (0.4% for non-inflationary model) at the time of project appraisal. Reasons for this are thought to be: (1) Total project cost in the local currency was increased (approx. 1.5 times higher than that of original plan), and (2) O&M costs were around 2.6 times higher than the amount predicted at the time of appraisal.

[16] However, an NRW countermeasure component for the southern part of Greater Colombo was not included in this yen loan project as a result. After twist and turns, the on-going "Water Sector Development Project (II)" finally included the component of NRW reduction measures for the above area. (Source: Results of interview with JICA officers)

[17] As mentioned in the above, "Water Sector Development Project (II)" (where loan agreement was concluded in July 2007 and the total project cost is JPY 10.85 billion), the follow-up to this project, is currently implementing the component of NRW measures (including replacement of distribution pipes, water supply expansion to the poor residents through household water connections, etc.) in the Colombo Municipality area. This project aims at reducing the NRW rate from 52.7% in 2007 to 37.9% in 2013.

Table 8: Recalculation of FIRR

Timing	Preconditions and Assumptions for Recalculation (Project Life: 50 years after the completion of the Project for each case)		FIRR
At the time of appraisal (in 1997)	Costs:	Construction cost, consulting service cost, and operation and maintenance cost (incl. water production cost)	7.9% (0.4%)[1)]
	Revenue:	Water tariff revenue (assuming increases from 1997 to 2000)	
At the time of ex-post evaluation (in 2011)	Costs:	Construction cost, consulting service cost and operation and maintenance cost (based on the actual expenditure up to 2010)	- 4.11%
	Revenue:	Water tariff revenue (assuming 10% increase in water tariff every 5 years after 2015)	
	NRW:	Assuming 5% reduction every 5 years from 2015 up to 2040, being 30% in 2015 as a base rate and being 5% after 2040 as a convergence rate.	

Note 1: For non-inflationary model

(2) Economic Internal Rate of Return (EIRR)

The economic internal rate of return (EIRR) was not calculated due to limited resources for this study because it would have been necessary to clarify input data from the beneficiary side, such as beneficiaries' WTP (Willingness to Pay) for water usage through individual interviews or through the estimation by using prices of substitution goods and water tariff level.

3.3.2 Qualitative Effects – Development of Alternative Water Source of Kelani Ganga System

As of 1997, Kelani Ganga was the only source of water supply in Greater Colombo, with further water intake problematic due to problems such as salinity intrusion. Upon completion of this project, the Moratuwa district was able to receive water from this project's treatment plant (the area previously had been relying on supplies from the Ambatale Water Treatment Plants located inside Kelani Ganga system).

Table 9: Indirect Effects to the Served Area by Kelani Ganga System

Indirectly Benefited Area By this Project	Newly Served Population By Water Treatment Plant of this Project
Dehiwala	25,000
Wellawatta	60,000
Kesbewa	*12,000*
Total Population Served	**97,000**
Volume of Water Supply Reduced	**31,632 m^3/day**

Source: Prepared from documents provided by RSC Western South

Note: Water supply to Kesbewa district was implemented from January 2009 to October 2010.

As a result, the amount of water handled by the Ambatale Water Treatment Plants fell by about 32,000 m^3/day (around 7% of total capacity). This "saved" water could then be redirected to other areas (the three districts of Dehiwala, Wellawatta and Kesbewa for example. See Table 9 for more details). This water is being used to supply water to new areas, with up to 97,000 people (at most) being newly supplied with water, which can be evaluated as an indirect benefit resulting from this project.

The main indicators, including population served, percentage of population served, amount of water supplied, and facility utilization rate, have all reached 80% of the target or greater. In addition, there are no particular problems with the quality of treated water produced. While the NRW rate is still higher than that of national level, specific countermeasures are being adopted by NWSDB to reduce NRW rate.

This project has largely achieved its objectives; therefore its effectiveness is high

3.4 Impact

3.4.1 Intended Impacts

(1) Impact on public health

Regarding the situation of accessibility to safe drinking water before and after completion of this project, the following results were obtained from a beneficiary survey.

Table 10: Accessibility to Safe Drinking Water before/after the Project
(For General Population, N=83)

Answers from Beneficiaries	Category of Water Users	Moratuwa	Panadura	Bandaragama	Horana	Total
Number of respondents who mentioned some difficulties to access safe drinking water **before** Project completion	New User	7 out of 10	6 out of 9	8 out of 11	1 out of 10	22 out of 40
	Existing User	0 out of 10	2 out of 9	9 out of 11	0 out of 10	11 out of 43
Number of respondents who still mention some difficulties to access safe drinking water **after** Project completion	New User	0 out of 10	0 out of 9	1 out of 11	3 out of 10	4 out of 40
	Existing User	1 out of 10	0 out of 9	0 out of 11	0 out of 10	1 out of 43

Source: Results of beneficiary survey[18]

Note: "New user" refers to a beneficiary who was newly connected to the water supply after completion of the project. "Existing user" refers to a beneficiary who had been receiving water services since before project completion.

The results of the aforementioned survey of beneficiaries show that this project has had a significant impact in improving access to safe drinking water. In particular, new beneficiaries have switched from using wells to using water supply pipes to obtain drinking water. As a result, it is likely these new users are strongly aware of the drastic improvements in water quality.

By district, the area that has seen the biggest improvement is Bandaragama, a farming district with a large number of poor residents.

(2) Impact on business environment

Regarding change in the business environment after project completion, the following responses were obtained from a total of 85 companies in the beneficiary survey, as shown in Table 11.

Table 11: Business Environment before/after the Project (N=85, Multiple Answers)

Answers by Private Companies	Moratuwa	Panadura	Bandaragama	Horana	Total
Production/Sales were increased after receiving new water	0	7	1	20	28 / 85
Quality of products/services were improved after receiving the new water	1	7	0	12	20 / 85
Number of customers were increased after receiving the new water	1	3	0	9	13 / 85
Production cost /Service delivery cost were decreased after receiving the new water	6	12	0	5	23 / 85

Source: Results of beneficiary survey (for 85 private companies)

Note: Type of business of interviewee: Manufacturing (including textiles, garment, lumber production, wood processing, etc.), construction, and service sector (including automobile spare parts sales, food processing, grocery retailing, hairdressing, laundry, pharmacy, restaurant, finance, etc.)

[18] Beneficiary survey implementation overview:
Locations: Areas served by this project (Moratuwa, Panadura, Bandaragama and Horana)
Subjects: General population, private companies (manufacturing, construction, service, etc.), and public institutions (hospitals, schools, temples, etc.)
Total sample: 247 (83 from general population, 85 private companies, 79 public institutions), segmented two-stage random sampling
Data collection method: Face-to-face interview

Similarly, regarding level of improvement of business and commercial activities in the target area, in-depth interviews of one large scale manufacturing company and one hospital in Greater Colombo Area at the time of the field survey obtained the following views on the direct effects associated with project completion, as shown in Table 12.

Table 12: Results of In-Depth Interviews with Private Companies in Greater Colombo Area

Answers by Interviewees	Type of Business
Conditions of water quality, pressure, and hours supplied all improved markedly.	Manufacturing, Hospital
Supply of high quality water contributed to improve the level of medical treatment.	Hospital
The maintenance cost was drastically reduced, by being able to avoid a water supply tank on the rooftop of the hospital	Hospital
Water supply costs have dropped by 30%, which has helped push down overall production costs. (Before this project was completed, the company obtained water from wells within company grounds, with water provided by the company's own water purification plant. Water supply costs stood at one million LKR/month, including electricity and fuel costs. Water charges now stand at LKR 700,000/month. LKR 40,000 was paid as a connection charge to connect the new water supply).	Manufacturing
Drought-related water shortages were significant impediments to operations when water was obtained from wells in the past. However, it is now possible to obtain water 24 hours a day, during both dry and rainy seasons, so it has become easier to map out operational schedules.	Manufacturing, Hospital
Water tariff is still expensive a little.	Hospital
Water connection charge is still expensive a little.	Manufacturing

According to the results of the beneficiary survey above, the construction of a system for providing good quality water (upon competition of this project) had a variety of positive impacts on many companies based in the area, thereby the project helped to improve the business environment. Many of the interviewee companies in this survey were small and medium-sized enterprises run by a small number of staff, such as textiles/clothing companies, lumber companies, manufacturers and retailers of foodstuffs, hairdressers and laundry stores. As the answers in Table 12 show, companies have been able to increase sales, cut production costs and attract more customers. This is likely to have several indirect beneficial impacts on the owners and employees of these small and medium-sized companies (rise in income, etc.).

Furthermore, according to the results of the aforementioned in-depth interviews, the hospital has seen "huge improvements in water quality, which has had a significantly positive impact on medical treatment," while the large-scale manufacturer has been able to substantially reduce production costs. On the other hand, some voices are saying water tariff level (including new connection charge) is "a little high." High water tariff are leading some manufacturers to cut back on water usage.

3.4.2 Other Impacts

3.4.2.1 Impact on Natural Environment

Implementation status of EIA and environmental monitoring during construction

As of 1997, the water supply capacity of this project was below the level at which Sri Lankan environmental law deems an Environmental Impact Assessment (EIA) necessary (500,000 m^3/day). As a result, no EIA was carried out.

As for environmental monitoring during construction, contractors monitored noise and vibration levels as appropriate. Contractors monitored vibrations from blasting operations under the watch of the Geotechnical Survey and Mining Bureau. Blasting operations involving heavy vibrations were carried out under the watch of the relevant supervisory authorities, so no particular problems arose during these operations either[19].

Water sprinkling was also carried out as appropriate during construction operations in order

[19] Source: Answers to the questionnaire to NWSDB and results of interview

to prevent any dust problems from occurring. The project was not seen to have any particular negative impacts on the natural environment.

3.4.2.2 Implementation Status of Resettlement and Land Acquisition

The project involved land acquisition. Table 13 below shows the scale and process of the acquisition. No resettlement of local residents was happened during the implementation of the project.

Table 13: Status of Resettlement and Land Acquisition of the Project

Item	Actual Status
Project-Affected Families (PAFs)	N.A.
Scale of Resettlement	N.A.
Compensation for Resettlement	N.A.
Land Acquisition Price	For the land acquisition price, the application of the average price of actual transactions using market price as a criterion was permitted. The project-implementing agency applied to the Cabinet and the price was decided. In this relation, official approval was given at a Cabinet meeting in April 2006. Based on this approval, the government issued an official notice, and payment was made.
Locations of Land Acquisition	Water treatment plant site, High level reservoir site
Expenses for Land Acquisition	22.4 million LKR

Source: Answers to the questionnaire to NWSDB

There were concerns about the difficulties involved in resettlement of residents from areas scheduled for water treatment facilities during the F/S phase. As a result, the Special Assistance for Project Formulation (SAPROF) study proposed shifting the target area for water treatment plants over to vacant timber-factory land owned by the Ministry of Industry and Commerce. Given this, with the Ministry's agreement, it was possible to acquire land before project construction was due to start. There were also plans to locate high level reservoir in an area belonging to a state-owned plantation enterprise. With the agreement of the enterprise, it was also possible to acquire this land before construction started.

All land acquisitions were smoothly implemented in accordance with the Land Acquisition Act (1950), without any particular problems occurring[20].

BOX－ Evaluation of Supplementary Component "Community-Participatory Pilot Scheme to Construct Household Water Supply Systems and Drainage Facilities"

As a supplementary component of this project (what is called "Community-Participatory Pilot Scheme"), household water connections and drainage facilities in the selected poor residential areas were constructed with the participation of beneficiary residents.

In this evaluation study on Kalu Ganga Water Supply Project for Greater Colombo, the evaluation of the above component was also conducted with the focus on i) to verify the effect of cooperation with the Japan Overseas Cooperation Volunteers (JOCV) in the abovementioned "Community - Participatory Pilot Scheme" and ii) to examine the spillover effects of the community-participatory water supply system development method on other areas.

As for i) the effect of cooperation with JOCV, thanks to the steady implementation of the government measures to promote conversion from communal taps to household water connections, substantial progress has been made both in the Badowita area (the intervention group where JOCV intervened) and the Obesekarapura area (the control group where JOCV did not intervene). On the other hand, it is confirmed by the survey that the quality of water delivery services (turbidity, water volume, water pressure, and the frequency of water cutoff) is better for the intervention group than the control group. One factor for this difference is the realization of the appropriate management of infrastructure facilities through the meticulous maintenance activities of residents. Between these two areas, there is a

[20] Source: Ibid.

difference in the degree of the involvement of the resident organization CDC regarding the operation and maintenance activities, and the current level of organization / institutionalization and the level of the activities of CDCs differ considerably. The reason behind this situation seems to be the nature of this component in which the "mobilization activities of the JOCV and the NGOs (which includes facilitating the level of participation of residents to the activities, coordinating between CDC and related institutions involved in this component, etc.) aroused a sense of participation in the residents and brought about various changes in resident behavior."

Current Situation of Badowita Area

Regarding the "achievement of cost recovery for water supply," which was one of the major objectives of this component, there is little difference in the burden of water charge between the intervention group and the control group, as far as the samples selected for this scheme are concerned. However, the situation of arrears on the payment of water rates is obviously worse in the Obesekarapura (the control group), and the payment situation in Badowita (the intervention group) is relatively better. In this component, beneficiary residents bore a certain portion of the construction costs for various facilities based on the "beneficiary-pay principle". Therefore, through the process of carrying out the component, there has been a great change in the cost-consciousness of residents, and it seems that changes in their behavior are ongoing even today.

Based on the above analysis, it is concluded that "mobilization activities by disinterested outsiders" and "cost sharing by beneficiary residents in the construction of infrastructure facilities," which were experimented with for the first time under this component, generated some effects in the development of infrastructure in urban poor areas in Sri Lanka.

As for ii) the spillover effects of the community-participatory water supply system development method, the "community-participatory infrastructure development method" has indirectly become a mainstream method in Sri Lankan policy for improving the residential environment for the poor, and a lot of large and small projects have been implemented using this approach. In the implementation of these projects, "mobilization by outsiders" is considered important, in addition to existing participatory development methods. Before this pilot scheme was implemented, skeptical views were prevailing on the ability of the urban poor to pay water rates. The success of this component raised a kind of "awareness" in the NWSDB, which has come to consider the urban poor as "customers."

The spirit and approach of this component surely gained positive responses from the parties concerned in Sri Lanka and, though indirectly, helped bring the existing community participation methods unique to Sri Lanka into a new stage.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspect of Operation and Maintenance

NWSDB[21] Regional Support Center - Western South and NWSDB Western - Production Department are responsible for operation and maintenance (hereafter O&M) of the related facilities that were built in the project. There is a clear demarcation between these two entities for their responsibility of O&M activities, and there seems to be no problem with the operation and maintenance structure.

The NWSDB's organizational structure includes departments involved in policy and strategy making, and water and sewerage project implementation, as well as Regional Support Centers (RSCs) set up in 11 regions throughout the country. RSC Western South (one of the aforementioned RSCs) is in charge of O&M for project facilities, together with the Production Department directly under the Additional General Manager - Western. For details, see Table 14.

[21] NWSDB is a public corporation that was established under the legal authority of the National Water Supply and Drainage Board Law, No.2 of 1974, which came into force in January 1975. It oversees development, supply, operation and management of water and sewerage facilities.

Table 14: Responsibility Matrix of Operation and Maintenance Activities

Type of Facilities	NWSDB RSC Western South	NWSDB Western Production Department
Water Intake / Raw Water Transmission Facilities		In charge
Water Treatment Plant		In charge
Water Transmission Facilities		In charge
Water Distribution Facilities	In charge	

Source: Answers to the questionnaire to NWSDB and results of interview

As shown in Table 15, O&M activities (excluding large-scale repairs) of the related facilities under NWSDB's responsibility are implemented by direct management. O&M manuals have been prepared by the consultant. No particular problems regarding implementation structure of both RSC Western South and Production Department are found for planning, bidding and management of the contractors upon large-scale repairs.

Table 15: Operation and Maintenance System of Project Facilities

Stage/Category of Maintenance Activities	Planning	Preparation of Tender Documents	Implementation	Supervision
Daily Maintenance	W.S / W.P	n.a.	W.S / W.P	W.S / W.P
Periodical Maintenance	W.S / W.P	n.a.	W.S / W.P	W.S / W.P
Large Scale Maintenance	W.S / W.P	W.S / W.P	Contractors	Consultants

Source: Answers to the questionnaire to NWSDB
Note: W.S refers to NWSDB Regional Support Center – Western South. W.P refers to NWSDB Western - Production

Table 16: Number of Staff of NWSDB

Year	NWSDB Staff in Total	Of which, O&M Staff	Of which, O&M Staff of W.S	Of which, O&M Staff of W.P
2007	8,768	6,830	38	31
2008	9,006	7,079	51	32
2009	9,063	7,432	49	31
2010	9,018	7,485	54	31

Source: Prepared from NWSDB Annual Report, NWSDB website, PCR and answers to the questionnaire to NWSDB
Note 1: W.S refers to NWSDB Regional Support Center – Western South. W.P refers to NWSDB Western - Production
Note 2: Part-time workers are included in the total number of NWSDB staff.

NWSDB has 9,018 personnel as of the end of 2010, consisting of 8,627 for permanent staff and 391 for part-time and other staff. Among them, the number of personnel who are in charge of O&M is 85 persons in total (of which 54 persons are for RSC Western South and 31 persons are for Western – Production). The total number of personnel has not fluctuated significantly over the past three years, and the number of workers engaged in O&M activities has been rising and accounted for 83% of total personnel in 2010. From 2007, the proportionate volume of O&M personnel who are in charge of O&M for facilities related to this project is being secured on an ongoing basis.

3.5.2 Technical Aspects of Operation and Maintenance

Technical skills of engineers and workers

The total number of employees assigned to technical jobs for operation, maintenance, and management of the project facilities are 85 persons as of 2010, consisting of 19% of university graduates, 33% of vocational school graduates, and 48% of others. They have five to 15 years of experience in operation and management of the water supply facilities. As described, the

proportionate volume of personnel is being secured for O&M activities of the project facilities since the start of operation in October 2006. The NWSDB has many similar water facilities in Sri Lanka, and is amply accumulating O&M skills through the operation of these facilities. It would appear that there is no problem with the quantity and quality of engineering and technical staff.

Training programs provided by contractors of the Project

Various trainings for technical staff for maintenance have been conducted by the contractors. Three types of training are provided; 1) lecture (of which subjects include control systems), 2) OJT during commissioning period, and 3) overseas training. Regarding the training program of SCADA (Supervisory Control And Data Acquisition, a control system for water treatment facilities), six engineers participated in the entire program and 10 engineers did during OJT conducted in the commissioning period. Overseas training was implemented from 2002 to 2008, with he total number of participants of 41.[22] Training is conducted by the contractor constantly, and the contents of the training are valued by the trainees.[23]

3.5.3 Financial Aspects of Operation and Maintenance

Taking facilities related to this project alone, the operating balance surplus is growing, and the earning position for O&M is sound. However, with the NWSDB overall, although earning capacity is improving, some concerns about short-term financial security remain due to the increase in loan interest payments.

(1) Earnings condition

From 2002 onward, NWSDB has posted a deficit every year. The main causes are: (1) Increase in general administration cost (overhead costs), (2) Start of and increase in interest payable on past loans that have come along with the end of repayment grace periods, and (3) Increase in cost of sales (direct operating expenses). In particular, overhead costs have nearly doubled between 2006 and 2010 as shown in Table 17. As mentioned earlier, taking into account the fact that total number of employees has remained about the same over the past three years (about 9,000), it seems that indirect department costs have become bloated. The main factors behind the rise in cost of sales are the rise in electricity, fuel, and other fees associated with the sharp global rise in the price of oil.

At the same time, along with the start of operations of new water facilities (including those of this project) and the increase in population connected, as well as water tariff increases mentioned later, sales are growing sharply at a speed greater than that of the growth in cost of sales (direct operating expenses).[24] In particular, due to the water tariff revision in 2009, gross profit margin (operating profit on sale of water), which had fallen in 2008, has recovered rapidly from 2009 onward.

As for trends in water tariff increase,[25] tariff were raised a total of four times starting in 1999. Most recently, a revision was implemented with the assistance of the ADB in February 2009. These increases are being carried out with a high level of frequency compared to other developing countries in general, and while they do have an aspect of responding to the rise in the consumer price index,[26] they are still exerting a great upward impact on the earning

[22] The engineers were dispatched to Japan, Germany, U.K., France, Taiwan, China and other countries. Two engineers participated in a roughly three-month training program that was then operated by JICA, and received training in various numerical calculation methods required for O&M planning.

[23] Source: Results of interviews with employees who underwent training.

[24] Cost of sales increased 73% over the past five years, while sales increased 83% over the same period.

[25] Regarding water tariff, the Sri Lankan government is currently planning to introduce a tariff adjustment mechanism that responds to the rise in the price index. The Cabinet looks ready to approve it by the end of this year at the earliest.

[26] Since 2005, the consumer price index (Colombo Consumer Price Index, (CCPI)) has risen between 10% and 25% each year. (Source: Department of Census and Statistics)

capacity of the NWSDB.[27]

Table 17: Profit and Loss (P/L) Statement of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Sales of Water	5,869	6,481	6,743	9,670	10,744
Direct Operating Expenses	4,080	4,903	6,089	6,322	7,047
Operating Profit on Sale of Water	1,789	1,578	654	3,348	3,697
Administration Overheads	*1,349*	*1,762*	*1,895*	*2,062*	*2,564*
Revaluation Deficit	-	-	-	-	*12,697*
Depreciation	*1,100*	*1,381*	*1,398*	*1,410*	*3,423*
Profit from Operation Activities	255	▲575	▲1,715	184	▲13,654
Finance cost	512	852	1,193	1,569	1,419
Profit from Ordinary Activities before Tax	▲150	▲1,224	▲2,848	▲1,336	▲14,975
Net Operating Profit after Tax	▲214	▲1,278	▲2,915	▲1,425	▲15,080

Source: Prepared from documents provided by NWSDB

Note: The huge deficit in FY2010 (LKR 15 billion, or about JPY 12 billion) came along with the recording of loss on revaluation, aimed at the change of accounting standards to IFRS (International Financial Reporting Standards).

(2) Financial status

The capital ratio at the end of FY2010 was about 77%, maintaining a high level. However, total liability is consistently trending upward, and the burden of interest payments on loans is weighing on management.[28] In the past, current ratio and quick assets ratio were maintained at very high levels, but both ratios are close to 100% now as a result of the sudden increase in current liabilities accompanying the jump in interest payments. Some degree of concern remains regarding short-term financial security and short-term solvency.

Table 18: Balance Sheet (B/S) of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Assets					
Current Assets	13,620	13,093	15,190	13,460	15,044
Quick Assets	5,079	6,021	5,250	4,301	4,175
Fixed Assets	89,991	100,813	115,632	135,978	140,284
Total Assets	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**
Liabilities and Equity					
Equity Capital	84,175	92,797	105,226	118,734	119,508
Current Liabilities	2,136	2,852	5,315	7,379	9,345
Fixed Liabilities	17,300	18,257	20,281	23,324	26,475
Total Liabilities and Equity	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**

Source: Prepared from documents provided by NWSDB

Table 19: Financial Indices

Year / Item	2006	2007	2008	2009	2010
Gross Margin Ratio (%)	30.5	24.3	9.7	34.6	34.4
Sales to Receivable Ratio (%)	1.2	1.1	1.3	2.2	2.6
Days Sales Outstanding	316	339	284	162	142
Gross Debt (Mil. LKR)	19,436	21,109	25,596	30,703	35,820
Current Ratio (%)	637.6	459.1	285.8	182.4	161.0
Quick Asset Ratio (%)	444.5	331.3	216.3	131.3	116.9
Fixed Assets to Fixed Liability Ratio (%)	88.7	90.8	92.1	95.7	96.1
Capital Ratio (%)	81.2	81.5	80.4	79.5	76.9

Source: Prepared from P/L and B/S

Receivables generated from unpaid water charge, etc., have been decreasing in the past several years. However, as shown in Table 19, as of 2010 the sales to receivables ratio of 2.6 and the average days sales outstanding of 142 are still at low standards, making for a situation

[27] At the same time, slightly less than 50% of the overall population are benefitting from discount tariff for the impoverished. (For example, fees for new connections are about 1/3 of ordinary fees.) In order to further boost earning capacity, there are expectations for more newly connected population and secure collection of water tariff, along with curtailment of costs and streamlining of indirect departments.

[28] For the payment of principal on loans, a certain amount of subsidies is provided from the government. The ratio of subsidies differs depending on the loan case.

where an average of over four months are needed to collect fees. In order to improve financial soundness, ongoing upgrade of the fee collection system is desirable.

Regarding the measures to strengthen NWSDB's financial status and sustainability (such as reduction of administrative expenses, formulation of appropriate water tariff policy, strengthening of inventory control, reduction of NRW rate, etc. which were mentioned at the time of project appraisal), some components to tackle with these issues are included in the ongoing Water Sector Development Project by JICA.

(3) Operation and maintenance expenditure relating to the Project

As shown in Table 20, operating balance in the areas involved in this project that are under the administration of NWSDB RSC Western South have achieved a surplus in FY2010, along with: (1) The water tariff increase in February 2009, and (2) Higher water tariff revenue due to the increased number of connected households. The surplus further expanded in FY2010.

Table 20: O&M Expenditure Relating to the Project Facilities

Unit: Thousand LKR

Item	2007	2008	2009	2010
Treatment / Transmission Facilities	84,341	93,942	93,859	97,998
Distribution Facilities	51,042	248,570	259,498	305,751
O&M Expenditure	**135,383**	**342,512**	**353,357**	**403,749**

Source: Prepared from documents provided by NWSDB

Table 21: Income and Expenditure of RSC Western South (2010)

Unit: Mil. LKR

Item	2010
Income	1,243.9
Expenditure	1,014.1
Operating Profit	**229.8**

Source: Documents provided by NWSDB

The annual expenditure for O&M of the project's facilities (including the additional component's distribution network) has risen every year after the start of operation. Specifically, the O&M expenses for distribution network have sharply increased, compared to other expenditure items.

As part of its activities to decentralize and strengthen the authority of the regional support centers, NWSDB is currently instructing each RSC in independent accounting. In response, RSC Western South is carrying out various measures of its own, including strategies to increase connected population and to reduce NRW rate.

In addition, as already mentioned in the Effectiveness section, a plant with water treatment capacity of 48,000 m^3/day will begin operating within 2013 through the follow-up stage, Water Sector Development Project (II). This will result in further expansion of RSC Western South's overall source of income and create an environment for improving its earning position.

3.5.1 Current Status of Operation and Maintenance

In general, the utilization status and O&M of the various facilities and equipment under the administration of the NWSDB (intake, water treatment, transmission, and distribution facilities and related equipment) are good, and no major problem has occurred to date. Items such as an O&M manual have been developed through this project.

On the other hand, several problems occurred after the facilities began operations, including (1) malfunctioning of sludge processing facilities[29]

Sludge Drying Beds

[29] **The malfunctioning of sludge processing facilities:** Sludge (polluted mud) is created during the water treatment process. There are times when solar drying of the sludge drying bed does not happen as planned due to

and (2) the frequent occurrence of lightning and power cuts[30]. It would be desirable if the executing agencies could deal with these problems using their own "managerial efforts" from hereon.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is highly consistent with government policies, and no problems with O&M systems can be found. Although slight concern remains about the financial sustainability of the NWSDB itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities relating to this project steadily expanding. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations for Executing Agency

Recommendation-1 for NWSDB RSC Western South

Measures to reduce non-revenue water should be implemented in earnest. As mentioned earlier, each regional support center takes the initiative in implementing its own measures to reduce non-revenue water in line with the Corporate Action Plan developed by the head office of the NWSDB. In the target area of this project, various measures have been taken by the NWSDB RSC - Western South, including changing water pipes to PVC pipes, though only limited effects have been observed so far. (The non-revenue water rate in the jurisdiction of the center in 2011 is 34.9%, whereas the national average in 2010 was 31.6%.) At present, reduction measures are continued under the Corporate Action Plan 2007–2011. For the future, it is advisable to continue various measures (particularly measures against water leakage, which is believed to be the main cause of non-revenue water). For example, the "24-hour water leakage helpline for customers" that NWSDB RSC - Central is introducing under JICA's Water Sector Development Project is effective in helping reduce the non-revenue water rate and is also attractive as a measure that can directly enhance customer satisfaction. The possibility of introducing this system in the medium to long term should be explored.

Recommendation-2 for NWSDB RSC Western South

In order to address detailed issues concerning operation and maintenance, voluntary "management efforts" are expected from the executing agency. With regard to the issue of power failure, for example, voluntary measures are expected to be taken, such as those similar to the "construction of power lines connected to the main transmission network using one's own

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weather-related problems and so on. This leads to substantial impediments to sludge processing operations. RSC Western South is planning to take the necessary measures to deal with these problems from hereon (the problems are expected to be dealt with from Phase II stage onwards).

[30] **The frequent occurrence of lightning and power cuts:** The target areas for this project were areas in Sri Lanka which are prone to lightning strikes. These strikes sometimes place excessive loads on some electrical equipment, for example, or impede the supply of electricity to pump stations through frequent blackouts. Furthermore, utility costs are rising (electricity and fuel costs, etc.) as generators need to be kept working during blackouts. These problems are external factors outside of the control of the executing agencies (NWSDB), but it would be a good idea for them to implement their own measures to deal with the problem of regional blackouts, such as the "construction of new power lines connected to the main transmission grid using one's own funds" as implemented in JICA's Greater Kandy Water Supply Project.

funds" as implemented by RSC - Central in JICA's Greater Kandy Water Supply Project.

4.2.2 Recommendations for JICA

N.A.

4.3 Lessons Learned

In this project, it took more than two years to start the selection of consultants, and this became the main cause of the substantial delay in the project implementation period. Similar situations have occurred in past yen loan projects in Sri Lanka. In view of this, when implementing similar projects in the water sector in Sri Lanka in the future, particular attention needs to be paid to time management when hiring consultants. Measures for "expediting the procurement process," which are taken by JICA Sri Lanka Office, should be continued, along with efforts to seek further enhancement of the project management capacity of the executing agency.

Regarding associated projects, it was pointed out that the mobilization activities (encouraging the participation of beneficiary residents in the project, facilitating coordination between CDCs and various agencies concerned, etc.) of the Japan Overseas Cooperation Volunteers (JOCV) and of NGOs evoked a sense of participation among residents and brought about various changes in resident behavior (i.e., the payment of water rates). Although these effects may depend largely on the personal efforts of the JOCV and NGO staff, they seem to present certain suggestions for the implementation of water supply projects in poor residential areas.

End

Comparison of Original and Actual Scope

Item	Plan	Actual
A) Output		
1.1 Water Intake Facility		
· Intake Capacity	126,000 m³/day	The same
· Raw Water Pumps	63,000 m³/day, Pump house: 60 m^2	63,000 m³/day, Pump house: 114 m^2
1.2 Raw Water Transmission Facility		
· Raw Water Transmission Main	From intake to treatment plant, 2,140m	217.5 m
1.3 Water Treatment Plant		
· Treatment Capacity	60,000 m³/day	The same
1.4 Water Transmission Facility		
· Clear Water Pump	29.2 m³/min.×2 units, Pump house: 60m^2	20.8 m³/min.×4 units, Pump house: 341 m^2
· Clear Water Transmission Main	6.7 km	6.35 km
· High Level Water Reservoir	15,000 m³/day	The same
· Water Transmission Mains		
➢ High Level Reservoir to Bandaragama	10.3 km	8.832 km
➢ Bandaragam to Panadura	9.7 km	9.515 km
➢ Panadura to Moratuwa	10.3 km	7.903 km
1.5 Water Distribution Facility · Distribution Pipelines	150 km in toal (for Horana, Bandaragama, Panadura districts)	245.96 km in total (Panadura East and Raigama were added to the districts shown in left)
1.6 Water Supply Equipment		
· Domestic Water Meters and Connection Material	20,000 sets in total	The same
· Bulk Meters	7 sets in total	14 sets in total
1.7 Others	Office building, Staff accommodations, O&M vehicle, Electricity supply facilities to the intake facilities and treatment plant, Telecommunication equipment, etc.	The same for staff accommodations, O&M vehicle, electricity supply facilities and telecommunication equipment
1.8 Additional Components	n.a.	The following items were added to the original scope by using a budget surplus. (Activities related to this were implemented from 2006 to 2008) · Construction of office buildings of Bandaragama and Panadura districts · Construction of Water towers at Panadura East (for Water Sector Development Project (II)) · Procurement of chlorine neutralization equipment (1), Generator (2) and Transformer (1)
1.9 Consulting Service		
· Consulting Service M/M	496 M/M in total (Foreign:116 M/M, Local: 380 M/M)	640.71 M/M in total (Foreign:86.75M/M, Local: 553.96M/M)
· Consulting Service TOR	Detailed Design (D/D), Bidding support, Construction supervision, Decision of distribution areas, etc.	In addition to the left, detailed design of Water Sector Development Project (II)

Item	Plan	Actual
B) Project Period	August 1997 – June 2003 (71 months)	August 1997 – October 2006 (111 months)
C) Project Cost Foreign currency Local currency Total Japanese ODA loan portion Exchange rate	 6,418 million yen 3,277 million LKR 13,268 million yen 11,278 million yen 1 LKR ＝ 2.09 yen (as of January 1997)	 6,460 million yen 6,681 million LKR 13,225 million yen 11,107 million yen 1 LKR ＝ 0.96 yen (as of April 2009)

Appendix-1: Resetting Target Values for Evaluating Effectiveness

This project was carried out before the introduction of a system for ex-ante evaluation. As a result, clear target figures were not set out during the appraisal phase of this project (by NWSDB). Also, as touched on above when discussing efficiency, the target areas for water distribution increased following an enlargement of the scope of this project. Based on the specific circumstances of this project (as outlined above), attention was paid to the calculation of goal attainment levels when evaluating effectiveness. Outlined below are the specific viewpoints and things to consider with regard to calculating goal achievement levels for each indicator.

Target year: According to the SAPROF report, the target year for this project (which is Phase I Stage 1 of the overall plan) was set at 2006, with the project scope fixed so as to ensure the relevant demand would be met in the third year after the completion of the project (the completion year was 2003). In light of this, the target year was set at 2010 (three years after this project was completed) and the estimated values for 2010 were set as target figures.

Water-supplied population: The estimates for 2010 were set as the target values. During the F/S Phase in 1994, the estimated water-supplied population (including Raigama and Panadura East, added as extra target areas for water distribution) was listed as 267,800 people. This was set as the target value.

Water supply coverage: Neither estimates nor target values exist for 2010, so it is difficult to calculate goal achievement levels. On the other hand, as mentioned in the Sustainability section, NWSDB is currently instructing each RSC in independent accounting, and is helping to improve management levels through the introduction of Key Performance Indicators (KPIs) for management goals. In light of this, a 2011 target rate for water supply coverage of 50.5% (as determined by NWSDB RSC - Western South) was used when calculating achievement levels.

Supply volume: The estimates for 2010 were set as the target values. At the time of the feasibility study conducted in 1994, estimated water supply volume (including Raigama and Panadura East, added as extra target areas for water distribution) was listed at 58,500 m^3/day. This was set as the target value.

Facility utilization rate: Based on the aforementioned estimated water supply volume of 58,500 m^3/day, the facility utilization rate for 2010 was calculated at 97.5% (= 58,500/60,000). This was set as the target value.

Water supply hours: According to the NWSDB, the target rate as at the time of project appraisal was set at 24 hours/day. This value was set as the target.

Sri Lanka

Ex-Post Evaluation of Japanese ODA Loan
"Project for the Improvement of National Blood Transfusion Services"

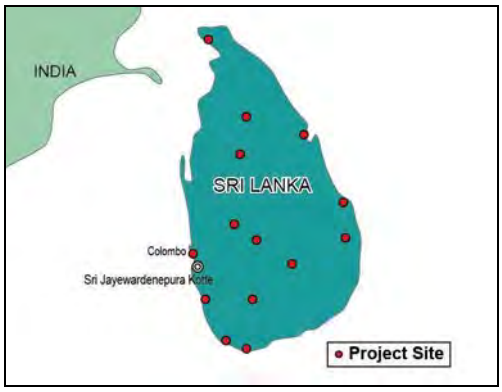
External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

This project sufficiently matches Sri Lanka's development policy, development needs and Japan's aid policy, hence its relevance is high. Although the project cost was within its plan, the project period was significantly exceeded; therefore efficiency of the project is fair. By implementing the project, various project effects were seen as planned such as an increased number of blood donations, an increased voluntary blood donation rate, increased blood product supplies of red blood cells, platelet and fresh frozen plasma, decreased blood discards, improved safety of the blood transfusion service, improved blood testing and screening capacity. Therefore the effectiveness of the project is high. Furthermore, the project has contributed to better medical treatment in hospitals and clinics through the increase of blood supply, which has been a positive impact. Lastly, the operation and maintenance of the project in terms of system, skills and finances is good and the project's sustainability is high.

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

1. Project Description



Project Locations

The National Blood Center (NBC), Colombo

1.1 Background

After gaining its independence, the Government of Sri Lanka made social sector development, including healthcare sector development, a priority. Following this, the child mortality rate was 16.5 per 1,000 (1998), the maternal mortality rate was 24 per 100,000 birth (1998) and the average life expectancy was 72.9 (1995) Therefore, the basic health indicators of Sri Lanka were good compared to other developing countries in the same income level group. The healthcare system of the country has been maintained by the public hospitals network which includes teaching hospitals across the country, provincial general hospitals, and regional hospitals, as well as a community-based healthcare service network for which public health inspectors and family health workers are responsible.

On the other hand, a transition to advanced medical systems has been in demand in order to correspond to phenomena such as aging as the result of the decreased birth and death rates, and main constituents shifting from contagious diseases to chronic diseases such as cardiac disease, high blood pressure, and cerebrovascular disease. In 2000, the blood transfusion service of Sri

Lanka was operated by the Central Blood Bank (CBB) and 56 Regional Blood Banks (RBB) under the control of the Ministry of Health, however, the CBB was facing difficulties in responding to the increasing demand for blood and within their existing facilities there were problems such as the deterioration of the building, shortages in facilities for blood collecting, blood testing, screening and blood storage, insufficient educational and training facilities. The CBB building was built before the 1960s.

1.2 Project Outline

The objective of this project was to ensure safety, adequacy, and easy accessibility of blood products for the public by the construction of a new National Blood Transfusion Center (NBTC), the upgrading the operation equipment of the National Blood Transfusion Services (NBTS), and through technical transfer to staff in charge of NBTS, thereby contributing to the improvement of the public health sector in Sri Lanka.

Loan Approved Amount/ Disbursed Amount	1,508 million yen / 1,332 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	November 2000 / January 2001
Terms and Conditions	Interest Rate: 2.2% (Interest rate for consulting service: 0.75%) Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: Partial Tied
Borrower / Executing Agency	Government of the Democratic Socialist Republic of Sri Lanka / Ministry of Health
Final Disbursement Date	May 2008
Main Contractor (Over 1 billion yen)	Not applicable
Main Consultant (Over 100 million yen)	YAMASHITA SEKKEI (Japan)
Feasibility Studies, etc.	Master Plan Study for Strengthening the Health System in the Democratic Socialist Republic of Sri Lanka, JICA, 2002-2003
Related Projects	County-Focus Training “Laboratory Methodology and the Management System for Blood Banks”, JICA, 2005-2007

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: November 2010 – October 2011
Duration of the Field Study: April 24 – May 7, 2011, July 30 – August 6, 2011

2.3 Constraints during the Evaluation Study

None

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Sri Lanka

At the appraisal, in the health sector action plan (1998), human resource development in the public and private health sector, the improvement of health and medical care services, the decentralization of health and medical care services, and the mitigation of the regional gap in health and medical care services were set as development objectives. In order to respond to the above objectives, improvement in the quantity of the blood supply, improvement in the quality and efficiency of blood transfusion services and human resource development were emphasized.

At the time of ex-post evaluation, the Health Master Plan (2007-2016)[3] of the Government of Sri Lanka stated the following five strategic objectives; (1) To ensure the delivery of comprehensive health services, which reduce the disease, burden and promote health; (2) To empower communities (including households) towards more active participation in maintaining their health; (3) To improve the management of human resources for health; (4) To improve health financing, resource allocation and utilization; and (5) To strengthen stewardship and management functions of the health system. In order to achieve the above strategic objectives, twenty priority programs and projects were specified, including blood safety.

3.1.2 Relevance with the Development Needs of Sri Lanka

At the time of appraisal, the blood transfusion services in Sri Lanka were operated by the National Blood Transfusion Center (NBTC) together with 56 Regional Blood Banks (RBB) under the control of the Ministry of Health. Since the NBTC building was built before the 1960s, it faced recognised constraints such as its aged facilities, lack of facilities for blood collection, blood screening, and blood preservation, and lack of space for training and education. On the other hand, as the blood supply in Sri Lanka had increased by 10% every year since 1993 due to increase of diseases associated with adult lifestyle habits and development of advanced medical technology, the existing NBTC and RBB could not meet requirements due to their capacity limitation. Therefore, the upgrading of NBTC and the modernization of the blood transfusion system in Sri Lanka was necessary.

At the time of ex-post evaluation, the blood transfusion service in Sri Lanka was operated by the National Blood Center (NBC) and 16 Cluster Centers (CC) nationwide as well as 64 Hospital Blood Banks (HBB) under control of the National Blood Transfusion Service (NBTS), Ministry of Health[4]. Through this project, modernization of the National Blood Center (NBC) and 5 Cluster Centers was conducted, and remarkable improvements were seen in both the quality and the quantity of the blood transfusion services in Sri Lanka. On the other hand, the demand for blood transportation and blood products has been continuously increasing, and there is now a high demand for the new construction of blood banks in the northern region, which had been left behind after the end of the civil war in 2009, as well as for modernization of the facilities of small scale HBBs. The needs for the modernization of the blood transfusion services in Sri Lanka and the expansion of its service coverage areas are thus still recognized.

3.1.3 Relevance with Japan's ODA Policy

At the appraisal, the Country Assistance Program for Sri Lanka of the Ministry of Foreign Affairs, Japan, gave the following as priority areas: (1) development and improvement of the

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

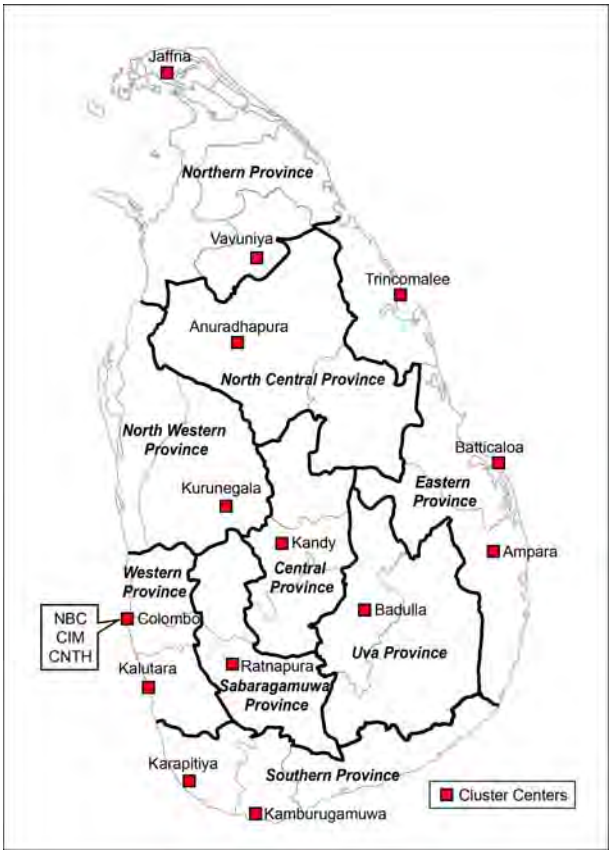
[2] ③: High, ②: Fair, ①: Low.

[3] The Health Master Plan (2007-2016) was prepared by the "Master Plan Study for Strengthening the Health System in the Democratic Socialist Republic of Sri Lanka (2002-2003)" by JICA and it was officially approved by the Government of Sri Lanka in February 2007 as the 10-year Health Sector Plan of the country.

[4] The National Blood Transfusion Service (NBTS) underwent a structural reform in 2009, and the former Central Blood Bank (CBB), Provincial Blood Bank (PBB), Regional Blood Bank (RBB) changed names to National Blood Center (NBC), Cluster Center (CC) and Hospital Blood Bank (HBB), respectively.

economic infrastructure, (2) development of the mining and manufacturing industries, (3) development of the agriculture, forestry and fishery industries, (4) human resource development, and (5) improvement of the health and medical systems. JICA's Assistance Strategy for Japanese ODA loan to Sri Lanka (1992-2002) [5] emphasized support for improvement of the social infrastructure and human resource development in order to sustain continuous economic development. Hence, collaboration with the World Health Organization (WHO), which supports Sri Lanka in the field of infection control measures and primary health care, was also in line with this policy (See **3.2.1 Project Outputs** for more information on the collaboration between JICA and WHO for this project). Furthermore, this project meets the G8 Communiqué Okinawa 2000 declared by the Kyushu-Okinawa Summit stating the need to "Implement an ambitious plan on infectious diseases, notably HIV/AIDS, malaria and tuberculosis".

This project has been highly relevant with Sri Lanka's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.



Note: Three Cluster Centers are located in Colombo.

Figure 1：Location of Cluster Centers

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Planned outputs of this project were (1) Construction of the National Blood Center (NBC) (3 story building, 5,010 square meters), (2) Procurement and installation of equipment for the NBC (apheresis system, testing and screening equipment, storage facilities, etc.) as well as for 8 Provincial Blood Banks (PBB) and 48 Regional Blood Banks (RBB) (storage facilities, ambulances, etc.), and (3) Procurement of training materials and blood transfusion manuals (for all blood banks). As for items (1) and (3), the actual outputs were as planned. As for (2) the actual output was almost as planned except for a change in the quantity of equipment procured, and a decrease in the target blood banks from 8 PBB to 5 Cluster Centers. The 5 Cluster Centers were: Kandy (Central Province), Jaffna (Northern Province), Anuradhapura (North Central Province), Ampara (Eastern Province) and Kamburugamuwa (Southern Province). At the time of appraisal, it was envisaged that the project would cover 8 PBBs in all 8 provinces of Sri Lanka, however, the target PBBs were narrowed down to the above 5 PBBs (or current Cluster Centers) due to a policy change of the Ministry of Health that prioritized 5 PBBs out of 8 PBBs to strengthen capacity in the course of project implementation.

In the original plan, the consulting services consisted of two packages, 'Engineering Services" and "Education and Training Services". The 'Engineering Services" involved detailed

[5] It was the Medium-term Strategy for Overseas Economic Cooperation Operation (December 1992-March 2002) originally established by the former Japan Bank for International Cooperation (JBIC).

design and assistance for tender that considered environmentally friendly aspects, environmental monitoring during the construction stage, and technical advice for counter measures for medical wastes. 'Education and Training Services" was to provide education and training for all NBTS employees including medical doctors, nurses and laboratory technicians on how to manage blood transfusion services according to the global standards with the introduction of modern equipment and advanced testing methods. The 'Education and Training Services" package, was carried out by consultants from WHO and its cost was covered by the consultant fee of this project based on a Letter of Agreement between the Ministry of Health and WHO. The above two consulting service packages were implemented as planned (See **Comparison of the Original and Actual Scope of the Project** in the last page of this report for more information on the planned and actual project outputs).

In addition to these outputs, JICA's Country-Focus Training, "Laboratory Methodology and the Management System for Blood Banks[6]" was conducted in coordination with the education and training of this project, in which approximately forty NBTS employees (medical doctors, nurses, medical laboratory technologists and public health inspectors) received technical training in Japan for four years between 2005 and 2008. According to the JICA training evaluation report, the levels of achievement of the trainees were substantial.

The NBTS, the executing agency of this project, underwent structural reform in 2009, which saw a shift from the conventional system of the "Central Blood Bank (CBB) - Provincial Blood Bank (PBB) - Regional Blood Bank (RBB)" to the "National Blood Center (NBC) – Cluster Center (CC) – Hospital Blood Bank (HBB)". In comparison to the old system, the new system focused on the enhancement of Cluster Centers (CC) so that at least one was set up in each province. Each Cluster Center received substantial empowerment from the NBC in every area regarding the management and operation of the blood transfusion service except finance, and thus each Cluster Center has more responsibility for operational control of the Hospital Blood Banks (HBB) in its respective area. Currently there are 16 Cluster Centers and 64 HBBs nationwide (See **3.5.1 Structural Aspects of Operation and Maintenance** for more details).

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost amounted to 1,908 million yen (including the 1,508 million yen of the Japanese ODA loan), resulting in a reduction from the planned cost of 2,010 million yen (including the 1,332 million yen of the Japanese ODA loan). This is 95% of the planned cost, which means that the project cost was lower than planned. As mentioned above, although there was a change in the number of target blood banks from eight to five locations, the cost saving through this change was off set by an increase in the amount of expensive equipment such as refrigerated centrifuges and ambulances. As a result, the actual project cost was within the planned project cost.

Table 1: Planned and Actual Project Cost

Items	Plan			Actual		
	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)
1. Civil Work	532	157	758	532	371	929
2. Procurement of Equipment & Materials	573	0	573	603	154	768

[6] The contents of training were quality assurance and clinical blood transfusion work focusing on work implementation, standards, document storage and record keeping, human error prevention and quality control based on GMP (Good Manufacturing Practice). Training was conducted by the Japanese Red Cross Fukuoka Blood Center.
*GMP (Good Manufacturing Practice) is a system that those who are engaged in pharmaceutical and biotech production must follow to ensure that products are consistently produced and controlled according to quality standards appropriate to their intended use and as required by the product specification.

Items	Plan			Actual		
	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)
3. Technical Transfer	24	0	24	3	0	3
4. Training & Education	64	0	64	57	2	59
5. Engineering Services	81	0	81	100	11	112
6. Interest During Construction	96	0	96	37	0	37
7. Physical Contingency	138	0	138	0	0	0
8. Tax & Duties	0	192	276	0	0	0
Total	1,508	349	2,010	1,332	538	1,908

Source: JICA appraisal documents and Project Completion Report (PCR) of this project.
Note: Exchange rate used: (Planned cost) LKR1=JPY1.44 (February 2000), (Actual cost) LKR1=JPY1.07 (year and month is unknown).

3.2.2.2 Project Period

The planned project period was a total of 57 months from January 2001 (the signing of the loan agreement) until September 2005 (the end of the educational and training consulting services). However, the actual project period was significantly longer than planned, from January 2001 (the signing of the loan agreement) until May 2008 (the end of procurement of equipment and materials), a total of 89 months and 156% longer (a delay of 27 months). The main factors for the delay were, (1) delays in the administrative procedures within Sri Lanka due to a lack of experience of the executing agency in Japanese ODA loan procedures including an unfamiliarity towards JICA's procurement guidelines, (2) changes in the number of target blood banks and the amount of procured equipment, and (3) the Sri Lankan civil war[7] between the government and an anti-government armed organization called the "Liberation Tigers of Tamil Eelam (LTTE)"; there was a delay in the installation of equipment of blood banks in the Northern Province of Sri Lanka which was under the control of LTTE. Of these three factors, (3) is an external factor, which made correspondence more difficult for the project. Nevertheless, the actual project period was longer than planned even ignoring the above external factor.

The opening ceremony of the National Blood Center (NBC) took place on November 2, 2006.

Table 2: Planned and Actual Project Period

Activities	Plan	Actual
1. Signing of Loan Agreement	January 2001	January 2001
2. Civil Work	1st Quarter 2001 – 4th Quarter 2003	3rd Quarter 2002 – 2nd Quarter 2007
3. Procurement of Equipment & Materials	2nd Quarter 2001 – 4th Quarter 2003	3rd Quarter 2002 – 2nd Quarter 2008
4. Engineering Services	2nd Quarter 2001 – 1st Quarter 2004	2nd Quarter 2002 – 2nd Quarter 2007
5. Training and Education Services	4th Quarter 2002 – 3rd Quarter 2005	3rd Quarter 2001 – 4th Quarter 2007
6. Project Completion	September 2005	May 2008
7. Entire Project Period	January 2001 – September 2005 (57 months)	January 2001 – May 2008 (89 months)

Source: Questionnaire survey results to the National Blood Transfusion Service (NBTS).

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

[7] The end of the civil war between government troops and the anti-government armed organization, "Liberation Tigers of Tamil Eelam (LTTE)" was officially announced by President Rajapaksa at the National Assembly of Sri Lanka on May 19, 2009.

Equipment and Facilities provided by the Project at the National Blood Center (NBC)

Microbiology Laboratory

Blood Group Serology Laboratory

Reference Immunohematology Lab.

Blood Component Laboratory

Refrigerator Room for Blood Storage

Training for Medical Students

3.3 Effectiveness (Rating: ③)

This project not only modernized the facilities and equipment of the NBC and five Cluster Centers, but training for medical doctors, nurses and other NBTS employees was also conducted in order to improve their skills and knowledge. In addition, proposals were made to reform the organization and systems for the improvement of quality control and the management capacity of NBTS for consulting services. The beneficiaries of the training and education extended to all blood bank staff nationwide. This means that the outcome of training and education was not limited to the strengthening of NBC capacity for management, testing, research, training and education as the hub of the Sri Lankan blood transfusion service, but also included capacity development of individual blood banks as well as the entire blood transfusion service system in Sri Lanka.

Based upon the above understanding, in addition to analysis of the project effects regarding NBC and the five Cluster Centers mainly targeted by this project, this ex-post evaluation concludes that changes in the performance of the entire blood transfusion service system in Sri Lanka before and after the project should be also analyzed as an effect of this project.

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

a) Number of Blood Donations

The number of blood donations in Sri Lanka increased 1.9 times; from 158,541 before the project (2002) to 302,883 after the project (2010). In 2010, the proportion of blood donations by province was: Western Province (where Colombo is located), 41.2%, followed by Central Province (12.5%), Southern Province (12.2%), North Central Province (10.1%), North Western Province (10.1%), Uva Province (5.5%), Eastern Province (4.8%), Sabaragamuwa Province (3.1%), and Northern Province (3.1%) (See Table 3).

The NBC and Cluster Centers in five locations (Kandy, Jaffna, Anuradhapura, Ampara and Kamburugamuwa), all main target blood banks of this project, also observed increases in blood donations by 1.4 to 3 times between 2002 (2003 for the NBC) and 2010 (See Table 4). The reasons why the number of blood donations at NBC decreased after 2008 to 78,684 in 2009 and 63,569 in 2010 having hit a peak of 96,388, are: (i) the number of blood donations in the entire

Western Province tended to decline after 2008, and (ii) there was an increase in the number of blood donations at other blood banks in Western Province as the result of capacity improvement of the Cluster Centers and Hospital Blood Banks after the introduction of the Cluster System through the structural reform of 2009. Consequently, there was a relative decline in the number of blood donations in the NBC. In fact, the total number of blood donations in Western Province, excluding those at the NBC, increased little by little from 53,238 in 2008 to 58,073 in 2009 and 61,092 in 2010. Regarding the Kamburugamuwa Cluster Center, this was newly established during the project implementation period and commenced operations in 2006.

Table 3: Number of Blood Donations in Sri Lanka (2002-2010)

Unit: Number of Blood Donations

Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
Western	73,651	78,079	90,250	93,302	115,539	120,008	149,626	136,757	124,661
	46.5%	46.6%	49.6%	45.6%	46.8%	46.2%	46.9%	44.2%	41.2%
Central	22,613	24,696	27,522	28,096	31,852	32,466	36,430	38,433	37,979
	14.3%	14.7%	15.1%	13.7%	12.9%	12.5%	11.4%	12.4%	12.5%
North Western	10,894	10,881	12,075	15,012	17,644	21,238	25,785	25,239	22,780
	6.9%	6.5%	6.6%	7.3%	7.2%	8.2%	8.1%	8.1%	7.5%
North Central	13,740	14,894	15,246	17,274	20,133	20,538	28,697	28,670	30,587
	8.7%	8.9%	8.4%	8.5%	8.2%	7.9%	9.0%	9.3%	10.1%
Uva	8,156	9,711	10,494	10,751	12,525	14,870	16,525	15,358	16,657
	5.1%	5.8%	5.8%	5.3%	5.1%	5.7%	5.2%	5.0%	5.5%
Southern	16,369	15,283	7,952	21,697	26,768	28,315	36,298	38,159	36,801
	10.3%	9.1%	4.4%	10.6%	10.8%	10.9%	11.4%	12.3%	12.2%
Sabaragamuwa	4,689	3,794	6,215	6,436	8,274	8,253	9,657	8,698	9,397
	3.0%	2.3%	3.4%	3.1%	3.4%	3.2%	3.0%	2.8%	3.1%
Northern	3,753	4,773	6,108	6,997	6,084	5,350	4,892	5,762	9,485
	2.4%	2.8%	3.4%	3.4%	2.5%	2.1%	1.5%	1.9%	3.1%
Eastern	4,676	5,422	6,140	4,847	7,933	8,915	10,953	12,679	14,536
	2.9%	3.2%	3.4%	2.4%	3.2%	3.4%	3.4%	4.1%	4.8%
Total	**158,541**	**167,533**	**182,002**	**204,412**	**246,752**	**259,953**	**318,863**	**309,755**	**302,883**

Source: National Blood Transfusion Service (NBTS).
Note: The volume of blood per one blood donation is 450cc.

Table 4: Number of Blood Donations in Six Blood Banks (2002-2010)

Unit: Number of Blood Donations

Blood Bank	Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
NBC	Western	-	46,204	53,145	52,651	67,687	75,666	96,388	78,684	63,569
Kandy	Central	11,003	11,519	13,732	13,722	17,162	17,009	18,963	19,209	20,016
Jaffna	Northern	2,513	3,597	4,689	5,643	5,268	4,975	4,517	4,427	5,584
Anuradhapura	N. Central	10,216	11,543	10,945	12,386	15,132	15,300	22,463	21,099	22,495
Ampara	Eastern	1,607	1,831	2,237	3,122	3,488	4,513	5,133	5,715	4,957
Kamburgamuwa	Southern	-	-	-	-	8,259	13,291	17,992	18,076	16,975
Total		25,339	74,694	84,748	87,524	116,996	130,754	165,456	147,210	133,596

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of blood per one blood donation is 450cc.
Note 2: Since Kamburgamuwa is a newly established blood bank which commenced operations in 2006, there is no actual number of blood donations from 2002 to 2005.

b) Voluntary Blood Donation Rate[8]

The rate of voluntary blood donations improved from a national average of 55% in 2004 to 89% in 2010 (See Table 5). Before the completion of this project, 45% of blood donations relied

[8] The voluntary blood donation rate is the ratio of volunteers and non-remunerated blood donations among all blood donations.

on replacement donations[9] and the selling of blood, however, the fact that this rate decreased to 10% post-project while voluntary donations increased to 90% contributes to improved blood safety. The main target blood banks of the project, the NBC and the Cluster Centers in five locations, have seen a significant improvement in the voluntary blood donation rate, especially the NBC and the blood banks at Jaffna, Anuradhapura and Kamburugamuwa, which have achieved almost a 100% voluntary blood donation rate (See Table 6).

Table 5: Voluntary Blood Donation Rate in Sri Lanka (2004-2010)

Unit: %

	2004	2005	2006	2007	2008	2009	2010
Voluntary Blood Donation Ratio in Sri Lanka	55.0	62.9	75.0	81.0	88.0	84.0	89.0

Source: National Blood Transfusion Service (NBTS).

Table 6: Voluntary and Replacement Blood Donation Rate in Six Blood Banks (2006-2010)

Unit: %

		2006	2007	2008	2009	2010
NBC (Western Province)	Voluntary	96.2	94.7	97.4	98.6	97.7
	Replacement	3.8	5.3	2.6	1.4	2.3
Kandy (Central Province)	Voluntary	81.8	81.4	86.4	86.8	87.5
	Replacement	18.2	18.6	13.6	13.2	12.5
Jaffna (Northern Province)	Voluntary	73.5	81.9	96.4	100.0	99.9
	Replacement	26.5	18.1	3.6	0.0	0.1
Anuradhapura (N. Central Province)	Voluntary	86.1	92.4	97.6	99.2	99.6
	Replacement	13.9	7.6	2.4	0.8	0.4
Ampara (Eastern Province)	Voluntary	75.1	78.8	83.6	90.5	89.6
	Replacement	24.9	21.2	16.4	9.5	10.4
Kamburgamuwa (Southern Province)	Voluntary	99.9	98.5	98.4	98.5	99.3
	Replacement	0.1	1.5	1.6	1.5	0.7

Source: National Blood Transfusion Service (NBTS).

Note: Currently remunerated blood donations are forbidden by law in Sri Lanka. Therefore the replacement blood donations in Table 6 do not include remunerated blood donations.

Currently, on national average, 80% of blood donations are conducted outside of the blood banks (off-site), while the remaining 20% are conducted within the blood banks (on-site). Each blood bank actively participates in blood collection, in collaboration with its local community, by dispatching mobile units with blood bank employees such as medical doctors and nurses and ambulances to public facilities such as community centers, Buddhist temples, schools and offices. Such efforts have resulted in an increase in the number of blood donations nationwide. In the case of Sri Lanka, the level of service standards in education and healthcare is relatively high compared to other developing countries of the same income level group. Public health inspectors and health workers are assigned in each local community and they often assist in blood donation campaigns. The fact that this public health inspector system in Sri Lanka is well utilized is one of the reasons why blood donations using mobile units are successful there. The

[9] A replacement blood donation is when a patient who is in need of a blood transfusion receives blood from his/her family and relatives. If the blood type of the family member does not match, blood in stock is used, but if there is a match, the blood is used as it is after being tested. However, if the blood testing capacity in the hospital is not sufficient, a replacement blood donation can have a high risk of transmitting disease. Also, since the blood must be checked by required tests, including the screening test for transmittable infectious viruses before transfusion, cases where the blood collected from replacement donors is directly user for transfusion take longer than using stocked blood which is already examined through proper tests and screening.

project provided 19 ambulances equipped with refrigerators (5 for the NBC, 14 for the Cluster Centers and 2 for the Hospital Blood Banks) and this is another factor that has contributed to the expansion of off-site blood collection.

The main factors for the increase in the voluntary blood donation rate are (1) successful blood collection activities through the use of mobile units, and (2) the positive attitude of Sri Lankan people towards voluntary blood donations based on their Buddhist spirit, i.e., they are enthusiastic to "do good for others" through donating blood.

The project's main target blood banks, the NBC and Cluster Centers in five other locations, have observed an increase in off-site blood donations using mobile units (see Table 7). However, decreases in off-site blood donations have been observed at Jaffna (Northern Province) and Ampara (Eastern Province). These were 59.3% and 67.9% respectively in 2010, in comparison to the national average of 80%. According to the Jaffna and Ampara blood banks, the reason is assumed to be unique ethnic and religious backgrounds in those regions[10].

Table 7: Off-Site and On-Site Blood Collection Ratio in Six Blood Banks (2006-2010)

			2006	2007	2008	2009	2010
NBC (Western Province)	Off-Site	No. Blood Donations	63,264	68,930	88,284	75,963	57,272
		Ratio (%)	93.5%	91.1%	91.6%	96.5%	90.1%
	On-Site	No. Blood Donations	4,423	6,730	8,104	2,721	6,297
		Ratio (%)	6.5%	8.9%	8.4%	3.5%	9.9%
Kandy (Central Province)	Off-Site	No. Blood Donations	13,111	12,693	15,187	15,448	16,248
		Ratio (%)	76.4%	74.6%	80.1%	80.4%	81.2%
	On-Site	No. Blood Donations	4,051	4,316	3,776	3,761	3,768
		Ratio (%)	23.6%	25.4%	19.9%	19.6%	18.8%
Jaffna (North Province)	Off-Site	No. Blood Donations	2,153	2,472	2,164	2,501	3,309
		Ratio (%)	40.9%	49.7%	47.9%	56.5%	59.3%
	On-Site	No. Blood Donations	3,115	2,503	2,353	1,925	2,275
		Ratio (%)	59.1%	50.3%	52.1%	43.5%	40.7%
Anuradhapura (N. Central Province)	Off-Site	No. Blood Donations	11,595	13,053	19,598	18,933	20,351
		Ratio (%)	76.6%	81.5%	87.2%	89.7%	90.5%
	On-Site	No. Blood Donations	3,537	2,967	2,865	2,166	2,144
		Ratio (%)	23.4%	18.5%	12.8%	10.3%	9.5%
Ampara (Eastern Province)	Off-Site	No. Blood Donations	1,584	2,335	3,410	3,781	3,365
		Ratio (%)	45.4%	51.7%	66.4%	66.2%	67.9%
	On-Site	No. Blood Donations	1,904	2,178	1,723	1,933	1,592
		Ratio (%)	54.6%	48.3%	33.6%	33.8%	32.1%
Kamburgamuwa (Southern Province)	Off-Site	No. Blood Donations	8,198	12,865	17,360	17,351	16,437
		Ratio (%)	99.3%	96.8%	96.5%	96.0%	96.8%
	On Site	No. Blood Donations	61	426	632	725	538
		Ratio (%)	0.7%	3.2%	3.5%	4.0%	3.2%

Source: National Blood Transfusion Service (NBTS).

[10] In the Northern Province and Eastern Province where Jaffna and Ampara are located, the population is largely Tamil. According to the interview with the blood banks in Jaffna and Ampara, the Tamils are not as proactive as Simharas in blood donation. Sri Lanka's ethnic makeup is as follows: Shimharas 72.9% (mostly Buddhists), Tamils 18.0% (mostly Hindus), Moors 8% (mostly Muslims) and others 1.1% (from the Japanese Ministry of Foreign Affairs website).

On the other hand, off-site blood collection by mobile units is influenced by seasonal changes which cause the number of donors to decrease in number during festivals or farming/harvest seasons. Also off-site blood collection by mobile units requires a higher cost, more time and labor than the on-site blood collection. Since the amount of on-site blood collection has not increased at many blood banks in the same way as off-site blood collection has, it is necessary to promote on-site blood collection within blood banks in order to secure a stable volume of blood. The NBTS recognizes this issue, and plans for enhancing on-site blood collection such as promotion of awareness campaigns though the mass-media have been discussed in the NBTS.

Blood Donation at the National Blood Center (NBC)



Off-Site Blood Donation Campaign using a Mobil Unit at the Buddhist Temple in Kandy



c) Blood Supply

Red Blood Cells

Sri Lanka's red blood cell supply doubled from 156,147 bags in 2002, pre-project, to 320,966 bags in 2010, post project. By Province, Eastern Province, Sabaragamuwa Province, Northern Province and North Central Province have marked increases of five times, four times, 3,8 times and three times, respectively.

The Cluster Centers in five locations, the main target blood banks of this project (except Kamburugamuwa), have increased their red blood cell supply by 2-4 times, but this is not the case for the NBC. The NBC red blood cell supply decreased by approximately 20%, from 20,672 bags in 2003, pre-project, to 4,278 bags in 2010, post project[11]. This is because, pre-project, the NBC was responsible for the blood demand not only of Western Province but also other neighboring provinces as the functions of each provincial and regional blood bank were rather limited. However, the blood donation and blood product supply capacity improved at the blood banks outside of the NBC post project, causing the NBC supply of blood products to decrease. In addition, the Cluster Center at Kamburugamuwa is a newly built blood bank in the course of the project, and it is an independent facility which is not attached to an existing

[11] As reference, 80% of red blood cells provided by the Kandy Cluster Center in 2010 were for the Kandy Teaching Hospital to which the Cluster Center is attached (39.3% for medical wards, 26.5% for surgical wards, 9.7% for pediatric wards, 5.2% for obstetrics and gynecology wards). The remaining 20% was provided to other public hospitals (13.5%) and private hospitals (5.8%).

public hospital. The functions of the Kamburugamuwa Cluster Center are blood collection, blood testing and screening, the production of blood products, and the distribution of blood products to the other Hospital Blood Banks (HBB) in Southern Province[12]. Therefore, Kamburugamuwa Cluster Center does not directly supply blood products to the medical institutions which need blood for transfusions. For this reason, there is no supply of red blood cells in Kamburugamuwa indicated in Table 9.

Table 8: Supply of Red Blood Cells in Sri Lanka (2002-2010)

Unit: Bag

Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
Western	79,290 50.8%	66,418 44.2%	5,195 5.6%	75,879 43.7%	86,999 44.3%	88,992 41.6%	104,492 43.7%	110,141 37.7%	119,405 37.2%
Central	21,329 13.7%	23,195 15.4%	22,331 24.2%	23,831 13.7%	24,601 12.5%	28,332 13.2%	30,757 12.9%	40,489 13.9%	42,748 13.3%
North Western	10,851 6.9%	11,412 7.6%	11,994 13.0%	13,957 8.0%	16,987 8.6%	18,552 8.7%	18,996 7.9%	26,059 8.9%	24,894 7.8%
North Central	10,322 6.6%	11,894 7.9%	12,298 13.3%	14,911 8.6%	18,221 9.3%	18,588 8.7%	23,329 9.8%	34,577 11.8%	31,819 9.9%
Uva	7,653 4.9%	10,305 6.9%	8,926 9.7%	9,476 5.5%	10,591 5.4%	12,732 6.0%	12,570 5.3%	15,422 5.3%	16,784 5.2%
Southern	14,533 9.3%	13,334 8.9%	16,299 17.6%	16,769 9.6%	16,589 8.4%	20,964 9.8%	23,817 10.0%	31,959 10.9%	32,552 10.1%
Sabaragamuwa	4,337 2.8%	3,674 2.4%	4,015 4.3%	3,862 2.2%	6,575 3.3%	9,276 4.3%	7,207 3.0%	9,482 3.2%	17,577 5.5%
Northern	3,509 2.2%	4,423 2.9%	4,841 5.2%	6,605 3.8%	6,880 3.5%	6,240 2.9%	6,307 2.6%	9,685 3.3%	13,341 4.2%
Eastern	4,323 2.8%	5,570 3.7%	6,544 7.1%	8,529 4.9%	9,080 4.6%	10,152 4.7%	11,740 4.9%	14,170 4.9%	21,846 6.8%
Total	**156,147**	**150,225**	**92,443**	**173,819**	**196,523**	**213,828**	**239,215**	**291,984**	**320,966**

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of red blood cells contained in one bag is 275-300cc.
Note 2: The shelf-life of red blood cells is 35-42 days.

Table 9: Supply of Red Blood Cells in Six Blood Banks (2002-2010)

Unit: Bag

Blood Bank	Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
NBC	Western	-	20,672	3,276	8,140	9,639	5,232	5,202	4,296	4,287
Kandy	Central	11,300	11,701	11,710	11,833	12,295	14,616	15,921	20,532	22,063
Jaffna	Northern	2,070	3,394	4,075	5,341	5,917	4,824	4,338	5,171	6,992
Anuradhapura	N. Central	7,774	9,246	8,678	11,134	14,003	14,916	19,259	27,890	25,274
Ampara	Eastern	1,447	1,886	2,374	3,057	3,112	3,564	3,881	5,548	6,191
Kamburgamuwa	Southern	-	-	-	-	0	0	0	0	0
Total		22,591	46,899	30,113	39,505	44,966	43,152	48,601	63,437	64,807

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of red blood cells contained in one bag is 275-300cc.
Note 2: The shelf-life of red blood cells is 35-42 days.
Note 3: Since Kamburgamuwa is a newly established blood bank which commenced operations in 2006. There is no actual number of blood donations from 2002 to 2005.

Platelet

Sri Lanka's platelet supply increased 1.5 times from 74,259 bags in 2006, pre-project, to 109,498 bags in 2010, post project (See Table 10). Because platelet can be preserved for a shorter period of time, only for five days, compared to red blood cells, it is produced and supplied as needed, and thus its amount may vary depending on the province and year. About 60% of the country's overall platelet supply is concentrated in Western Province which has the

[12] The Kamburugamuwa Cluster Center is called the Kamburugamuwa Collection and Distribution Center.

largest population among nine provinces. The NBC and the Cluster Centers in five locations that are the main target blood banks of the project (except Kamburugamuwa) showed a marked expansion in their capacity for platelet supply although there were some inconsistencies seen annually. For the same reason as that given for the red blood cell supply, there is no supply of platelet in Kamburugamuwa indicated in Table 11.

Table 10: Supply of Platelet in Sri Lanka (2006-2010)

Unit: Bag

Province	2006		2007		2008		2009		2010	
Western	48,692	(65.6%)	50,457	(67.1%)	60,474	(67.1%)	65,443	(53.5%)	66,410	(60.7%)
Central	6,585	(8.9%)	6,671	(8.9%)	7,515	(8.3%)	11,192	(9.1%)	12,341	(11.3%)
North Western	3,654	(4.9%)	2,877	(3.8%)	2,566	(2.8%)	6,069	(5.0%)	1,861	(1.7%)
North Central	6,383	(8.6%)	5,336	(7.1%)	5,205	(5.8%)	7,419	(6.1%)	6,977	(6.4%)
Uva	864	(1.2%)	2,180	(2.9%)	2,570	(2.9%)	3,165	(2.6%)	3,700	(3.4%)
Southern	6,044	(8.1%)	5,631	(7.5%)	8,880	(9.9%)	23,471	(19.2%)	11,160	(10.2%)
Sabaragamuwa	883	(1.2%)	985	(1.3%)	1,517	(1.7%)	2,668	(2.2%)	3,469	(3.2%)
Northern	955	(1.3%)	762	(1.0%)	807	(0.9%)	1,528	(1.2%)	1,636	(1.5%)
Eastern	199	(0.3%)	321	(0.4%)	566	(0.6%)	1,383	(1.1%)	1,935	(1.8%)
Total	**74,259**		**75,220**		**90,100**		**122,337**		**109,489**	

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of platelet contained in a one bag is 50cc.
Note 2: The shelf-life of platelet is 5 days.

Table 11: Supply of Platelet in Six Blood Banks (2006-2010)

Unit: Bag

Blood Bank	Province	2006	2007	2008	2009	2010
NBC	Western	4,860	4,258	3,537	3,913	6,466
Kandy	Central	5,321	5,121	472	7,600	9,277
Jaffna	Northern	871	550	637	78	1,017
Anuradhapura	N. Central	6,202	5,009	4,882	6,968	6,544
Ampara	Eastern	63	115	313	977	93
Kamburugamuwa	Southern	0	0	0	0	0
Total		17,317	15,053	9,841	20,245	24,243

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of platelet contained in a one bag is 50cc.
Note 2: The shelf-life of platelet is 5 days.

Fresh Frozen Plasma (FFP)

Sri Lanka's fresh frozen plasma supply increased 1.4 times from 132,970 bags in 2006, pre-project, to 180,340 bags in 2010, post project (See Table 12). Like platelet, Western Province took about 50% of the country's overall fresh frozen plasma supply. In addition, the fresh frozen plasma supply was 215,583 bags in 2009 which was higher compared to other years. This was because there was a dengue fever outbreak in Sri Lanka, and there was a higher demand for fresh frozen plasma according to the NBTS. The NBC and the Cluster Centers in five locations that are the main target blood banks of the project (except Kamburugamuwa) have shown a marked expansion in their capacity for fresh frozen plasma supply although there were some inconsistencies seen annually. For the same reason as that for red blood cells and platelet supply, there is no supply of fresh frozen plasma in Kamburugamuwa indicated in Table 13.

Table 12: Supply of Fresh Frozen Plasma (FFP) in Sri Lanka (2006-2010)

Unit: Bag

Province	2006		2007		2008		2009		2010	
Western	69,439	(52.2%)	72,552	(50.5%)	82,470	(52.3%)	96,382	(44.7%)	95,527	(53.0%)
Central	14,730	(11.1%)	15,780	(11.0%)	17,879	(11.3%)	21,438	(9.9%)	21,595	(12.0%)
North Western	11,301	(8.5%)	13,860	(9.6%)	11,361	(7.2%)	15,485	(7.2%)	7,899	(4.4%)
North Central	4,602	(3.5%)	6,777	(4.7%)	6,705	(4.3%)	14,079	(6.5%)	13,143	(7.3%)
Uva	6,322	(4.8%)	6,562	(4.6%)	7,144	(4.5%)	10,636	(4.9%)	4,893	(2.7%)
Southern	11,606	(8.7%)	13,034	(9.1%)	15,674	(9.9%)	35,378	(16.4%)	17,953	(10.0%)
Sabaragamuwa	6,283	(4.7%)	6,301	(4.4%)	7,220	(4.6%)	7,426	(3.4%)	6,876	(3.8%)
Northern	3,662	(2.8%)	3,752	(2.6%)	4,276	(2.7%)	6,489	(3.0%)	5,744	(3.2%)
Eastern	5,025	(3.8%)	5,017	(3.5%)	4,813	(3.1%)	8,273	(3.8%)	6,710	(3.7%)
Total	**132,970**		**143,635**		**157,542**		**215,583**		**180,340**	

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of fresh frozen plasma contained in one bag is 150cc.
Note 2: The shelf-life of fresh frozen plasma is one year.

Table 13: Supply of Fresh Frozen Plasma (FFP) in Six Blood Banks (2006-2010)

Unit: Bag

Blood Bank	Province	2006	2007	2008	2009	2010
NBC	Western	4,046	4,218	2,405	4,499	7,104
Kandy	Central	5,706	7,230	607	9,269	8,997
Jaffna	Northern	2,971	2,901	3,408	4,208	4,878
Anuradhapura	N. Central	3,151	5,522	5,692	10,914	10,940
Ampara	Eastern	1,142	934	1,277	4,075	1,495
Kamburugamuwa	Southern	0	0	0	0	0
Total		17,061	20,805	13,389	32,965	33,414

Source: National Blood Transfusion Service (NBTS).
Note 1: The volume of fresh frozen plasma contained in one bag is 150cc.
Note 2: The shelf-life of fresh frozen plasma is one year.

It should be noted that currently, component blood products such as red blood cells, platelet, and fresh frozen plasma are mainly used, and whole blood transportations are rare except in special circumstances.

d) Blood Discard Amount and Rate

The blood discard rate in Sri Lanka has significantly improved from 20% in 2008, pre-project, to 8.47% in 2010, post project (See Table 14). Primarily, this is due to the effects of an improved preservation capacity of blood products and a cold chain system resulting from the provision by the project of cooling facilities and ambulances equipped with refrigerators. Secondary reasons are improved systems, such as the functional enhancement of the Cluster Centers, business management based on 5S[13], and the introduction of a quality control policy in the field of blood transfusion services as the result of the structural reform of 2009 mentioned earlier. In the old blood transfusion service system, regional coordination between the Provincial Blood Banks (PBB) and the Regional Blood Banks (RBB), as well as quality control functions, were pointed out as being weak, however, in the new system, each Cluster Center has responsibility for its own Hospital Blood Bank (HBB) inventory control, and quality control of blood products under its respective area (See **3.5.1 Structural Aspects of Operation and**

[13] 5S stands for the slogan, Seiri (Sorting/Putting things in order), Seiton (Orderliness/Proper arrangement), Seisou (Clean/Cleanliness), Seiketsu (Standardizatoin/Purity), and Shitsuke (Sustaining/Discipline/Commitment) that is used in maintaining and improving the work environment in production and service industries.

Maintenance for more details).

The NBC and the Cluster Centers in five locations that are the main target blood banks of the project were below the national average of 5.3-7.4% for the blood discard rate in 2010.

Table 14: Blood Discard Rate

Unit: %

Blood Bank	Province	2007	2008	2009	2010
NBC	Western	7.4	6.2	3.0	5.3
Kandy	Central	N.A.	N.A.	11.2	7.4
Jaffna	Northern	N.A.	N.A.	7.2	5.7
Anuradhapura	N. Central	N.A.	N.A.	6.4	2.4
Ampara	Eastern	N.A.	N.A.	14.5	7.3
Kamburugamuwa	Southern	N.A.	N.A.	3.0	5.6

Source: National Blood Transfusion Service (NBTS).

e) Coverage of Blood Screening Tests for Blood Transmittable Infectious Viruses and Bacillus (HIV, hepatitis B and C, syphilis)

Sri Lanka attained a 100% screening ratio for reactions to all the above viruses and bacillus (HIV, hepatitis B and syphilis) except for hepatitis C before the project started. In 2004, during the conduction of this project, pilot screening tests for hepatitis C by ELSIA[14] started, and 100% screening ratio nationwide had been attained by 2009 (See Table 15).

Table 15: Coverage of Blood Screening Tests for Hepatitis C

Unit: %

	2003	2004	2005	2006	2007	2008	2009	2010
Coverage of the Blood Screening Test for Hepatitis C	0	*	*	92	95	8	100	100

Source: National Blood Transfusion Service (NBTS).
Note: The period between 2004 and 2005 was for pilot screening tests

f) Virus Infection Rate of Patients Resulting from Blood Transportation

According to the NBTS, in Sri Lanka, there was only one case of HIV infection by blood transportation reported in 2000. From 2001 to the present, there have been no reports of virus infection of patients resulting from blood transportation[15].

g) Reduction in Time to Prepare Transfusions of Blood

There is no statistical data on the reduction of time to prepare transfusions of blood, however, the key informant interview[16] conducted during the field survey of this ex-project evaluation revealed that blood supply services and the systems at blood banks have improved, and that necessary blood products can be provided at any time 24 hours, as needed. It can thus be assumed that there has been some reduction in time.

h) Numbers for Blood Supply Areas and Medical Institutes

Regarding blood supply areas, since the end of the civil war in 2009, the NBTS has expanded the existing service area of blood banks in the northern regions left behind in

[14] An abbreviation for Enzyme-linked Immunosorbent Assay (ELISA), which is a popular antibody screening method used worldwide.

[15] The current blood transfusion service system in Sri Lanka has established a tracing system for donors whose blood caused any side effects. Also the Ministry of Health collects and archives infection disease data nationwide.

[16] Details of the key informant interview are show in **3.3.2 Qualitative Effects**.

development by upgrading existing blood banks as well as constructing new blood banks based in the Jaffna Cluster Center which was improved and modernized by this project. On the other hand, what increase there has been in the number of medical institutes is not known since the NBTS does not keep track of this.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

The IRR of the ex-post evaluation will not be calculated for the following reasons: (1) no IRR was calculated at the appraisal, (2) if the IRR were to be calculated at the time of the ex-post evaluation, special knowledge of the health sector would be necessary in order to set preconditions for the costs and economic benefit effects, and (3) additional time and cost would be required to collect information.

3.3.2 Qualitative Effects

Before the project, the National Blood Transfusion Center (NBTC) building was old, there was a lack of facilities for blood collection, blood screening, and blood preservation, and the space for training and education was insufficient. After the project, these were remarkably improved. Firstly, there had been a quantitative expansion in and modernization of blood collection, testing devices and blood keeping facilities. The introduction of blood tests and screening by ELISA enabled more accurate and a larger number of blood tests than before. It is now possible to screen for hepatitis C in addition to the conventional screenings (serodiagnosis of HIV, hepatitis B, syphilis, malaria) upon blood transfusion. The capacity and accuracy of histocompatibility tests (tissue typing) were enhanced. The above mentioned improvements were seen not only in the NBC but also in the five Cluster Centers mainly targeted by this project. In addition, an apheresis machine, which is a blood component separator, was newly installed in the NBC.

Furthermore, the training and educational capacity of the NBC was strengthened by the expansion of training and of laboratory space, equipment and facilities. A voluntary blood donator registration system was established of in all the blood banks.

At the time of ex-post evaluation, a key informant interview was conducted using questionnaires at blood banks and private hospitals in 14 locations in order to grasp the quantitative effects and impact. The numerical breakdown[17] of these hospitals was: 7 Cluster Centers, 5 Hospital Blood Banks and 2 private hospitals[18].

(1) Improved Safety of the Blood Supply and Transfusion System

The results of the key informant interview revealed that eleven hospitals considered that the safety of their blood supply system had improved post project. Areas mentioned in particular were: (i) improved blood collection safety (11 responses), (ii) improved hygiene conditions / work place environment (9 responses), (iii) well-functioning referral system[19] of the NBC (10 responses), (iv) sufficient blood management and conservation in the blood banks (11 responses), and (v) establishment of a committee for quality control and medical accident prevention (8 responses).

[17] The breakdown of the key informant interview target facilities is as follows: 7 Cluster Centers (Kandy, Jaffna, Anuradhapura, Ampara, Kuliyapitiya, Kurunegala, Kamburugamuwa), 5 Hospital Blood Banks (Sri Lanka National Hospital, Ragama North Colombo Teaching Hospital, Mahamodara Hospital, Ratnapura Hospital, Peradeniya Hospital) and 2 private hospitals (Lanka Hospital, Ninewells Hospital).

[18] Since Kamburugamuwa Cluster Center was a newly established blood bank in 2006, some questions that compared pre and post project were unanswered. For Peradeniya Hospital, because the respondent was a newly assigned person who was not familiar with the pre project status, some questions remained unanswered.

[19] The NBC is the headquarters for all blood banks in Sri Lanka and plays the role of reference center that has information on the supply and demand of blood, quality unification and blood management, ,conducts high level blood testing that cannot be handled in the Cluster Centers or at Hospital Blood Banks, and gives technical advice throughout the country.

(2) Improvement of Testing and Screening of the Blood Transfusion Service

The results of the key informant interview revealed that 11 hospitals considered that there had been some improvements in blood testing and screening post project in comparison to pre project. Areas mentioned in particular were: (i) improved accuracy of blood matching tests (11 responses), (ii) decreased side effects associated with blood transfusions (11 responses), and (iii) establishment of blood donor tracing systems in the case of emerging side effects after blood transfusion (9 responses).

(3) Improved Technical Capacity of NBTS Employees

The results of the key informant interview revealed that 13 hospitals considered that the technical capacity of the NBTS employees had improved post project in comparison to pre project. Areas mentioned in particular were: (i) improved accuracy and responses of blood testing and screening, (ii) decreased human errors during testing and screening, (iii) improved record management, and (iv) improved work efficiency as a result of the introduction of 5S.

In the consulting service of the project, training and education on international standardized blood management was given to NBTS employees. As shown in Table 16 below, various training programs were conducted during the project implementation period, and a total 675 employees participated in the programs during the period between 2002 and 2007. These included 326 medical officers/doctors, 77 nurse officers, 136 medical laboratory technologists, 90 public health inspectors and 46 other staff. In addition, about 40 NBTS staff including medical officers/doctors, nurse officers, medical laboratory technologists, and public health inspectors attended JICA's County-Focus Training "Laboratory Methodology and the Management System for Blood Banks" conducted by the Japanese Red Cross Fukuoka Blood Center in Japan from 2005 to 2008.

Table 16: Training Programs conducted during the Project Implementation Period

Training Program	Year	Participants
Workshop on Basic Computer Knowledge	2002-2003	SMO: 12, MO: 12, NO: 16, MLT: 10, PHI:80
Quality Management Training Workshop	2002	MO: 20, MLT: 5
Quality Assurance Training Workshop	2003	NO: 26, MLT: 17, PHI: 10, Office staff: 16
Seminar on Transfusion Transmitted Infections	2003	MO: 25, MLT: 13
Program for Tecan Machine Training	2003	MLT: 12
Workshop on HCV ELISA	2004	MO: 8, MLT: 12
Japanese 5S System Awareness Program	2004	MO: 24, NO: 20, MLT: 16, Minor staff: 30 (All NBC staff)
Blood Group Serology Workshop on Improving Immune Haematological Techniques	2004	MO: 18, MLT:12
GMP* Awareness Program	2004	MO: 24, NO: 15, MLT: 18
Technical Aspects of Blood Banking	2004	MO: 29
Workshop on Quality Assurance and Technical Training in the Blood Transfusion Service	2004	MO: 70, MLT: 21
Appropriate Clinical Use of Blood	2006	MO: 32
Bio Safety and Waste Management	2007	MO: 20
Donor Counselling and Management	2007	MO: 32

Source: National Blood Transfusion Service (NBTS).

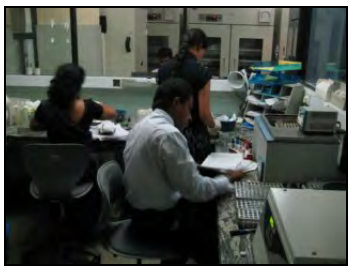
Note 1: SMO: Senior Medical Officer (Doctor); MO: Medical Officer (Doctor); NO: Nurse Officer; MLT: Medical Laboratory Technologist; PHI: Public Health Inspector.

Note 2: *GMP (Good Manufacturing Practice) is a system that those who are engaged in pharmaceutical and biotech production must follow to ensure that products are consistently produced and controlled according to quality standards appropriate to their intended use and as required by the product specification.

Since this project supported the technical capacity development of NBTS employees together with the improvement and modernization of the facilities and equipment of the blood banks, it produced the outcome of "improved technical capacity of NBTS employees" which led to other outcomes such as "improved safety of the blood supply and transfusion system" "improvement of testing and screening of the blood transfusion service"

For these reasons, this project has largely achieved its objectives, therefore its effectiveness is high.

Five Cluster Centres mainly improved by the Project



Kandy (Central)

Jaffna (Northern)

Anuradhapura (North Central)

Ampara (Eastern)

Kamburugamuwa (Southern)

Mobile Unit

3.4 Impact

3.4.1 Intended Impacts

(1) Contribution to Medical Treatment in Hospitals and Clinics by an Increase in the Blood Supply

The results of the key informant interview revealed that 12 hospitals had positive perceptions of the project's contribution to medical treatment in hospitals and clinics. In particular, these included: (i) increase in the number/cases of surgical operations (11 responses), and (ii) increase in the number of cases of other medical treatments (8 responses). Regarding the increase in the number/cases of surgical operations, although this depended highly on the scale, level, number of specialists and technical skills of each medical institute, some improvements were observed where surgical procedures had been restricted due to an insufficient blood supply, except for some special cases.

In Kurunegala in North Western Province, the only domestic thalassemia center in Sri Lanka is found, the region having the most thalassemia patients in the country. In this region, there is a high demand for blood transfusion on a daily basis, and thalassemia treatment cases have increased through the project.

A safe blood supply service is an essential part of the medical infrastructure, and it can be seen that the project has played an important role in the increase of treatment cases where blood transfusion is required by establishing the preferable environment where safe blood can be obtained anytime.

3.4.2 Other Impacts

(1) Impacts on the natural environment

a) Disposal of Medical Waste

An incinerator was built by the project on the premises of the NBC for medical waste disposal. Upon completion of the project, the incinerator was used for the disposal of medical waste, but soon after it started to experience trouble. Currently the medical waste disposal of the NBC is outsourced to a private medical waste service provider. The reasons are as follows: (i) since the incinerator was manufactured overseas, the maintenance costs such as for repair or spare parts is high; (ii) when the project started, the NBC was supposed to take care of its own medical waste since there was no private medical waste service provider. Now, there are several private medical waste service providers authorized by the government, and it costs less to outsource the service than for the NBC to have its own incinerator and to conduct repair and maintenance on a regular basis.

Although the incinerator is no longer in use as planned at the beginning, the disposal of medical waste from the NBC is handled appropriately by the private medical waste service provider, and considering it is more efficient from the point of view of operating cost to outsource the service, the decision to outsource is considered to be appropriate.

Medical waste from the Cluster Centers and the Hospital Blood Banks (HBB) are handled by each hospital's own facility (incinerator). According to the NBTS, the treatment is carried out properly.

b) Environmental Impact Monitoring System of the National Blood Center

The NBC is required by law to undergo inspections for noise, water quality, air and waste, and to renew their environment protection license. However, the environmental authority inspections are mainly based on documentary examination of process and procedures, and on-site inspections of the NBC are conducted only irregularly. Other than the environmental authority inspections, the NBC takes its own measures, primarily treating drainage using chemicals, then allowing it to drain in to the sewage. The NBC is planning to strengthen their environmental monitoring system by having a water quality test carried out by an external inspection agency.

The NBC renews its environment protection license annually according to law, and the disposal of medical waste and drainage are appropriately carried out. Thus, there is no negative impact on the natural environment from the project.

(2) Social Impacts associated with Land Acquisition and Resettlement

Since the NBC was built in a compound owned by the Ministry of Health, there was no land acquisition and settlement for the project.

From the above, it can be seen that some positive impacts of the project were observed such as the contribution to medical treatment in hospitals and clinics as the result of increased transfusions of blood. Also, there were no negative impacts on the natural environment or on society due to land acquisition and resettlement.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance (O&M)

The O&M agency for the project facilities is the National Blood Transfusion Service (NBTS) under the Laboratory Service Department, Ministry of Health. The NBTS shares its function as the National Blood Center (NBC), and it has constructed the public blood transfusion system of Sri Lanka with its affiliated Cluster Centers in 16 locations and Hospital Blood Banks in 64 locations. The total number of NBTS employees at present is 1,037 including 355 medical doctors and 320 nurses. There are 191 staff working at the NBC in

Colombo. The NBTS conducted a structural reform in 2009, and its structure shifted from the conventional system of "Central Blood Bank (CBB) - Provincial Blood Bank (PBB) - Regional Blood Bank (RBB)" to the new system of "National Blood Center (NBC) – Cluster Center (CC) – Hospital Blood Bank (HBB)". One or more Cluster Centers are situated in each of all nice provinces[20] and they have received a significant level of empowerment (other than over financing) from the NBC, in order that they can be responsible for the blood transfusion service in each region, including management of the HBBs in their respective areas. All Cluster Centers and Hospital Blood Banks except for the NBC and the Kamburugamuwa Cluster Center (Southern Province) are located within existing public hospitals. However, their budget, staff, authority and scope of works are solely independent from the public hospitals to which they are attached.

Upon structural reform in 2009, the concept of business administration and quality management policy based on 5S was introduced to Sri Lanka[21]. In 2010, The NBC was awarded the Taiki Akimoto 5S Award[22] which is given to a company/organization that has successfully introduced and diffused 5S by the Japan Sri Lanka Technical and Cultural Association (JASTECA)[23]. The NBC is the first organization to receive this award in the healthcare sector in Sri Lanka.

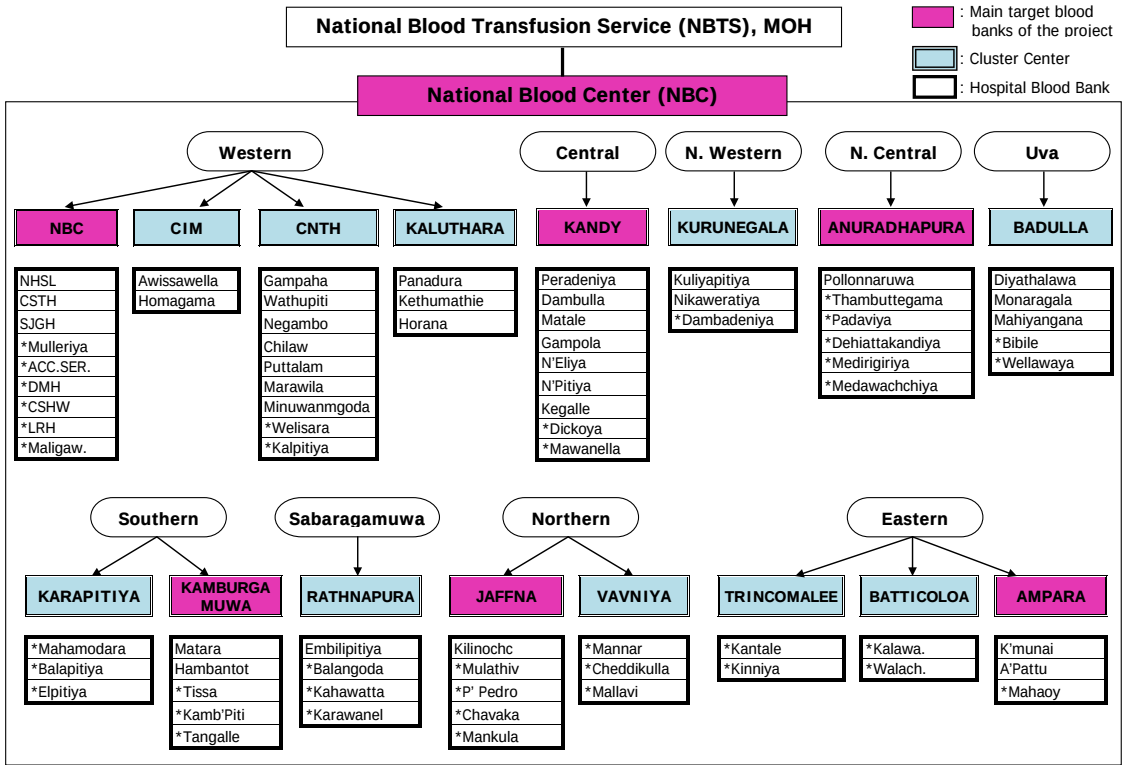
Currently, as of April 2011, there are 80 Cluster Centers and Hospital Blood Banks in Sri Lanka, and there is ongoing effort to establish new blood banks in Northern Province, North Central Province and Eastern Province where their development was delayed. The organization chart of the NBTS is shown in Figure 2.

[20] Although the old system set one blood bank in each province, the new system gave consideration to the population of each province, its geographical condition and regional healthcare service status, and established more than two Cluster Centers each in Western, Southern, Northern and Eastern Provinces.

[21] The main reason why the concept of 5S was introduced to the blood transfusion services is because when the current director of NBTS who was assigned the position in 2009 (he is also a director of the National Blood Center) was at the Kurunegala Public Hospital as a director, the hospital brought in the 5S practice with great success. For this reason, he took an active role in introducing the 5S into the blood transfusion services. During the implementation period of this project, a Japanese 5S System Awareness Program was conducted in 2004 for NBTS employees. Furthermore, since 2009 JICA has been conducting a technical cooperation project, "Improvement of the Quality of and Safety in Healthcare Institutions in Sri Lanka" (2009-2012) introducing the 5S, Kaizen, TQM approaches at seven pilot hospitals. One of the seven pilot hospitals is the Castle Street Hospital in Colombo to which a hospital blood bank is attached.

[22] Taiki Akimoto 5S Award is an award the 5S promotion named after the late Mr. Taiki Akimoto who used to give AOTS seminars as a lecturer in Sri Lanka. This award is given to applicants who made the most successful efforts to introduce and promote the 5S among all companies and organizations who apply.

[23] JASTICA (Japan Sri Lanka Technical and cultural Association) is a non-profit organization founded by the alumni of the Association for Overseas Technical Scholarship (AOTS) in 1984 in order to promote international exchange between Japan and Sri Lanka and to disseminate the 5S system in Sri Lanka.



Source: National Blood Transfusion Service (NBTS).
Note 1: Those marked with an asterisk (*) are only storage blood banks and do not collect blood at the moment.
Note 2: National Blood Center (NBC) also functions as one of the four Cluster Centres in Western Province.
Note 3: CIM: Cancer Institute, Maharagama; CNTH: Colombo North Teaching Hospital; NHSL: National Hospital of Sri Lanka; CSTH: Castle Street Teaching Hospital; SJGH: Sri Jayawarananapura General Hospital; ACC. SER: Accident Service Blood Bank; DMH: De Zoya Maternity Hospital; CSHW: Castle Street Hospital for Women; LRH: Lady Ridgeway Hospital.

Figure 2: Organizational Chart of NBTS (As of April 2011)

3.5.2 Technical Aspects of Operation and Maintenance

The NBTS established Sri Lanka's original blood transfusion service guidelines, which referred to the U.K. guidelines, with the support of the project. Also, as a part of quality management, it has set up a system to check the testing skills of each blood bank by sending a blind sample from the NBC once a year and getting feedback on the result. The NBTS also emphasizes employees' technical training, and there are many training courses available such as the orientation of new recruits for all employees, specialized training for doctors, nurses and laboratory technicians in their respective fields, and a diploma and doctoral degree in transfusion medicine.

The WHO has set the NBC as its Coordination Center in South Asia and conducts training there for government offices working for blood transfusion services in South Asian countries. After the completion of the project, the WHO has continuously provided support through consulting services, and domestic and overseas training for medical doctors, nurses and laboratory technicians as part of its technical cooperation for the NBTS.

3.5.3 Financial Aspects of Operation and Maintenance

The O&M budget of the NBTS increased from 422 million Rupees to 591 million Rupees in 2009, post project (See Table 16). The results of the key informant interview revealed that the blood banks are relatively satisfied with the O&M budget. All necessary testing reagents for a year are stocked and managed at the NBC, and the necessary budget allowances are provided for reagents and expendable supplies.

Table 16: O&M Budget of the NBTS

Unit: Sri Lankan Rupee: LKR

	2008	2009	2010
Allocated Budget	442,052,738	591,066,599	546,870,705
Actual Expenditure	385,981,000	591,066,589	547,039,022

Source: National Blood Transfusion Service (NBTS).

The Sri Lankan government maintains the principle of providing free medical care and education for its citizens, and as for the blood transfusion service, it provides free blood product supplies for public medical institutions, and collects minimum cost-recovering fees from private medical institutes. Therefore, the current revenue source for O&M of the NBTS largely relies on income from the national budget and not on the sales revenue from blood products.

3.5.4 Current Status of Operation and Maintenance

Project facilities, equipment and machinery are well utilized and maintained. There is an equipment workshop at the NBC and all damaged and malfunctioning equipment and machinery is sent to the workshop for repair. If the equipment workshop cannot handle the problem, an external service provider is asked to provide repair services instead.

Also, most reagents are imported from advanced countries such as Australia and U.K., although some reagents for antibody screening are produced within the NBC in order to reduce costs and improve research and technical skills.

Equipment Workshop (NBC)

Reagent Laboratory (NBC)

Reagent Store (NBC)

From 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 sufficiently matches Sri Lanka's development policy, development needs and Japan's aid policy, hence its relevance is high. Although the project cost was within its plan, the project period was significantly exceeded; therefore efficiency of the project is fair. By implementing the project, various project effects were seen as planned such as an increased number of blood donations, an increased voluntary blood donation rate, increased blood product supplies of red blood cells, platelet and fresh frozen plasma, decreased blood discards, improved safety of the blood transfusion service, improved blood testing and screening capacity. Therefore the effectiveness of the project is high. Furthermore, the project has contributed to better medical treatment in hospitals and clinics through the increase of blood supply, which has been a positive impact. Lastly, the operation and maintenance of the project in terms of system, skills and finances is good and the project's sustainability 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

- While 80% of blood donations rely on off-site donations using mobile units, there are seasonal fluctuations and these require a higher cost and more labor for staffing and transportation. For this reason, in order to secure a more stable blood supply, the promotion of on-site blood donations at the blood banks is required. This may be achieved with methods such as through the promotion of public awareness campaigns using mass-media and through collaboration with local medical institutions. This should increase the number of on-site blood donations at the blood banks.

- Although the NBTS provides training opportunities for staff of cluster centers and blood banks at the NBC in Colombo, each cluster center and blood bank carry out their routine work with a limited number of staff, therefore opportunities for staff to participate in training are limited. On the other hand, staff are highly enthusiastic in learning new skills and gaining knowledge and their need for trainings is high. It is recommended that local training is organized at each province, especially in those provinces distant from Colombo.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

The project was designed and implemented using the following approaches: (1) collaboration between different Japanese ODA schemes such as ODA loans and technical cooperation, (2) a combination of support for the "hardware" aspects that focused on the modernization of facilities and equipment and the "software" aspects that emphasized human resource development and organization and system improvement, (3) mobilization of the knowledge and expertise of the WHO which possesses abundant experience and achievements in this field. These approaches were the key to the success of the project. The project hired WHO consultants for its consulting service and they advised that facilities be designed to match their specialized needs. They also advised on the selection of procured equipment, conducted training for medical doctors, nurses and other NBTS employees to improve the skills and knowledge of those directly engaged in the operation of the modernized facilities, and proposed that organization and systems be reformed for the improvement of quality control and the management capacity of NBTS from the viewpoint of securing the effectiveness and sustainability of the project. It is notable that this technical assistance component was provided in parallel with the infrastructure development component and was given the same priority as the infrastructure development component as a main project component, not as a subordinate component in the project. This was a good project plan and design and can be used as a useful reference for health sector projects in other developing countries.

End

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs (1) Construction Work Construction of the National Blood Center (NBC)	• Three story building, 5,010 m^2	• Three story building, 5,367 m^2
(2) Equipment Procurement	• Equipment to be installed at the NBC (Apheresis system, testing equipment, storage facilities, etc.) • Equipment to be installed at the blood banks in 8 provinces and 48 regions (storage facilities, ambulances, etc.) • Training materials and manuals	• There were some changes in numbers but the contents were as planned. • There were changes in the number of target blood banks. • As planned
(3) Consulting Service a) TOR	<u>Engineering Service</u> • Detailed design and assistance in tender that considered the environmentally friendly aspects • Techinical advice on environmental monitoring during the construction stage, and on counter measures for medical wastes tretment <u>Education and Training Service</u> • Technical training and education on the international standardized blood transfusion service for NBTS employees (by WHO consultants)	• As planned • As planned • As Planned (Conducted education/training at 5 Cluster Centers and 48 Hospital Blood Banks for their staff)
b) Work Volumes	<u>Engineering Service</u> • Foreign: 16.2 M/M • Local: 128.3 M/M <u>Education and Training Service</u> • Foreign 24 M/M	• Almost as planned • Almost as planned
2.Project Period	Jan. 2001 – Sep. 2005 (57 months)	Jan. 2001 – May 2008 (89 months)
3.Project Cost		
Amount paid in Foreign currency	(Unknown)	(Unknown)
Amount paid in Local currency	(Unknown)	(Unknown)
Total	2010 million yen	1908 million yen
Japanese ODA loan portion	1,508 million yen	1,332million yen
Exchange rate	1 Rupee = 1.44 yen (As of Feb. 2000)	1 Rupee = 1.07 yen (Annual average but years are unknown)

Sri Lanka

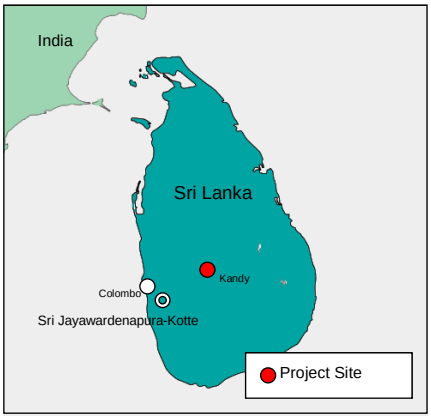
Ex-Post Evaluation of Japanese ODA Loan
"Greater Kandy Water Supply Project"

External Evaluator: Hajime Onishi
Mitsubishi UFJ Research & Consulting Co., Ltd.

0. Summary

This project is highly consistent with government policies, and no problems with operation and maintenance (O&M) systems can be found. Although slight concern remains about the financial sustainability of the implementing agency (the National Waster Supply & Drainage Board, NWSDB) itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities involved in this project steadily expanding. Major indicators such as population served by this project, amount of water supplied, and facility utilization rate have exceeded 80% of the target value, and there is no particular problem with the quality of the treated water produced. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In addition, in terms of efficiency, although the project period was longer than planned, project cost was kept within the planned amount. In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Location Map

Katugastota Water Treatment Plant

1.1 Background

At the time in 1997, Kandy, the capital of Sri Lanka's Central Province and the country's second largest city, had fallen into a situation where, along with rapid population growth in the metropolitan area, the demand for water far outstripped the water supply capacity. In particular, there was concern about the increasing seriousness of water shortages within the city of Kandy and in the northern part of Greater Kandy.

Specifically, according to JICA's appraisal documents, the water supply capacity for Greater Kandy in 1997 was about 60,000 m^3/day, which was grossly insufficient to cover the maximum demand for water of about 130,000 m^3/day. Even in areas equipped with water supply facilities, supply of water had been rationed by district to certain days and hours due to supply capacity restrictions. It was predicted by JICA's appraisal documents that the maximum demand for water in 2015 would reach 170,000 m^3/day, making the increase of water supply capacity a

pressing task. In addition, according to the 2001 Sri Lankan census, it was believed that rapid, long-term population growth in the Greater Kandy area was a certainty, and the situation was one in which future pressures on water supply and demand could not be avoided.

Against this backdrop, advancing the implementation of a new water supply project for Greater Kandy was an urgent challenge for the Sri Lankan government at the time, and the prompt implementation of a water supply project for the purpose of drastically closing the supply-demand gap was desired.

1.2 Project Outline

The objective of this project is to secure a constant supply of water and to expand the capacity of water supply for Kandy City and northern district of Greater Kandy Area by constructing new facilities for water supply, thereby contributing to the improvement in public health and living environment in the target area.

Loan Amount / Disbursed Amount	5,151 million yen / 4,644 million yen
Exchange of Notes / Loan Agreement Signing Date	January 2001 / March 2001
Terms and Conditions	Interest Rate: 0.95% (0.75% for Consulting Services) Repayment Period:40 years (Grace Period:10 years) Conditions for Procurement: Bilateral Tied[1] (General Untied for Consulting Services)
Borrower / Executing Agencies	Democratic Socialist Republic of Sri Lanka / National Water Supply and Drainage Board, NWSDB
Final Disbursement Date	June 2008
Main Contractors (over 1 billion yen)	Hitachi Ltd. (Japan) / Taisei Corporation (Japan) (JV)
Main Consultant (over 100 million yen)	NJS Consultants Co., Ltd. (Japan) / Nihon Suido Consultants Co., Ltd. (Japan) (JV)
Feasibility Studies, etc.	1997 - 1999 Feasibility Study (by JICA) 2000 - 2002 Detailed Design (by JICA)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Onishi (Mitsubishi UFJ Research & Consulting)

2.2 Duration of Evaluation Study

Duration of the Study: December, 2010 – November, 2011

[1] This project was implemented by applying "Special Yen Loan". This is a facility established in 1998 for the rapid economy recovery of Asian nations which had been affected by the economic crisis, aiming at to provide financial assistance for infrastructure provision which helps to streamline logistics and distribution facilities, to strengthen production bases and to deal with large-scale disaster preventions. Under this scheme, more discretionary loans are granted than in regular projects in terms of interest rate and repayment period, with the conditions that i) prime contractors are tied to Japanese firms, and ii) country of origin of goods and services to be procured are limited to Japan (Total cost of goods procured from other countries shall be no more than 50% of the total yen loan amount), thereby leading to an expansion of opportunities for Japanese firms to participate in Official Development Assistance projects.

Duration of the Field Study: March 9, 2011 – March 24, 2011 / July 10, 2011 – July 16, 2011

2.3 Constraints during the Evaluation Study

None.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Sri Lanka

Relevance with the national policies

At the time that project appraisal was carried out in 2001, the Sri Lankan government had set a state objective of "Safe Water for All by 2010" and was working on expanding the water supply network. In addition, under the "Six Year Development Programme" (1999-2004), concrete targets had been set for the development of water supply facilities and the provision of safe drinking water, such as: (1) The supply of safe drinking water under a socially reasonable tariff system, (2) The development of water facilities capable of 24-hour supply, and (3) The efficient utilization of water resources.

Meanwhile, the administration of Mahinda Rajapaksa that came into power in 2005 sought to correct regional income disparities and wealth inequalities through infrastructure development, as well as promote priority investment in growth centers in each region, through the "Mahinda Chinthana (Mahinda Vision)" announced at the time of inauguration, as well as the policy framework for turning this vision into reality, "Creating Our Future. Building Our Nation: The Economic Framework of the Government of Sri Lanka."[4] In addition, at the Sri Lanka Development Forum held in January 2007, the Ten Year Horizon Development Framework 2006-2016, which sets promotion of basic infrastructure development in regions, including water supply infrastructure, as a priority strategic area, was enacted and announced under President Rajapaksa's strong initiative.

Therefore, for both program planning and ex-post evaluation, investment in infrastructure development, especially the promotion of investment in the water supply and sewerage sector, has been assigned high priority in higher-level national policies, and consistency of national policy even through changes of administration has been secured. Thus, consistency between this project's objective of "improving public health through stable supply of water" and national policy is very high.

Relevance with the sector policies

At the time of appraisal in 2001, the Public Investment Program 1997-2001 that set the Sri Lankan government's plan for public investment had an allocation of LKR 23.525 billion planned for the water and sewerage sector, equivalent to 6.9% of the total investment amount, and continuous capital investment into that sector was declared as a fundamental policy.

As of 2011 as well, the National Policy on Drinking Water announced in June 2009 continues to hold up the "sustainable supply of safe water" to urban and rural areas as a mission of the utmost importance. In addition, the National Policy on Drinking Water Supply and Sanitation (2004) formulated by the project implementing agency National Water Supply & Drainage Board (hereafter NWSDB), sets the following two targets for water supply development: (1) Percentage (penetration rate) of safe water of 85% by 2015, and 100% by

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

[3] ③: High, ② Fair, ① Low

[4] Specifically, (1) Development of road networks, (2) Expansion of electric power supply capacity, (3) Development of ports, and (4) Water and sewerage sector investment, are set as priority areas for investment.

2025, and (2) Percentage of drinking water supplied by water piping of 100% in urban areas and 75% in non-urban areas by 2015.

Therefore, for both program planning and ex-post evaluation, a certain level of ongoing investment in the water and sewerage sector has been clearly stated in the basic objectives for sector policy, and water supply development in greater metropolitan areas continues to be emphasized.

3.1.2 Relevance with the Development Needs of Sri Lanka

In 1997, when the feasibility study for this project was carried out, water demand had already far outstripped water supply capacity in Greater Kandy, which includes Kandy City, and due to restrictions on supply capacity, there were districts with limitations on water supply days and hours. As shown in Table 1 below, water supply capacity has been significantly strengthened in 2007[5] as a result of the October 2006 start of operation of facilities related to this project, including water treatment plants. On the other hand, maximum daily demand for water has increased an average of 3.5% each year, and the supply-demand gap that had once been mitigated is again expanding.

Maximum demand is predicted to reach 183,000m^3/day in 2015, and supply of safe water through expansion of water supply capacity continues to be a pressing task.[6] Had this project——which achieved substantial increase of water supply capacity and greatly contributed to bridging the supply-demand gap——not been implemented, the current supply-demand gap was projected to have widened more than it has.

Table 1: Water Demand and Supply in Greater Kandy Area

Unit: 10,000 m^3 / day

Year	Maximum Daily Water Supply a	Daily Water Demand		Demand - Supply Gap b-a
		Maximum b	Average	
2005	6.0	14.7	12.2	8.7
2006	6.0	14.2	11.9	8.2
2007	9.7	14.7	12.2	5.0
2008	9.7	15.1	12.6	5.4
2009	9.7	15.6	13.0	5.9
2010	9.7	16.3	13.6	6.6
2015 1)	*18.0*	*18.3*	*15.2*	*0.3*
2020 2)	*18.5*	*20.5*	*17.1*	*2.0*

Source: Answers to the questionnaire to NWSDB and JICA Mid-Term Review Report
Note 1: Planned (for daily water supply) and forecasted (for daily water demand) figures by NWSDB
Note 2: The operation of the project facilities started in October 2006.

3.1.3 Relevance with Japan's ODA Policy

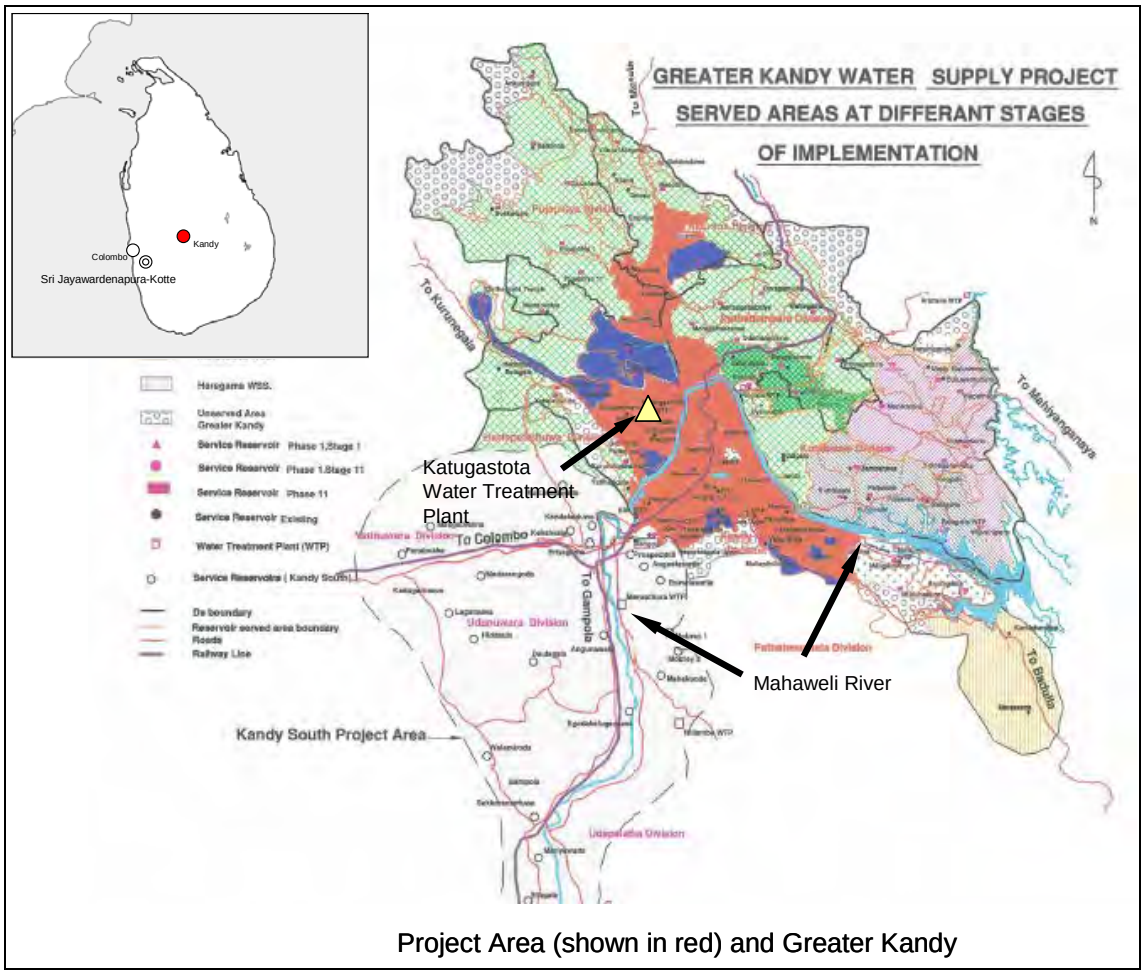
Under the policy of implementing yen loans to Sri Lanka in 2001 at the time of the appraisal, Japan was taking a course of assisting Sri Lanka that centered on water supply development programs in urban areas with urgent water demand, based on the recognition that water utilities are social infrastructure that contribute to the improvement of public health and the living environment, and that particularly in urban areas they are infrastructure that is indispensable to carrying out economic activities. Japan also had the policy of expanding the targets of water supply development from the Greater Colombo area to regional core cities such as Greater Kandy, while trying to improve the financial aspects of the implementing agency

[5] The maximum water supplied has risen from 60,000m^3/day to 97,000m^3/day, an increase of 62%.

[6] Due to the high supply needs, Water Sector Development Project was implemented as a follow-up to this project, and a plant capable of treating 100,000m^3/day is now under construction. For details, see the Sustainability section below, etc.

NWSDB. Therefore, this project was extremely consistent with Japan's aid policies.

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.



Project Area (shown in red) and Greater Kandy

Figure 1: Location of the Project Site

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Comparison of outputs planned and actual performance is shown in Table 2 below. There is no major change for the following three outputs: i) Intake capacity of intake facilities, ii) Treatment capacity of treatment facilities, and v) Procurement of maintenance equipment.

On the other hand, reductions in scope were confirmed for water conveyance, transmission and distribution facilities. In particular, the outputs for i) conveyance pipelines, iii) transmission pipelines, iii) pumping stations, iv) number of distribution facilities (reservoirs) total reservoir capacity, and distribution pipeline length are lower than planned. The reasons for the shrinkage in scope and the reduced outputs are as follows:

Table 2: Changes in Output

Project Components	Original	Actual	Differences
i) Intake and Raw Water Transmission Facility			
· Intake Capacity	115,000 m³/day	The same	As planned
· Conveyance Pipelines	2,200m	1,100m	50% of original plan
ii) Water Treatment Plant			
· Treatment Capacity	33,000 m³/day	36,700 m³/day	Mostly as planned
iii) Water Transmission Facility			
· Transmission Pipelines	39,290m	26,696m	68% of original plan
· Pumping Station	24 stations in total	4 stations in total	17% of original plan
iv) Water Distribution and Chlorination Facility			
· Distribution Reservoirs	18 reservoirs in total	4 reservoirs in total	22% of original plan
· Reservoirs Capacity	9,358m³	5,900m³	63% of original plan
· Distribution Pipelines	Approx. 30,000m	14,870m	49% of original plan
v) Procurement of Maintenance Equipment	Water quality analysis equipment, Leakage detection equioment, Truck with loading crane, etc.	Water quality analysis equipmen, Asphalt cutters, Backhoes, PCs, etc.	Mostly as planned (Some of the equipment were procured under Water Sector Development Project.)
vi) Consulting Services			
· Consulting Service M/M	352M/M in total (Foreign:138M/M, Local: 214M/M)	620.52M/M in total (Foreign: 56.14M/M, Local: 564.38M/M)	176% of original plan
· Consulting Service TOR	Bidding support, Construction supervision, Studies on environmental measures, etc.	Mostly as the same	Mostly as planned

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

- ✓ The original scope could not be pushed through because construction cost greatly exceeded the estimate at the time of detailed design (hereafter "D/D") due to unexpected sharp increase in minimum bid price.[7,8]

[7] The estimate at the time of D/D was about LKR 3.3 billion (about JPY 4.1 billion at the current rate), while the minimum bid price was about LKR 4.87 billion (about JPY 6 billion), a roughly 50% markup. (Source: JICA internal data)

[8] Though the rationale is not necessarily evident, NWSDB has pointed out that one of the reasons for the increased project cost was that the procurement under Special Yen Loan was Japan-tied (Source: Answers to the questionnaire to NWSDB). On the other hand, at the time of the mid-term review in 2006, the consultants claim that the both NWSDB and contractor sides have not been fully aware to receive the high quality Japanese technology and know-how through Special Yen Loan, and have not been able to appropriately respond to it at that time. At the same time, the contractor did not directly refer to the project cost or the quality itself, but they pointed out the delay of the

- ✓ Due to the above situation, in August 2003 a second-best option of excluding some water distribution areas from the scope and dealing with the excluded areas in a follow-up project (Water Sector Development Project)[9] was adopted through the discretion and approval of the implementing agency, Kandy Municipal Council (KMC), the consultants, and JICA.
- ✓ Through the above process, they a) Reduced the number of water distribution facilities (reservoirs) from 18 to four, and b) Nearly halved the length of water distribution pipelines.[10] In tandem with this, c) The length of water transmission pipelines was reduced by 30%, and d) The number of pumping stations was decreased to 1/4 of the original scope.
- ✓ Change of conveyance pipeline specifications arose mainly due to construction site conditions and improvements in safety.

Regarding vi) consulting services, consultant input also rose significantly over the original estimate. There are two reasons for this increase: (1) The increase in work hours of local consultants in charge of construction management that came along with the extension of project implementation period and, (2) Expansion of process management personnel that came along with the increasing complexity of process management.[11] For local consultants, who cost less than foreign consultants, there have been cases of increases in employment volume after project commencement, and a similar situation can be seen as having occurred this time.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total cost of the project was originally 6,710 million yen (the Japanese ODA loan share was 5,151 million yen) but the actual project cost was 6,172 million yen (the Japanese ODA loan share was 4,644 million yen), which was equivalent to 92% of the original plan.

Foreign currency portion (about JPY 2.9 billion) was almost at the same level as the original plan at the time of project appraisal, but the local currency portion (about LKR 4.1 billion) greatly exceeded the original plan of about LKR 2.6 billion. Causes of the increase of the local currency portion included: (1) Generation of additional work due to changes in design, (2) Increase in consultant costs accompanying the delay in construction, and (3) Sudden rise in construction material[12] and construction worker personnel costs due to tsunami reconstruction after December 2004[13]. At the same time, due to the impact of the depreciation of the Sri Lankan rupee, which exceeded inflation rate, overall project cost decreased slightly.

As already stated in the Output section above, a portion of the scope was eliminated due to a significant rise in the minimum bid price.

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construction work due to the lack of sufficient preparation by NWSDB (Source: JICA Mid-Term Review Report).

[9] Water Sector Development Project is currently in progress through a JICA yen loan. Project completion is scheduled for September 2012. Total project cost is JPY 17.64 billion.

[10] The Kandy Municipal Council had initially objected to this reduction in scope because its area would be greatly affected by the decrease in areas receiving water distribution, but it understood the unavoidable situation entailed by the steep rise in bid price, and in the end agreed to the reduction in the number of reservoirs from 19 to four. (Source: Official at KMC Water Department)

[11] For background on the increased complexity of process management see the Project Period section below.

[12] For example, compared to the 11.5% rise in wholesale prices overall in 2005, the wholesale prices in the same year for investment commodities, including construction materials, rose by 36%, and 30% in 2006. (Source: Central Bank of Sri Lanka Annual Report, etc.)

[13] The breakdown of expense item in local portion was: LKR 2.10 billion for civil works, LKR 0.12 billion for consulting services, LKR 0.06 billion for land acquisition, LKR 0.54 billion for taxation, and LKR 1.30 billion for others (including administrative costs). Civil works costs and consulting service costs were severely increased compared to those of the original plan (53% and 125% increase, respectively).

3.2.2.2 Project Period

The project period was longer than planned.

The project was scheduled from March 2011 to May 2006, a period of 63 months, but it extended to 68 months, from March 2001 to October 2010[14], which was equivalent to 108% of the original plan.

Table 3: Comparative Table of Project Periods

Task	Original Schedule (months)		Actual (months)		Differences (months)
Consulting Service	Apr. 2001 – Dec. 2005	(57.0)	Apr. 2001 – Mar. 2007	(72.0)	- 15.0
Tender / Procurement[1)]	Sep. 2002 – Dec. 2003	(16.0)	Sep. 2002 – Dec. 2003	(16.0)	0.0
Civil Works	Oct. 2003 – Dec. 2005	(27.0)	Oct. 2003 – Dec. 2006	(39.0)	- 12.0
O&M Training	Jan. 2006 – May 2006	(5.0)	Apr. 2006 – Sep. 2006	(6.0)	- 1.0
Completion Certificate[2)]		n.a.		Jan. 2007	n.a.
Total[3)]	Mar. 2001 – May 2006	(63.0)	Mar. 2001 – Oct. 2006	(68.0)	- 5.0

Source: JICA internal documents, answers to the questionnaire to NWSDB and results of interviews

Note 1: Bidding for construction works began earlier than originally planned. As shown above in the Project Cost section, minimum bid price exceeded the original budget, and time was needed to deal with this. However, the contract for construction works was signed by December 2003, without falling behind the original plan.

Note 2: Although project completion certificate was issued in January 2007, the operation of the constructed facilities started in October 2006. Auxiliary works inside and outside the facilities (fence installation, landscaping, etc.) and preparation of as-built drawings, were carried out in the period from October 2006 to January 2007.

Note 3: Project commencement was defined as the date of L/A conclusion. For the definition of the date of project completion, refer to the Footnote-14.

The main reasons for the delay included: (1) Redesign work[15] accompanying the review of the D/D and delay in the start of main construction work[16], (2) Suspension of night work remotely caused by the intensification of the civil war after the presidential election of November 2005, and the accompanying increase in complexity of construction schedule supervision, and (3) Difficulty in recruitment of construction workers due to the sudden rise in personnel costs during the aforementioned tsunami reconstruction process. Occurrence of a three-month delay was due in particular to the effects of (1).

In addition, as shown in the Efficiency section above, a portion of the outputs of this project, such as water distribution facilities, was greatly reduced. In cases where output has been reduced, it is necessary to take it into consideration when evaluating the project period. However, intake facility and water treatment plant specifications were virtually unchanged from the original plan, and the intake facility and water treatment plant construction components were critical path activities for both the original and actual construction work period. For these reasons, the reduction in the distribution reservoirs and the water distribution network could not

[14] Although the loan completion date for this project was June 2008, as shown in Table 1 above, the majority of construction was completed in October 2006, and all of the related facilities began operating in October 2006. Since from that time onward, water was supplied throughout Kandy and project effects began to appear, it is considered reasonable to set project completion to the above date of start of operation.

[15] In particular, in the course of foundation work for the Asgiriya Reservoir, the largest under this project at 4,100m^3, there was a need to carry out basic redesign because the position of the bedrock was considerably deeper than that predicted by the ex-ante ground survey. Regarding accuracy of the detailed design and cost estimate, the NWSDB considers the implementation method and implementation scale of the ground survey to have been somewhat insufficient. (Source: Results of interview with the NWSDB)

[16] It has been pointed out that the advance to the contractor was paid six months after contract signing. Subsequently, recruitment of personnel by the contractor in the early phase of construction work was somewhat delayed. (Source: JICA internal documents)

become factors in shortening the construction work period, and the output reduction did not impact the evaluation of the project period.

The sharp increase in the bid price of contractors was one kind of external factor, and scope reduction was an unavoidable measure. As a result, even though investment of input (funds) was close to that of the original plan and outputs were reduced, the above phenomenon should be considered as "a result of a next-best policy that dealt with external factors," and the design change is judged appropriate. Furthermore, regarding the project period, as will be shown below, the output reduction this time did not become a factor shortening the construction work period. Therefore, the above phenomena did not have an influence on the evaluation of the project period.

Although the project cost was lower than planned, the project period was longer than planned (117% of the original plan), therefore efficiency of the project is fair.

3.3 Effectiveness (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Population served, average water supply per capita and percentage of population served

Population served by this project: As of the end of March 2011, the population served by this project within the target areas was 255,000 people (refer to Table 4), and close to the post-scope reduction revised target of 258,000.[17]

After completion of facilities related to this project, various work aimed at increasing connections (sales activities aimed at making new connections and customer service improvements through the introduction of Key Performance Indicators (KPIs)) led by the NWSDB Regional Support Centre - Central (RSC Central) has succeeded, and the number of households connected to the waterworks has been steadily growing since 2007.[18]

Factors behind the population served by this project reaching the revised target include: (1) The abovementioned management efforts by RSC Central, (2) The fact that in comparison to the distribution pipeline length reduction, the reduction in total capacity of reservoirs was effectively contained (63% from the original plan was secured; for details see the Efficiency section), while giving consideration to priority levels of the target areas for supply, and (3) The fact that through a Water Sharing System[19] with Kandy Municipal Council (KMC), the water distribution network within Kandy City was utilized to secure a certain volume of water supply.

Average water supply per capita: The per capita water volume supplied for Greater Kandy, which includes the area in this project, was 135 liters/day (converted with an average of 4.3 persons per household) as of the end of March 2011, falling short of the 2005 level of 159

[17] If long-term non-residents and other floating population of 145,000 are included, population served by the project becomes 400,000. (Source: NWSDB RSC Central)

[18] 161,461 households in RSC Central's jurisdiction were connected as of end of October 2010. The annual growth rate is 8%.

[19] **"Water Sharing System" with the Kandy Municipal Council**: Mutual accommodation is being carried out between the NWSDB and the KMC Water Department. The predecessor of this mutual accommodation system was the water supply system from the Kandy City Water Treatment Plant to NWSDB-administrated districts that began in 1998. At present, a maximum of about 4,500 m^3/day is being supplied by the Kandy City Water Treatment Plant to the NWSDB-administrated districts of Ampitiya and Thennekumbura. Meanwhile, immediately after completion of this project in October 2006, water supply from the NWSDB-side began, and an average of about 15,000m^3 to 16,000m^3/day is being supplied from the Katugastota Water Treatment Plant that was completed through this project to various districts in Kandy City under the administration of the KMC Water Department. The NWSDB benefits from being able to sell and get water charge for the entire amount of 15,000-16,000 m^3/day from the Department of Water without concerns about non-revenue water and enjoy the revenue benefits. On the other hand, the Department of Water, although having to pay a certain cost of buying the water, has the advantage of being able to secure a continuous flow of high quality tap water. This mutual accommodation system is a win-win situation for the two parties.

liters/day. In addition, when limited to the target areas of this project, per capita water volume supplied falls to 129 liters/day[20]. Two main factors are thought to be behind the shortfall from the 2005 level: (1) The rise in water charges in 2005 and 2009, and (2) The awareness activities such as the water conservation campaign developed nationwide by the NWSDB.

Percentage of population served: The percentage of population served by water supply in Greater Kandy as a whole has reached 56% as of the end of 2010, due to the abovementioned steady growth of the population served by this project. This level is twice the baseline figure of 28% at the time of project appraisal in 2001.[21] In addition, facilities related to Water Sector Development Project, which is a follow-up to this project, are scheduled to begin operations within 2012, and percentage of population served is expected to improve further.

Table 4: Achievement Rate of Main Indicators

Operation and Effect Indicators	Baseline Data (2001, At the Time of Appraisal)	Target Value (Expected Completion Year) a	Actual Value (2005, At the Time of Mid-Term Review)	Actual Value (As of 2011) b	Achievement Ratio (%) b/a
Population Served	Not known[2)]	258,000[3)]	Not known	255,000	99%
Average Water Supply per Capita [1)]	Not known	Not known	159 liter/day	135 liter/day	n.a.
Percentage of Population Served[1)]	28%[4)]	79%[4)]	35%	56%	n.a.
Water Supply Volume (to be added by the Project)	n.a.	36,670m^3/day	n.a.	33,000m^3/day	90%
Rate of Facility Utilization	n.a.	100%	n.a.	90%	90%
Water Supplied Hours (for inside Kandy City)	20 hrs/day	24 hrs/day	20 hrs/day	24 hrs/day	100%
Water Supplied Hours (for outside Kandy City)	7 hrs/day	24 hrs/day[5)]	4-10 hrs/day	24 hrs/day	100%

Source: Answers to the questionnaire to NWSDB, results of interviews with NWSDB, Project Completion Report, NWSDB Annual Report, JICA Mid-Term Review Report, etc.
Note 1: The per capita water volume supplied for Greater Kandy, which includes the area in this project
Note 2: Data for project target areas after project scope reduction is unclear. Under the original plan at the time of appraisal (which included areas covered by existing reservoirs, in addition to areas covered by the 19 reservoirs that were newly scheduled for construction under this project before the scope reduction), it was 288,000.
Note 3: This is post-project scope reduction target. The target at the time of the 2005 Mid-term Review was set at 147,103, but later adjusted upward. It does not included floating population.(Source: Answers to the questionnaire to NWSDB)
Note 4: Estimated figures by NWSDB (Source: NWSDB Corporate Plan 1999-2005)
Note 5: Revised target value after the Mid-term Review in 2005 (Source: JICA Mid-Term Review Report)

(2) Water supply volume, rate of facility utilization and water supplied hours

Due to the abovementioned steady increase in the population served by this project, the original (pre-scope reduction) water supply volume target of 36,670 m^3/day has been mostly achieved. The degree of facility utilization rate attainment is likewise high (target rate: 90%).

As for hours of water supplied per day, the numbers for both inside and outside Kandy City have improved substantially over the time of the appraisal in 2001. The extent of gains outside Kandy City, including rural areas, is especially high. Since many poor people live in the rural areas outside Kandy City, it is imagined that the significant increase in hours of water supplied per day is contributing a certain degree to the improvement of the living environment for the poor.

[20] Derived from the following calculation: 33,000 m^3/day (which is the average water supply volume per day as of 2011) / 255,000 (which is the population served by the project as of 2011)
[21] Moreover, the target at the time of appraisal was set at 79%, but this was before project scope reduction, and comparison using this value is deemed unsuitable.

(3) Water quality

This project's water quality monitoring at water intakes is being carried out at laboratories set up in water treatment plants and at the test facility at NWSDB Headquarters. To date, no serious problems with water quality have been confirmed. At the five points on the Mahaweli River, which is the intake source for this project, periodic water quality monitoring is being implemented at a frequency of once daily to once every three months.

Getambe Water Intake Point (This Project)

At the time of appraisal in 2001 and at the present time (2010), on the whole figures are improving except for DO (dissolved oxygen), and no particular problems with the water as waterworks source water can be seen. Due to the further adoption of water supply facilities, including through this project, and the increase in population and tourists, the amount of polluted water discharged into the Mahaweli River is growing. However, from what can be seen in the monitoring results shown in Table 5 below, the impact on water quality is estimated to be minor.

Table 5: Monitoring Status of Water Quality at the Selected Locations of Mahaweli River

Selected Location for Monitoring Activities	Year of Examination	pH	BOD (mg/l)	SS (mg/l)	DO (mg/l)
Peradeniya Water Intake (located at the upstream from Project's water intake facility)	2001 2010	6.12 6.52	2.3 3.2	25 6	8.0 7.0
Water Intake of KMC Treatment Plant (Ditto)	2001 2010	6.01 6.50	2.2 2.9	120 10	8.7 7.1
After downstream of confluence with Meda River (Ditto)	2001 2010	6.08 6.70	6.5 3.0	29 14	7.5 7.2
Gohagoda Water Intake (Ditto)	2001 2010	6.02 6.80	1.8 1.8	30 13	6.7 7.0
Polgolla Water Intake (Located at the downstream from Project's water intake facility)	2001 2010	6.08 6.92	3.5 2.0	25 17	8.2 7.0
Environmental Standards on Raw Water used for water supply (in Japan)		6.5 - 8.5	Desired: < 1.0 Disapproved: > 3.0	Below 30 in general	Desired for Water Creatures: >6.0

Source: Documents and information provided by NWSDB

Note 1: BOD: Biochemical Oxygen Demand, SS: Suspended Solids, DO: Dissolved Oxygen. All of these indicators are the typical environmental standards on the quality of river and lake water.

Note 2: Upper rows have 2001 values, lower rows 2010 values. pH and DO are minimum annual values, while SS and BOD are maximum annual values. All recorded pH levels have been below 7.0.

Note 3: Inspection locations are all inside Kandy City. Inspection locations are listed from most upstream. The planned Gohagoda intake site is the one originally scheduled for intake point construction of the Katugastota Water Treatment Plant (a plant that was built through this project), and is situated in the vicinity of the current Getambe intake point.

Moreover, regarding the Kandy City Wastewater Management Project[22] that was being

[22] **Kandy City Wastewater Management Project**: At the time of project appraisal, the Sri Lankan government was requesting a Greater Kandy Water Supply and Sewerage Project. However, the wastewater portion was scrapped from the components because tariff policy and implementation system for the wastewater plan were insufficient. Subsequently, the wastewater portion was planned under the Greater Kandy Wastewater Management Project and the loan agreement (L/A) was signed on March 26, 2010 (agreed amount under the L/A: JPY 14.087 billion). The project is being promoted with NWSDB as the implementing agency. Start of facility utilization is currently targeted for October 2017.

planned at the same time as this project (details below), a great deal of emphasis was initially being placed on monitoring of Mahaweli River water quality because the discharge point of wastewater treated at a wastewater treatment plant was planned at a location upstream from the water intake locations of this project. Construction under this wastewater management project began in 2010, and facilities are scheduled to go into service in October 2017. Monitoring of the quality of water in the Mahaweli River should continue, while paying attention to developments in the wastewater management project[23].

(4) Target and status of non-revenue water rate

At the time of appraisal in 2001, regarding measures for contributing to the financial sustainability of NWSDB, following were scheduled to be implemented by NWSDB itself as part of its Corporate Action Plan: (1) Formulation of appropriate water tariff policy, (2) Strengthening of the fee collection system, (3) Strengthening of inventory control, along with (4) Taking measures to reduce non-revenue water (NRW). Therefore, no component regarding reduction of non-revenue water was included in this project, and thus no NRW rate targets were set.

Table 6: Non-Revenue Water Rate in the Project Area

Category	2001 (Baseline)	2005	2009	2011
Inside Kandy City	Not known	46%	45%	45%
Outside Kandy City	41%	28%	40%	34%
National Average	Not known	34%	31%	32%

Source: Answers to the questionnaire to NWSDB and Kandy Municipal Council, NWSDB website, etc.

However, an NRW countermeasure component was included in Water Sector Development Project, the follow-up to this project. For now, the various activities involved in this component are being implemented in the target area of this project.[24] As shown in Table 6 below, after the start of this project, lowering of NRW rates outside of Kandy City, which is under the jurisdiction of NWSDB RSC Central, is progressing due to the abovementioned various countermeasures.[25]

Meanwhile, regarding inside Kandy City, which is under the administration of the KMC Water Department, NRW rate is holding at a high 45%. As shown below in the Sustainability section, shortages of various resources (insufficient number of employees, lack of skills, etc.) are thought to be the chief causes.

3.3.1.2 Results of Calculation of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

FIRR figures were recalculated with several conditions described in Table 7 below. (For more detailed analysis, refer to Appendix.)

The result of recalculating FIRR was 0.03%, which was lower than the 3.74% at the time of project appraisal. Reasons for this are thought to be: (1) O&M costs were more than double the amount estimated at the time of appraisal, and (2) The degree predicted at the time of appraisal for the water tariff increase was somewhat optimistic (3% annual increase).

[23] Note that it is planned to establish the "external monitoring committee" to monitor the quality of the effluent to be discharged from the facility under the Kandy City Wastewater Management Project.

[24] These include: (1) Renewal of old distribution pipes, (2) Renewal of metering equipment, and (3) Opening of a 24-hour customer helpline to address water leakage.

[25] The increase in NRW rate between 2005 and 2009 was due to the opening of new water supply facilities, including those under this project, and an accompanying sharp increase in the number of connected households.

Table 7: Recalculation of FIRR

Timing	Preconditions and Assumptions for Recalculation (Project Life: 50 years after the commencement of the Project for each case)		FIRR
At the time of appraisal (in 2001)	Costs:	Construction cost, consulting service cost, operation and maintenance cost	3.74%
	Revenue:	Water tariff revenue (assuming 3% increase in water tariff every year after operation)	
At the time of ex-post evaluation (in 2011)	Costs:	Construction cost, consulting service cost, operation and maintenance cost (based on the actual expenditure up to 2010)	0.03%
	Revenue:	Water tariff revenue (assuming 10% increase in water tariff every 5 years after 2015)	
	NRW:	Assuming 5% reduction every 5 years from 2015 up to 2040, being 30% in 2015 as a base rate and being 5% after 2040 as a convergence rate.	

(2) Economic Internal Rate of Return (EIRR)

The economic internal rate of return (EIRR) was not calculated due to limited resources for this study because it would have been necessary to clarify input data from the beneficiary side, such as beneficiaries' WTP (Willingness to Pay) for water usage through individual interviews or through the estimation by using prices of substitution goods and water tariff level.

3.3.2 Qualitative Effects

Effects such as improvement of public health and betterment of the living environment through upgrading of water supply conditions are appearing. Details are in the Impact section below.

Even though some outputs have been significantly reduced, the main indicators, including population served by this project, amount of water supplied, and facility utilization rate, have all reached 80% of the target or greater. In addition to there being no particular problem with the quality of treated water produced, regular water quality monitoring of the intake source for this project, the Mahaweli River, is being implemented under a solid system. While the still-high NRW rate in areas under Kandy Municipal Council's jurisdiction is a cause for concern in the mid-to long term, various measures are being undertaken under the follow-up Water Sector Development Project to reduce NRW rate.

This project has largely achieved its objectives; therefore its effectiveness is high.[26]

3.4 Impact

3.4.1 Intended Impacts

(1) Impact on Public Health

Regarding waterborne diseases before and after completion of this project, the following results were obtained from a beneficiary survey.

Table 8: Waterborne Diseases before/after the Project (For General Population, N=63)

Answers from Beneficiaries	Category of Water Users	Kandy City	Harispattuwa Division	Akurana Division	Total
Number of respondents who suffered from some water-related diseases **before** Project completion	New User	3 out of 10	9 out of 10	7 out of / 11	19 out of 31
	Existing User	0 out of 10	0 out of 10	0 out of 12	0 out of 32

[26] Furthermore, the customer satisfaction survey on "Special Yen Loan" scheme revealed that the NWSDB highly evaluates the technological competence of the Japanese contractor and the reliability of the Japanese-made equipment procured through this project.

Answers from Beneficiaries	Category of Water Users	Kandy City	Harispattuwa Division	Akurana Division	Total
Number of respondents who suffered from some water-related diseases **after** Project completion	New User	0 out of 10	0 out of 10	0 out of 11	0 out of 31
	Existing User	1 out of 10	0 out of 10	0 out of 12	1 out of 32

Source: Results of beneficiary survey[27]

Note: "New user" refers to a beneficiary who was newly connected to the water supply after completion of the project. "Existing user" refers to a beneficiary who had been receiving water services since before project completion.

It would be hard to describe the decreasing trend in infectious waterborne diseases shown above as solely due to the impact of this project, as it is naturally also thought to be largely due to the educational activities such as the Cleaning Campaign being developed throughout the country by the Sri Lankan Ministry of Health[28] and the strengthening of health education. At the same time, we can discern from the above beneficiary survey results that: (1) It is a fact that waterborne diseases among residents have decreased thanks to this project (the effects are especially significant outside Kandy City), and (2) Sewerage is still in an undeveloped stage.[29] From these findings, we can suppose that this project contributed a certain extent to waterborne disease reduction in Greater Kandy, along with improvement in quality of water supplied and increase in the percentage of population served.

(2) Impact on Living Environment

A survey of beneficiaries' level of satisfaction regarding the quality (turbidity/clarity, water pressure, quantity, and continuity) of water services revealed the following results. It can be seen that through the implementation of this project, the level of water supply services improved greatly. Satisfaction level is relatively high among newly connected users.[30]

[27] Beneficiary survey implementation overview:
Locations: Areas served by this project (Three areas: inside Kandy City and the divisions of Harispattuwa and Akurana outside the city)
Subjects: General population, companies, and public institutions (hospitals, schools, etc.)
Total sample: 195 (63 from general population, 70 private companies, 62 public institutions), segmented two-stage random sampling
Data collection method: Face-to-face interview

[28] A regional community organization in each area called a CDC (Community Development Committee) takes the initiative in this campaign to eradicate waterborne infectious diseases through activities such as cleaning drainage ditches in residential areas.

[29] The Kandy City Wastewater Management Project is currently in progress through a JICA yen loan. At the time of analysis regarding improvement of public health, it will be important to pay heed to the existence/nonexistence of a wastewater management project and related developments. However, at present sewerage is inadequate in Kandy City. Because water supply development will impose increased burden on the environment, it is vital to advance measures for wastewater treatment concurrently with water supply development, and the early completion of this wastewater management project is much awaited. Furthermore, although it is expected that sewage from daily life in Greater Kandy has increased along with the increase in water supply due to this project, the water quality of the Mahaweli River−one of the destinations of sewage discharge−has not worsened significantly, as shown in the Effectiveness section above.

[30] According to the beneficiary survey results, among service indicators, turbidity/clarity, water pressure, and quantity achieved a very high level of improvement from pre-project to post-project. As for continuity (the frequency of water outages), as shown in Table 9 (iv), the number of beneficiaries who responded "satisfactory" rose roughly fourfold after the end of project completion (from 17 to 67). To the separate question regarding continuity, the number of beneficiaries responding that outages occur once or more per month was 46 before project completion, while about half (24) responded thusly after project completion.

Table 9: Customer Satisfaction in Water Quality

i) Turbidity and Clarity
(Existing User: N=103, New User: N=89)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	24	89	79
Moderately Satisfactory	65	13	8
Not Satisfactory	14	1	2
Total	103	103	89

Source: Results of beneficiary survey

ii) Water Pressure
(Existing User: N=102, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	24	79	72
Moderately Satisfactory	59	17	12
Not Satisfactory	19	6	6
Total	102	102	90

Source: Results of beneficiary survey

iii) Water Quantity
(Existing User: N=101, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	35	84	76
Moderately Satisfactory	54	14	14
Not Satisfactory	11	3	0
Total	100[1)]	101	90

Source: Results of beneficiary survey
Note 1: Not answered from 1 existing user

iv) Continuity
(Existing User: N=101, New User: N=90)

Answers	Existing Users		New Users
	Before	After	After
Satisfactory	17	67	70
Moderately Satisfactory	56	27	14
Not Satisfactory	28	8	6
Total	101[1)]	102	90

Source: Results of beneficiary survey
Note 1: Not answered from 1 existing user

(3) Impact on Business Environment

Regarding change in the business environment after project completion, the following responses were obtained from a total of 70 companies in the beneficiary survey.

Table 10: Business Environment before/after the Project (N=70, Multiple Answers)

Answers by Private Companies	Kandy City	Harispattuwa Division	Akurana Division	Total
Production/Sales were increased after receiving new water	4	8	12	24 / 70
Quality of products/services were improved after receiving the new water	14	8	12	34 / 70
Number of customers were increased after receiving the new water	7	4	5	16 / 70
Production cost /Service delivery cost were decreased after receiving the new water	0	2	1	3 / 70

Source: Results of beneficiary survey (for 70 private companies)
Note: Type of business of interviewee: Tourism (including hotel, restaurant, etc.), Manufacturing (including textiles, pottery, etc.) and Service sector (automobile sales, car repairing, telecommunications, food, grocery retailing, education, finance, etc.)

Similarly, regarding level of improvement of business environment for companies, in-depth interviews of one manufacturing company and one tourism company in Greater Kandy[31] at the time of the field survey obtained the following views on the direct effects associated with project completion.

[31] The manufacturing company is a slipper making company (established 1986, 150 employees, located in the suburbs of Kandy City). The tourism company is a hotel and restaurant business (established 1998, 25 rooms, located inside Kandy City).

Table 11: Results of In-Depth Interviews with Private Companies in Greater Kandy Area

Answers by Interviewees	Type of Business
Conditions of water quality, pressure, and hours supplied all improved markedly.	Tourism, Manufacturing[1)]
Supply of high quality water backed up a decision to make a new investment (add hotel rooms).	Tourism
Due to continuous supply of safe water, we annexed food and drink facilities (restaurant and bakery) to the hotel, along with a spa facility.	Tourism
The hotel industry in the Kandy area is surely benefiting from the start of the supply of good quality water.	Tourism
Water tariff are somewhat high.	Tourism, Manufacturing
We use well water instead of waterworks as industrial-use water for manufacturing. Three reasons: (1) Water tariff are high, (2) Even if water quality is low, it has no impact on manufacturing, and (3) Plenty of rainwater can be collected during rainy season, so there is no incentive to use the waterworks.	Manufacturing

Note 1: Although the manufacturing company is not using water from the project for industrial use, it uses water from the project for employees' drinking and domestic use.

According to the above beneficiary survey results, through the provision of quality water services that came with project completion, various positive impacts are being enjoyed by many companies located in Greater Kandy and contributions to the improvement of the business environment can be observed. In particular, about half (34) of the 70 companies in the beneficiary survey responded that the quality of products or services improved after the start of water supply under this project. Regarding the tourism industry, specifically hotel operators, it is surmised that as stated in the above interview results, they have benefitted greatly from the project in the area of food and drink service provision.[32]

3.4.2 Other Impacts

3.4.2.1 Impact on Natural Environment

(1) Implementation status of IEE and EIA

To consider the impact of this project on the environment, an Initial Environmental Examination (IEE) and an Environmental Impact Assessment (EIA) were executed through a JICA development study. Deliberations on the following were carried out: (1) Land acquisition, (2) Impact due to water intake, (3) Impact on water quality, (4) Impact on transportation, (5) Odors and noise, and (6) Monitoring methods.

The IEE report was submitted to the Sri Lankan Central Environmental Authority (so-named at the time) in June 1993. Although there was no obligation to submit the abovementioned EIA,[33] one was prepared in February 1999 through the JICA development study.[34]

(2) Implementation status of environmental monitoring

Environmental monitoring of noise, vibration and impact on transportation was implemented during construction work by the contractor as needed. There was one complaint each from surrounding residents regarding noise and vibration during construction. The matters

[32] On the other hand, the manufacturing company that gave the in-depth interview remarked, "Regarding use of waterworks for industrial-use water, due to fee levels there is no incentive for continuous use." For some manufacturing companies, the high level of tariff was an obstacle to use.

[33] Regarding the EIA, since this was a water project with volume that fell below the level requiring EIA under Sri Lankan environmental law (500,000m^3/day), implementation of legal procedure and authorization was not required. In this relation, a letter to that effect was issued in August 1998 from the Sri Lankan Central Environmental Authority (so-named at the time).

[34] The approval of the Environment Agency was required in the construction of the intake facility and water treatment plant. On August 21, 1998, approval to carry out landfill construction at two construction sites for the intake facility and the water treatment plant was issued.

were solved by suspending nighttime work and changing equipment. When implementing environmental monitoring during construction work, in order to obviate discontent among residents, a questionnaire survey for residents was carried out, and complaints were processed in a timely fashion. There was no problem with the response by the implementing agency.[35]

As explained in the Effectiveness section, at a frequency of once daily to once every three months, periodic water quality monitoring is being implemented at the five points on the Mahaweli River with the collaboration between NWSDB and Kandy Municipal Council. No serious problems with water quality have been confirmed.

3.4.2.2 Implementation Status of Resettlement and Land Acquisition

The project involved resettlement of local residents and land acquisition. Table 12 below shows the scale and process of the resettlement.

No particular problems can be seen in the resettlement process. At the time of the mid-term review only two households were set for resettlement, but in the end 26 households became subject to resettlement. Resettlement was implemented smoothly[36]. Social infrastructure in the new location was better developed than that in the old location, and no dissatisfaction has emerged regarding compensation payments.[37] The Kandy City Municipal Council currently employs the majority of the resettled residents.

Table 12: Status of Resettlement and Land Acquisition of the Project

Item	Actual Status
Project-Affected Families (PAFs)	133 households
Scale of Resettlement	26 households
Compensation for Resettlement	1,554 million LKR
Detailed Process of Resettlement	Stakeholder meetings for resettled households were held separately, and replacement housing was built in line with the requests of the residents to be resettled. Infrastructure development (including water and electricity) was also carried out concurrently with housing construction. (Most of the resettled residents lived within the plot scheduled for construction of the water treatment plant)
Land Acquisition Price	For the land acquisition price, the application of the average price of actual transactions using market price as a criterion was permitted. The project-implementing agency applied to the Cabinet and the price was decided. In this relation, official approval was given at a Cabinet meeting in April 2006. Based on this approval, the government issued an official notice, and payment was made.
Scale of Land Acquisition	69 cases, 8.54 ha in total
Expenses for Land Acquisition	7,472 million LKR

Source: JICA internal documents and answers to the questionnaire to NWSDB

Note: Acquisition of farmlands and forests was completed before the start of construction, and construction work using these lands was advanced. Land acquisition was implemented based on the Land Acquisition Act (1950). There were 69 cases of farmland and forest acquisition. The earliest piece of land was acquired in October 2000 and the latest at the end of 2006.

Therefore, in addition to making contributions to waterborne disease reduction, this project, through its implementation, has significantly improved water supply services and service level, and is contributing to the betterment of the business environment for local companies. One can say that many positive impacts have been generated through this project's implementation.

[35] The NWSDB distributes questionnaires to nearby residents during construction work in order to receive complaints, and is working to obviate discontent among residents. It received a total of 13 complaints. Six were unrelated to the construction work, and the remaining seven were regarding damage to parapets on houses. The appropriate response was taken by the contractor. (Source: Results of interview with NWSDB)

[36] Majority of the resettled people were in planned site for a water treatment plant. After the final decision of the site location, some of the settlers were newly moved to this site. (Source: Results of interview with NWSDB)

[37] Source: Results of interviews with the NWSDB and Kandy Municipal Council.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspect of Operation and Maintenance

NWSDB[38] and the Water Department of Kandy Municipal Council (KMC) are responsible for operation and maintenance (hereafter O&M) of the related facilities that were built in the project. There is a clear demarcation between NWSDB and KMC for their responsibility of O&M activities, and there seems to be no problem with the operation and maintenance structure.

The NWSDB's organizational structure includes departments involved in policy and strategy making, and water and sewerage project implementation, as well as Regional Support Centers (RSCs) set up in 11 regions throughout the country. One of the abovementioned RSCs, RSC Central, is in charge of O&M for facilities related to this project. As for O&M for facilities inside Kandy City related to this project, the KMC Water Department is in charge. For details, see Table 13.

Table 13: Responsibility Matrix of Operation and Maintenance Activities

Type of Facilities	NWSDB Regional Support Center – Central	Kandy Municipal Council (KMC)
Water Intake and Raw Water Transmission	In charge	n.a.
Water Treatment Plant in Katsugastota	In charge	n.a.
Water Transmission Facilities	In charge, except for KMC area	Pumping station in KMC area
Water Distribution Facilities	3 service reservoirs, Distribution pipelines except for KMC area	1 service reservoir (Asgiriya), Distribution pipelines in KMC area

Source: Answers to the questionnaires to NWSDB and Kandy Municipal Council

As shown in Table 14, O&M activities (excluding large-scale repairs) of the related facilities under NWSDB's responsibility are implemented by direct management. O&M manuals have been prepared by the consultant. No particular problems regarding implementation structure of RSC Central are found for planning, bidding and management of the contractors upon large-scale repairs.

Table 14: Operation and Maintenance System of Project Facilities (for NWSDB only)

Stage/Category of Maintenance Activities	Planning	Preparation of Tender Documents	Implementation	Supervision
Daily Maintenance	Kandy North	n.a.	Kandy North	Kandy North
Periodical Maintenance	Kandy North	n.a.	Kandy North	Kandy North
Large Scale Maintenance	RSC Central	RSC Central	Contractors	RSC Central

Source: Answers to the questionnaire to NWSDB

Note: RSC Central refers to the headquarters of NWSDB Regional Support Center-Central, and Kandy North refers to the Kandy North Branch of NWSDB Regional Support Center-Central.

Meanwhile, although virtually all O&M work on related facilities under the administration of the KMC Water Department, excluding pumping stations, is carried out directly by the department, a lack of supervisors and engineers possessing the necessary skills has been cited.[39] Since there are currently only two technical engineers engaged in O&M work, one engineer is responsible for an average of 15,000 households (customers). One of these engineers is also scheduled to leave the job. On the other hand, the situation seems to be much worse in KMC,

[38] NWSDB is a public corporation that was established under the legal authority of the National Water Supply and Drainage Board Law, No.2 of 1974, which came into force in January 1975. It oversees development, supply, operation and management of water and sewerage facilities.

[39] Source: Result of interview with KMC Water Department staff

considering the fact that one engineer or manager of RSC Central is responsible for an average of 2,500 households.[40] Furthermore, as explained later, there is also some concern over the lack of seasoned employees engaged in O&M activities.

Table 15: Number of Staff of NWSDB and KMC Water Department

Year	NWSDB Staff in Total	Of which, O&M Staff	Of which, O&M Staff of RSC Central
2007	8,768	6,830	Not known (89)
2008	9,006	7,079	1,054 (111)
2009	9,063	7,432	924 (108)
2010	9,018	7,485	911 (122)

Source: Prepared from NWSDB Annual Report, NWSDB website, PCR and answers to the questionnaire to NWSDB

Note 1: In parentheses: the number of personnel among RSC Central O&M workers who are involved in O&M of facilities related to this project

Note 2: Part-time workers are included in the total number of NWSDB staff.

Year	KMC Water Department Staff in Total	Of which, O&M Staff
2008	267	147
2009	264	147
2010	268	143

Source: Prepared from answers to the questionnaire to KMC Water Department

Note: Among O&M workers, there are only two supervisors/engineers. The rest are all ordinary workers.

Based on sufficient awareness of this situation, RSC Central is appropriately providing the necessary O&M work support (including assistance for pumping station maintenance) to the KMC Water Department, and to date no serious problems have occurred[41]. However, for a fundamental solution to this problem, over the long term an increase in O&M supervisory and engineering staff at KMC is desirable.

As shown in Table 15, although the total number of NWSDB personnel has not fluctuated significantly over the past three years, the number of workers engaged in O&M activities has been rising and accounted for 83% of total personnel in 2010. The number of O&M workers at RSC Central has trended slightly downward, but from 2007, measures have been taken to increase O&M staff engaged in facilities related to this project in response to the growing number of customers, and the proportionate volume of personnel is being secured on an ongoing basis. As for KMC Water Department employees, neither the overall number nor the number of O&M workers has fluctuated significantly over the past three years. According to a Water Department engineer, even though the number of customers served has virtually doubled since project implementation (15,000 to 30,000), no increase in number of personnel has been carried out, and there seem to be problems in the timely implementation of O&M work.[42]

3.5.2 Technical Aspects of Operation and Maintenance

Technical skills of engineers and workers

The total number of employees at NWSDB RSC Central assigned to technical jobs for operation, maintenance, and management are 122 persons as of 2010, consisting of 21% of

[40] This figure is obtained from the following calculation – Total number of connected household under RSC Central (53,860, as of 2010) divided by the number of manager level staff (21) who are in charge of O&M. Conversely, additional 10 managers or engineers will be necessary in order for KMC Water Department to reach the level of RSC Central.

[41] As previously explained, the NWSDB is receiving a certain volume of water supply from the Kandy City side through the "Water Sharing System". It seems that NWSDB's incentives for continuing the support for KMC might be relatively high, considering the situation that water leakage rate are directly linked to the performance of NWSDB's own water supply services.

[42] According to the KMC Water Department engineer, although Kandy City has a stipulation that water pipe repair work shall be completed within three hours, a situation where this cannot be observed due to the shortage of staff persists. In addition, despite the existence of a plan to increase Water Department personnel by 2020, it does not seem to have been implemented yet. (Source: Results of interview with KMC Water Department engineer)

university graduates, 21% of diploma graduates, and 58% of others. They have five to 15 years of experience in operation and management of the water supply facilities. Regarding the KMC Water Department, the total number of employees assigned to O&M activities are 143 persons as of 2010, consisting of 2.5% of university graduates, 2% of high school graduates, and 95.5% of others. They have ten years of experience on average in O&M of the water supply facilities.

As shown in Table 15, the number of O&M workers at RSC Central has trended slightly downward, but from 2007 measures to increase staff engaged in O&M work at facilities related to this project have been taken, and the proportionate volume of personnel is being secured on an ongoing basis. The NWSDB has many similar water facilities in Sri Lanka, and is amply accumulating O&M skills through the operation of these facilities. It would appear that there is no problem with the quantity and quality of engineering and technical staff. However, in addition to the aforementioned insufficient quantity of KMC Water Department employees, a need for capacity building in terms of quality has also been cited.[43]

Lecture Room at Katugastota WTP Site

Training programs provided by contractors of the Project

Various trainings for technical staff for maintenance have been conducted by the contractors from 2006 to 2008. Three types of training are provided; 1) lecture[44], 2) OJT during commissioning period, and 3) overseas training[45], with he total number of participants of 238.[46] Training is conducted by the contractor constantly, and the contents of the training are valued by the trainees.[47] [48]

3.5.3 Financial Aspects of Operation and Maintenance

Taking facilities related to this project alone, the operating balance surplus is growing, and the earning position for O&M is sound. However, with the NWSDB overall, although earning capacity is improving, some concerns about short-term financial security remain due to the increase in loan interest payments.

(1) Earnings condition

From 2002 onward, NWSDB has posted a deficit every year. The main causes are: (1) Increase in general administration cost (overhead costs), (2) Start of and increase in interest payable on past loans that have come along with the end of repayment grace periods, and (3) Increase in cost of sales (direct operating expenses). In particular, overhead costs have nearly doubled between 2006 and 2010 as shown in Table 16. As mentioned earlier, taking into account the fact that total number of employees has remained about the same over the past three years (about 9,000), it seems that indirect department costs have become bloated. The main factors

[43] Source: Results of an interview with a KMC Water Department engineer.
[44] Subjects include control systems for water treatment facilities, pumping equipment, electrical components, and SCADA.
[45] Overseas training: Two engineers participated in a roughly three-month training program that was then operated by JICA, and received training in various numerical calculation methods required for O&M planning.
[46] The actual scope of implementation was a total of 1,820 man-days. Average number of days participated per person was 7.6.
[47] Source: Results of interviews with employees who underwent training.
[48] KMC Water Department staff did not participate in the above training during the project implementation period, but some employees are scheduled to participate in a training program under the follow-up project Water Sector Development Project that is currently underway.

behind the rise in cost of sales are the rise in electricity, fuel, and other fees associated with the sharp global rise in the price of oil.

At the same time, along with the start of operations of new water facilities (including those of this project) and the increase in population connected, as well as water tariff increases mentioned later, sales are growing sharply at a speed greater than that of the growth in cost of sales (direct operating expenses).[49] In particular, due to the water tariff revision in 2009, gross profit margin (operating profit on sale of water), which had fallen in 2008, has recovered rapidly from 2009 onward.

As for trends in water tariff increase,[50] tariff were raised a total of four times starting in 1999. Most recently, a revision was implemented with the assistance of the ADB in February 2009. These increases are being carried out with a high level of frequency compared to other developing countries in general, and while they do have an aspect of responding to the rise in the consumer price index,[51] they are still exerting a great upward impact on the earning capacity of the NWSDB.[52]

Table 16: Profit and Loss (P/L) Statement of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Sales of Water	5,869	6,481	6,743	9,670	10,744
Direct Operating Expenses	4,080	4,903	6,089	6,322	7,047
Operating Profit on Sale of Water	1,789	1,578	654	3,348	3,697
Administration Overheads	*1,349*	*1,762*	*1,895*	*2,062*	*2,564*
Revaluation Deficit	-	-	-	-	*12,697*
Depreciation	*1,100*	*1,381*	*1,398*	*1,410*	*3,423*
Profit from Operation Activities	255	▲575	▲1,715	184	▲13,654
Finance Cost	512	852	1,193	1,569	1,419
Profit from Ordinary Activities before Tax	▲150	▲1,224	▲2,848	▲1,336	▲14,975
Net Operating Profit after Tax	▲214	▲1,278	▲2,915	▲1,425	▲15,080

Source: Prepared from documents provided by NWSDB

Note: The huge deficit in FY2010 (LKR 15 billion, or about JPY 12 billion) came along with the recording of loss on revaluation, aimed at the change of accounting standards to IFRS (International Financial Reporting Standards).

As for measures to reduce NRW (which are not included in this Project, as described in the Effectiveness section), in line with the Corporate Plan drawn up by NWSDB Headquarters, unique countermeasures are being adopted under the leadership of each regional support center. Although NRW rate level is much lower than it was before project implementation, in 2010 it was still relatively high, with a national average of 32% and a value of 32.5% in areas under the jurisdiction of NWSDB RSC Central. Various measures aimed at further NRW reduction are being carried out in the follow-up project Water Sector Development Project, and continuing implementation of these measures will be desirable beyond the completion of that project.

[49] Cost of sales increased 73% over the past five years, while sales increased 83% over the same period.

[50] Regarding water tariff, the Sri Lankan government is currently planning to introduce a tariff adjustment mechanism that responds to the rise in the price index. The Cabinet looks ready to approve it by the end of this year at the earliest.

[51] Since 2005, the consumer price index (Colombo Consumer Price Index, (CCPI)) has risen between 10% and 25% each year. (Source: Department of Census and Statistics)

[52] At the same time, slightly less than 50% of the overall population are benefitting from discount tariff for the impoverished. (For example, fees for new connections are about 1/3 of ordinary fees.) In order to further boost earning capacity, there are expectations for more newly connected population and secure collection of water tariff, along with curtailment of costs and streamlining of indirect departments.

(2) Financial status

The capital ratio at the end of FY2010 was about 77%, maintaining a high level. However, as shown in Table 17, total liability is consistently trending upward, and the burden of interest payments on loans is weighing on management.[53] In the past, current ratio and quick assets ratio were maintained at very high levels, but both ratios are close to 100% now as a result of the sudden increase in current liabilities accompanying the jump in interest payments. Some degree of concern remains regarding short-term financial security and short-term solvency.[54]

Table 17: Balance Sheet (B/S) of NWSDB

Unit: Million LKR

Year / Item	2006	2007	2008	2009	2010
Assets					
Current Assets	13,620	13,093	15,190	13,460	15,044
Quick Assets	5,079	6,021	5,250	4,301	4,175
Fixed Assets	89,991	100,813	115,632	135,978	140,284
Total Assets	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**
Liabilities and Equity					
Equity Capital	84,175	92,797	105,226	118,734	119,508
Current Liabilities	2,136	2,852	5,315	7,379	9,345
Fixed Liabilities	17,300	18,257	20,281	23,324	26,475
Total Liabilities and Equity	**103,611**	**113,906**	**130,822**	**149,438**	**155,328**

Source: Prepared from documents provided by NWSDB

Table 18: Financial Indices

Year / Item	2006	2007	2008	2009	2010
Gross Margin Ratio (%)	30.5	24.3	9.7	34.6	34.4
Sales to Receivable Ratio (%)	1.2	1.1	1.3	2.2	2.6
Days Sales Outstanding	316	339	284	162	142
Gross Debt (Mil. LKR)	19,436	21,109	25,596	30,703	35,820
Current Ratio (%)	637.6	459.1	285.8	182.4	161.0
Quick Asset Ratio (%)	444.5	331.3	216.3	131.3	116.9
Fixed Assets to Fixed Liability Ratio (%)	88.7	90.8	92.1	95.7	96.1
Capital Ratio (%)	81.2	81.5	80.4	79.5	76.9

Source: Prepared from P/L and B/S

(3) Operation and maintenance expenditure relating to the Project

Operating balance in the areas involved in this project that are under the administration of NWSDB RSC Central (the northern part of the Greater Kandy area) have shifted from a deficit in FY2008 to a surplus in FY2009, along with: (1) The water tariff increase in February 2009, and (2) Higher water tariff revenue due to the increased number of connected households. The surplus further expanded in FY2010.[55]

[53] For the payment of principal on loans, a certain amount of subsidies is provided from the government. The ratio of subsidies differs depending on the loan case.

[54] Receivables generated from unpaid water charge, etc., have been decreasing in the past several years. However, as shown in Table 17, as of 2010 the sales to receivables ratio of 2.6 and the average days sales outstanding of 142 are still at low standards, making for a situation where an average of over four months are needed to collect fees. In order to improve financial soundness, ongoing upgrade of the fee collection system is desirable.

[55] The annual expenditure for O&M after the start of operation of the project's facilities has slightly risen over the past three years. Expense items are comprised of: (1) Utility costs (including electricity and fuel), (2) Personnel costs, (3) Chemicals cost, and (4) Repair work costs. Utilities and personnel account for over 80% of the overall expenditures.

Table 19: Income and Expenditure relating to Project

Unit: Thousand LKR

Item	2008	2009	2010
Water Tariff Revenue	70,770	112,042	147,731
Connection Charge	15,716	15,812	19,794
Other Income	8,471	10,864	5,109
Water Sale to KMC	44,944	72,286	77,681
Total Income	**139,900**	**211,004**	**250,315**
Personnel Costs	43,339	47,439	59,557
Utility Costs (Electricity, Fuel, etc.)	79,062	85,441	87,353
Chemicals Cost	8,346	8,508	8,455
Repairs Work Costs	5,801	5,595	5,601
Other Costs	27,131	22,818	21,161
Total Expenditure	**163,679**	**169,801**	**182,126**
Approved Budget	**133,429**	**172,043**	**157,013**
Operating Surplus	**▲23,778**	**41,203**	**68,189**

Source: Prepared from documents provided by NWSDB

Table 20: O&M Budget of KMC Water Department

Unit: Mil.LKR

Item	2010
Personnel Costs	120
Utility Costs (Electricity, Fuel, etc.)	80
Chemicals Cost	6
Other Costs	137
Total Expenditure	**343**
Approved Budget	**350**

Source: Prepared from results of interview with KMC
Note 1: Water purchase from NWSDB are not included.
Note 2: Separate income/expenditure data for only the areas related to this project could not be obtained due to "difficulty in providing"(KMC Water Department).

As part of its activities to decentralize and strengthen the authority of the regional support centers, NWSDB is currently instructing each RSC in independent accounting. In response, RSC Central is carrying out various measures of its own. These activities are all being steadily implemented under the leadership of RSC Central upper management, and are highly commendable as managerial efforts on the part of the implementing agency.[56] In addition, a plant with water treatment capacity of 100,000m^3/day will begin operating by the end of 2012 through the follow-up project Water Sector Development Project. This will result in further expansion of RSC Central's overall source of income and create an environment for improving its earning position.

Furthermore, cases where the each year's approved budget amount is lower than the actual expenditure have occasionally been seen. Improvement in the accuracy of budget estimates is desirable.

As shown in Table 20, the KMC Water Department's O&M expenditures as of 2010 fall below the budget amount. According to the KMC Water Department, "There will be no problem with budget allocation amounts if electricity tariff don't rise drastically."

3.5.4 Current Status of Operation and Maintenance

In general, the utilization status and O&M of the various facilities and equipment under the administration of the NWSDB (intake, water treatment, transmission, and distribution facilities and related equipment) are good, and no major problem has occurred to date. Items such as an O&M manual have been developed through this project.

Although some problems have occurred after the facilities went on-line, including: (1) Frequent power outages,[57] (2) Difficulty procuring some spare parts,[58] and (3) Difficulty

[56] RSC Central is drawing up various original strategies (including strategies to reduce excess personnel, increase connected population, reduce NRW rate, and lower chemical purchasing costs) and steadily putting them into practice. Many aspects of these efforts are under the leadership of RSC Central's upper management, and as shown in the Effectiveness and Sustainability sections, the fruits are being vividly manifested. In view of the progress in the privatization of electric power, water, and other public corporations and the decentralization of power from central governments to local governments in developing countries under the direction of the World Bank and other entities, one good idea regarding loans to public enterprises in countries where decentralization is advancing is to assess, to the extent possible, the competence and leadership capabilities of upper management, and make the assessment an important element of the financing (loan) decision. (If upper management changes frequently, then this may not be the case.)

[57] **Frequent power outages:** There has been difficulty in supplying power to pumping stations due to frequent power outages. Since continuous use of a generator during outages has cost disadvantages, a dedicated power line is being laid from the major power grid near the Ukuwela Power Station to the project's water treatment plant. Project cost is LKR 23 million, with completion scheduled by December 2011.

customizing SCADA (Supervisory Control And Data Acquisition),[59] NWSDB RSC Central is continually looking for solutions, which it is steadily putting into practice. This development is the fruit of the proposal making and leadership capabilities of RSC Central's upper management, as well as the ability of the relevant personnel to act on them, and is highly commendable as a timely and pioneering response by the implementing agency.[60]

Procured Generator

As for facilities related to this project that are under the administration of the KMC Water Department, although there are problems such as the shortage of engineers and supervisors in charge of O&M, as stated earlier, various support for O&M activities is being given by RSC Central, and no serious problem has occurred to date. However, in order to fundamentally resolve problems, as already stated, O&M supervisory and engineering personnel increases and employee capacity building are desirable.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is highly consistent with government policies, and no problems with operation and maintenance (O&M) systems can be found. Although slight concern remains about the financial sustainability of the implementing agency (the National Waster Supply & Drainage Board, NWSDB) itself, the O&M-related earning positions are robust, with the operating balance surplus of the facilities involved in this project steadily expanding. Major indicators such as population served by this project, amount of water supplied, and facility utilization rate have exceeded 80% of the target value, and there is no particular problem with the quality of the treated water produced. Furthermore, numerous positive impacts are appearing, including the improvement of both public health and the business environment in the target areas. In addition, in terms of efficiency, although the project period was longer than planned, project cost was kept within the planned amount.

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[58] **Difficulty procuring spare parts:** The NWSDB is obligated to have competitive bidding in the procurement of high-priced equipment, but for some of the equipment from Japan, Japanese equipment manufacturers do not have directly managed offices in Sri Lanka (they do have local agents), and the implementation of bidding is somewhat difficult. According to the NWSDB, when they make various inquiries related to spare parts procurement, the responses from the Japanese headquarters of these manufacturing companies have been without exception poor, and in many cases the matter is not addressed in a timely fashion. To deal with this situation, a proposal is underway for a procurement system at NWSDB headquarters that considers lifecycle cost. (Specifically, a proposal has been made to build an Emergency Procurement Scheme for procurement business under LKR 50,000, and introduce a procurement mechanism that takes bidding cost into consideration (including single tendering contracts).

[59] **Difficulty customizing SCADA:** Regarding SCADA systems procured from Japanese manufacturers, there is a low degree of flexibility for system design, and customization with system changes is difficult. In order to resolve this issue, NWSDB's IT engineers are developing their own system (a reservoir water level monitoring system) and addressing system change needs. The follow-up project Water Sector Development Project is currently working on a fundamental solution to this issue.

[60] In addition, due to regular inspection of the dam located at the headwaters of the Mahaweli River, for a few days a year there were conditions under which water level necessary for intake could not be secured. At the end of 2010 an agreement was made between the Mahaweli Development Agency, which administers the dam, and RSC Central to take steps to secure water level. The timely response to this issue is also commendable.

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

4.2 Recommendations

4.2.1 Recommendations for Executing Agency

Recommendation for NWSDB RSC Central

After commencement of this project, the NRW rate has trended downward in the area outside Kandy City, which is administered by NWSDB RSC Central. However, the rate is still at a high 45% in the area inside Kandy City, which is under the KMC Water Department's jurisdiction. While this is primarily an issue under the authority of the KMC Water Department, the NWSDB is receiving a certain volume of "water supply" from the Kandy Municipal Council through the "Water Sharing System," and trends in NRW rate (= leakage rate) are directly linked to the performance of its own water supply services. Therefore, it is desirable that the NRW countermeasures being carried out under follow-up project Water Sector Development Project continue to be implemented after completion of the latter project, in tandem with the KMC Water Department. Furthermore, taking into account the fact that the KMC Water Department is lacking in various resources, it is desirable that this matter be advanced with NWSDB taking the initiative.

Recommendation for KMC-1

Only two technical engineers are engaged in O&M duties at KMC Water Department, and each of these engineers is responsible for an average of 15,000 households (customers). There is also concern over the lack of seasoned O&M workers. Based on sufficient awareness of this situation, NWSDB is carrying out various types of assistance to KMC Water Department, and to date no serious problems have occurred. However, for a fundamental solution to this problem, it is desirable that O&M supervisory and engineering staff at KMC be increased based on a medium to long-term employment strategy. In particular, it can be recommended to increase approx. ten (10) supervisory staff in a phased manner, in view of the fact that the level of support from NWSDB might become low[61] after the completion of Water Sector Development Project (currently scheduled for September 2012).

Recommendation for KMC-2

NRW countermeasures should be advanced diligently. For example, the 24-hour customer helpline for water leaks that NWSDB is introducing through Water Sector Development Project is an effective measure contributing to NRW rate reduction, as well as an attractive policy that can raise customer satisfaction directly. The possibilities for its mid- to long-term implementation should be explored.

Recommendation for NWSDB RSC Central and KMC

Under the Kandy City Wastewater Management Project that was scheduled for concurrent implementation with this project, the discharge point of treated wastewater from a sewerage treatment plant was planned to be located upstream from the water intake facility of this project. This point was considered problematic at the time of appraisal, and a numerical simulation was run regarding future water quality trends.[62] This sewerage project began separately in 2010 as a new yen loan project, with the facilities scheduled to go into service in October 2017. Since the location of the treated sewage discharge point is not expected to change significantly, Mahaweli River water quality monitoring should continue, while paying attention to developments in the

[61] This may be caused by the situation that the number of customers under NWSDB RSC Central will drastically increase soon after the completion of this project.

[62] After technical deliberations, it was concluded that the discharge point being upstream from the intake point would not pose a problem for water quality. (Source: JICA internal documents)

wastewater management project.

4.2.2 Recommendations for JICA

In light of the KMC Water Department's lack of various resources, it might be quite difficult for KMC to advance NRW reduction measures on its own. Considering the possibility of collaboration with and/or expansion of JICA's on-going technical assistance project[63], it is hoped that some kind of indirect support is carried out in a form that successfully utilizes the expertise and existing resources—both hard (e.g., O&M equipment) and soft (e.g., program to reduce NRW)—of the NWSDB RSC Central, where certain countermeasures are already being advanced.

4.3 Lessons Learned

N.A.

[63] "The Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City", which is the technical assistance project of JICA, is currently implemented. (Expected completion date: September 2012)

Comparison of Original and Actual Scope

Item	Plan	Actual
A) Output		
1.1 Intake and Raw Water Transmission Facility		
· Intake Capacity	115,000 m³/day	As planned
· Conveyance Pipelines	2,200 m	1,433 m (for D/D), 969 m (for Mid-term Review), 1,100 m (Final output)
1.2 Water Treatment Plant		
· Treatment Capacity	33,000 m³/day	36,700 m³/day
1.3 Water Transmission Facility		
· Transmission Pipelines	39,290 m	41,585 m (for D/D), 27,111 m (for Mid-term Review), 26,696m (Final output)
· Pumping Station	24 stations in total	8 stations in total (for D/D), 4 stations in total (Final output)
1.4 Water Distribution and chlorination Facility		
· Distribution Reservoirs	18 reservoirs in total	19 reservoirs in total (for D/D), 4reservoirs in total (for Mid-term Review and final output)
· Reservoirs Capacity	9,358 m³	12,710 m³ (for D/D), 5,900 m³ (for Mid-term Review and final output)
· Distribution Pipelines	Approx. 30,000 m	27,687 m (for D/D), 17,366 m (for Mid-term Review), 14,870 m (Final output)
1.5 Procurement of Maintenance Equipment	Water quality analysis equipment, Leakage detection equioment, Truck with loading crane, etc.	Water quality analysis equipment (Turbidity meter, pH meter, etc.), Asphalt cutters, Backhoes (for water distribution pipeline works), PCs, etc.
1.6 Consulting Service		
· Consulting Service M/M	352M/M in total (Foreign:138M/M, Local: 214M/M)	620.52M/M in total (Foreign: 56.14M/M, Local: 564.38M/M)
· Consulting Service TOR	Bidding support, Construction supervision, Studies on environmental measures, etc.	Mostly as the same
B) Project Period	March 2001 – May 2006 (63 months)	March 2001 – October 2006 (68 months)
C) Project Cost		
Foreign currency	2,898 million yen	2,855 million yen
Local currency	2,647 million LKR	4,115 million LKR
Total	6,710 million yen	6,172 million yen
Japanese ODA loan portion	5,151 million yen	4,644 million yen
Exchange rate	1LKR ＝1.44 yen (as of February 2000)	1LKR ＝ 0.806 yen (as of March 2007)

Appendix: Detailed Analysis of Financial Internal Rate of Return

As shown in Table 7 of the main text of this report, Financial Internal Rate of Return (FIRR) were recalculated with several conditions and assumptions described below.

Appendix Table 1: Conditions and Assumptions for FIRR Recalculation (Base Case)

Timing	Conditions and Assumptions for Recalculation		FIRR
At the time of appraisal (in 2001)	Costs:	Construction cost, consulting service cost, operation and maintenance cost	3.74%
	Revenue:	Water tariff revenue (assuming 3% increase in water tariff every year after operation)	
	Project Life:	50 years after the commencement of the project	
At the time of ex-post evaluation (in 2011)	Costs:	Construction cost, consulting service cost, operation and maintenance cost (based on the actual expenditure up to 2010)	0.03%
	Revenue:	Water tariff revenue (assuming 10% increase in water tariff every 5 years after 2015)	
	(NRW:	Assuming 5% reduction every 5 years from 2015 up to 2040, being 30% in 2015 as a base rate and being 5% after 2040 as a convergence rate.)	
	Project Life:	50 years after the commencement of the project for each case	

The details of conditions set out in each case are as follows:

Costs: Construction cost, consulting service cost and operation and maintenance (O&M) cost are considered as the "cost" item for FIRR recalculation, in the same manner at the time of project appraisal. All the costs used for the recalculation are based on the actual record up to 2010. Taxes, duties, land acquisition cost and interests during construction (IDC) were excluded from the cost item, followed by the principles of FIRR calculation.

Revenue: Earnings induced by the water supplied from the Katugastota Water Treatment Plant, which is one of the project facilities, are considered as the "revenue" item for FIRR recalculation. This item consists of i) water tariff revenue from both existing and new users, ii) water connection charge from new users, and iii) revenue from water sale to Kandy Municipal Council (KMC)[1]. As to the water tariff revenue among them, it is assumed that the tariff will increase by ten percent every five years after 2015[2]. Non-revenue water (NRW) rate is assumed to reduce by five percent every five years from 2015 up to 2040, being 30% in 2015 as a base rate and being five percent after 2040 as a convergence rate[3], which is the similar level with the developed nations.

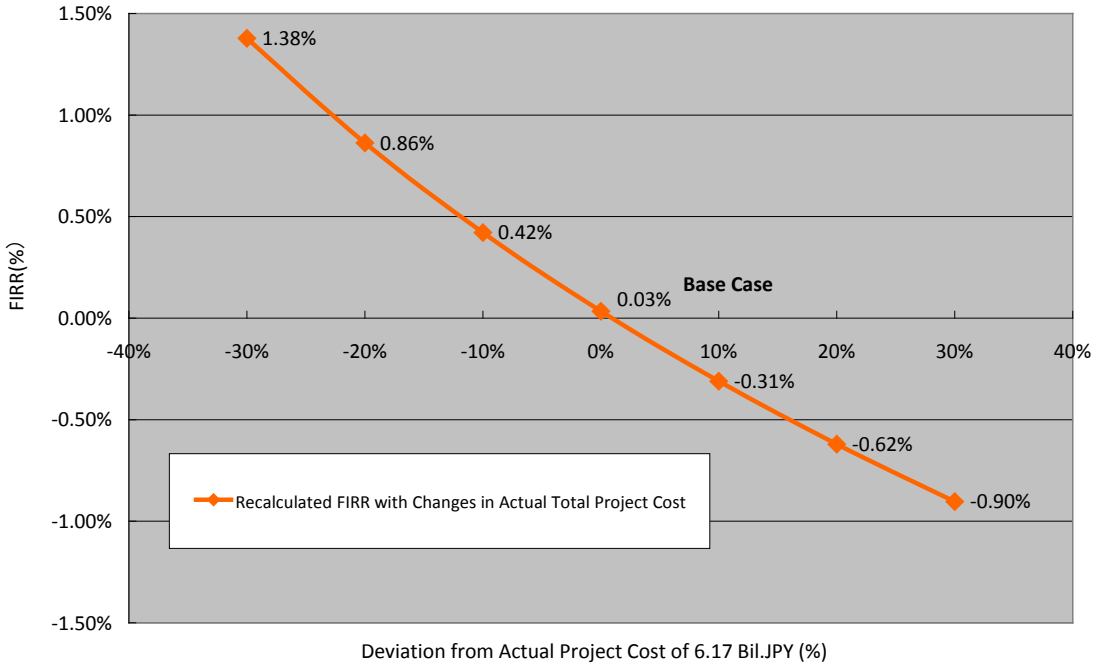
Project Life: 50 years after the commencement of the project is assumed in the same manner at the time of project appraisal.

As described in Section 3.3.1.2 of the main text of this report, the result of recalculating FIRR was 0.03%, which was lower than the 3.74% at the time of project appraisal. By setting this result (FIRR=0.03%) as the "Base Case", a sensitivity analysis was firstly conducted to review the correlation between the actual total project cost and the FIRR, with the total project cost as a parameter. The following figure shows the results.

[1] For the detailed facts and background information regarding water sale to KMC, refer to Footnote-19 of "Water Sharing System" with the Kandy Municipal Council, shown in the main text.

[2] The frequency of increase, once every five years, is assumed lower than that of the situation up to now, once every three years (four times in 12 years since 1999). Note that the NWSDB did not have "official prospect" for the frequency and degree of increase in the water tariff, although they answered to the post evaluator that 10% increase every three years was assumed.

[3] This scenario was assumed, considering the fact that i) the NRW rate as of 2011 is recorded as 34% in the target area of the project and ii) the improvement ratio of the NRW rate of NWSDB as a whole is about one percent per year on average (34.3% in 2006, 33.9% in 2007, 32.1% in 2008, and 31.1% in 2009).

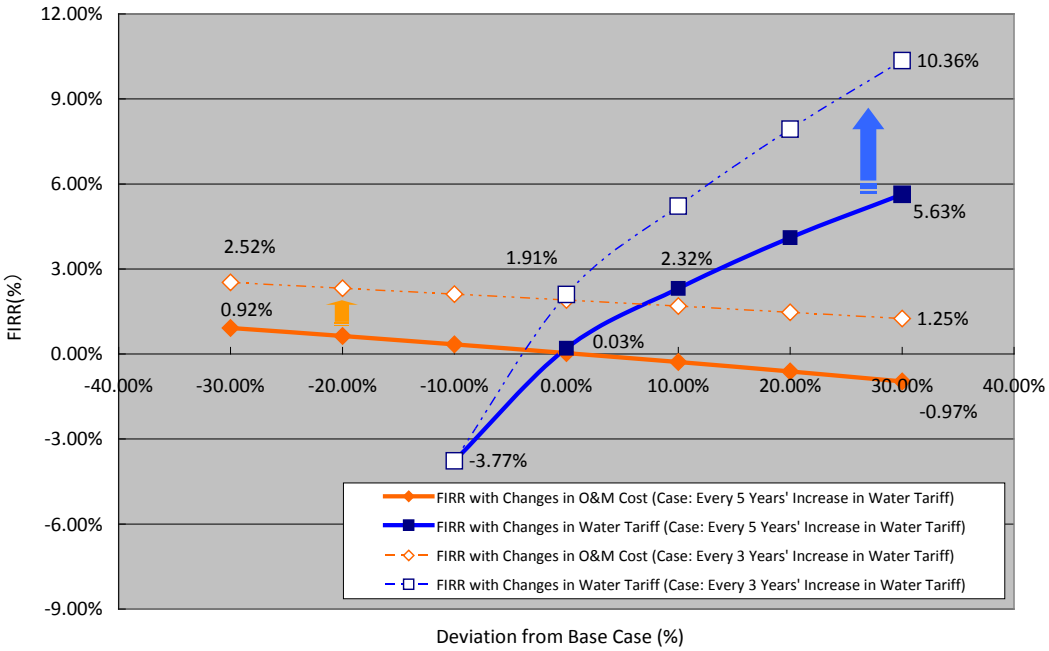


Appendix Figure 1: Results of Sensitivity Analysis of FIRR Recalculation #1
(Parameter: Actual Total Project Cost)

The horizontal axis (X-axis) represents the percentage changes in the actual total project cost of 6.17 billion Japanese Yen (which is equivalent to approx. 6.90 billion Sri Lankan Rupee), whereas the vertical axis (Y-axis) shows the calculated FIRR for each case. As can be seen from the figure, the FIRR would have increased from 0.03 to 1.38% if the actual total project cost had decreased by 30% from the original estimation. The "30% decrease" in the total project cost, 4.8 billion Sri Lankan Rupee in local currency equivalent, is approximately the same amount of the estimated total project cost of 4.7 billion Sri Lankan Rupee at the time of appraisal in 2001. Although the value of 1.38% is still low as an internal rate of return, the feasibility and profitability of the project would have further increased if the total project cost had been within the one estimated at the stage of planning in 2001.

Next, another sensitivity analysis was conducted to examine the future profitability of the project, being with i) O&M costs and ii) water tariff level as the parameters. The following figure shows the results. In a similar way with Appendix Figure-1, the horizontal axis represents the percentage changes in each parameter whereas the vertical axis shows the calculated FIRR.[4] If O&M costs increase by 30% from the current level, for example, the FIRR will decrease down to -0.97%. At the same time, the value will increase up to 0.92% if O&M costs can be reduced by 30% from the current level. As for the water tariff level, the recalculated FIRR will be improved up to 2.32%, by a ten percent increase in water tariff level from the base case (which means a 20% increase in tariff every five years).

[4] This kind of figure is called "a spider chart", which is deemed as one of the most useful tools for a sensitivity analysis where multiple parameters are used. The spider chart shows how the IRR (or Net Present Value, NPV) varies as a result of varying one of the input parameters while keeping the others constant.



Appendix Figure-2: Results of Sensitivity Analysis of FIRR Recalculation #2
(Parameters: O&M Cost and Water Tariff Level)

Considering the above analysis and as shown in Appendix Figure-2, the results suggest that the FIRR of the project is relatively more sensitive to changes in water tariff level, and less sensitive to changes in O&M costs. Additionally, one can see from the spider chart above that the two lines will be shifted upward, if assuming that the tariff increase every three years after 2015. (This result demonstrates that the FIRR will drastically be improved with the changes in frequency of water tariff increase.) Given the above, it is necessary to continuously increase the water tariff level, together with efforts in reducing O&M costs, in order to secure and enhance the profitability of the project[5].

[5] Additionally, and naturally, the reduction of non-revenue water (NRW) rate assumed in the base case (five percent reduction every five years from 2015 up to 2040, being 30% in 2015 as a base rate and being five percent after 2040 like in developed countries) should also be necessary as a prerequisite for this.

Bangladesh

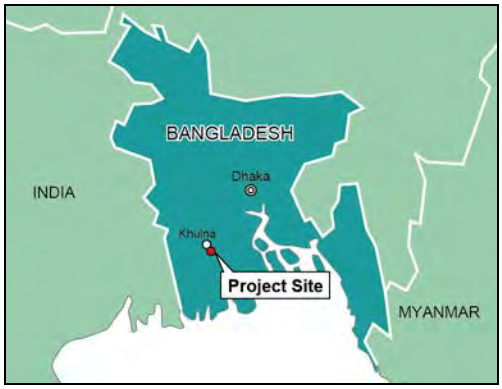
Ex-Post Evaluation of Japanese ODA Loan
"Rupsha Bridge Construction Project"

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

The project has been relevant to the development plans of Bangladesh and has been meaningful in terms of the country's development needs. Difficult construction works required longer time than the plan due to the treatment of soft soil were but changes in the technical specifications and construction methods limited the delay to a short period only. In tandem with the reduction of cargo handling at Mongla port, traffic demand grew less than it had been forecasted. For this reason, the traffic volume at the time of the ex-post evaluation remained at almost 50% of the forecast. Serious damage which could negatively affect the incidence of the project effect was not observed in the site survey. However, in long run, the tight maintenance budget of the executing agency and insufficient experience in the supervision of the maintenance works for long bridges are issues for sustainability. In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description



Project Location

The Rupsha Bridge

1.1 Background

Bangladesh is located in a delta region facing the Bay of Bengal in South Asia and its territory is divided by many rivers. Ferry crossings on the trunk roads linking major cities prevented the smooth flow of traffic. The Bangladesh government has made efforts to construct bridges for the elimination of ferry crossings on major corridors. At the beginning of the 2000s, the Meghna Bridge and the Meghna-Gumti Bridge on the Dhaka-Chittagong Corridor and the Jamuna Bridge on the Dhaka-Northwest Corridor were completed and the Paksey Bridge on the Northwest- Khulna Corridor was under construction. Japan supported these efforts of the Bangladesh government through the provision of official development assistance loans (Yen loans) and grant aid.

The Port of Mongla, the second biggest port in Bangladesh in terms of cargo handling tonnage, is located approximately 40km south from the largest city in the southwest region Khulna. At the beginning of the 2000s, a ferry service was used for river crossing at the Rupsha River and this was a major factor in preventing the smooth flow of traffic to the port. As a bridge over the Rupsha River would enable land transport from the Capital city Dhaka to Mongla Port via the Jamuna Bridge and the Paksey Bridge, it was expected that this would

improve the convenience of the port.

This is the background to the plan for a bridge over the Rupsha River. JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)/ (Phase 2)" carried out a feasibility study, design, and technological assessment at detailed level. It resulted in the provision of an ODA loan for the construction of the Rupsha Bridge[1].

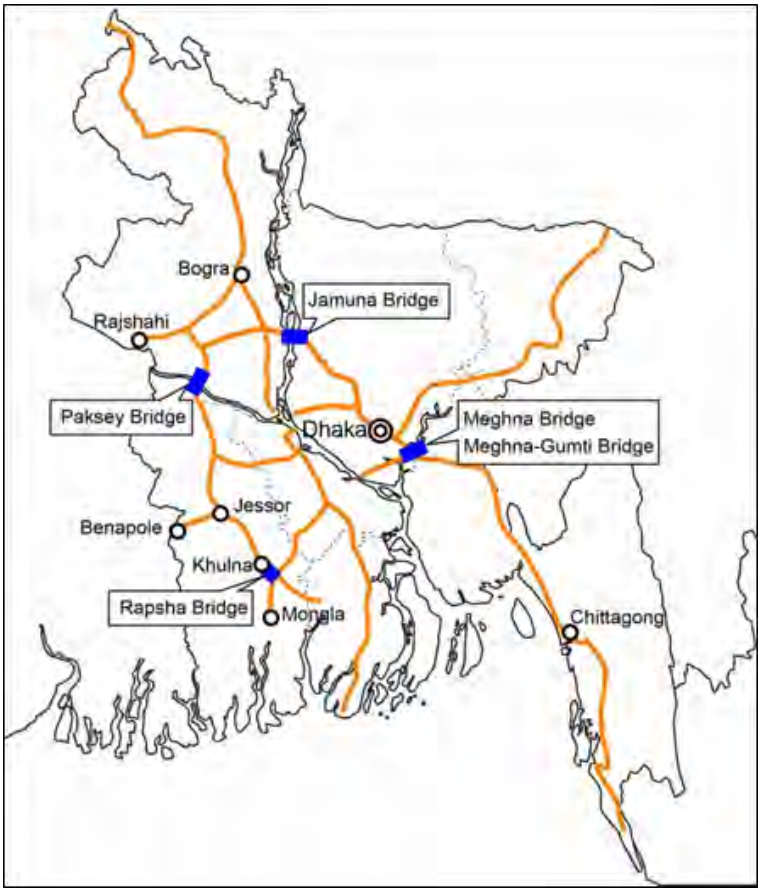


Figure 1: Major Bridges in Bangladesh

1.2 Project Outline

The objective of this project is to ensure smooth traffic across the Rupsha River by constructing a bridge over the river in the southern part of Khulna, thereby contributing to the regional development of the southwest part of Bangladesh and the convenient use of Mongla port.

Loan Approved Amount/ Disbursed Amount	8,300million yen / 7,966 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	August 2000 / March 2001
Terms and Conditions	Civil Work, etc.: Interest Rate 1.0%, Repayment Period: 30 years (Grace Period: 10 years), General untied

[1] The Rupsha Briged was named as the Khan Jahan Ali Bridge when it was completed. This report uses the name Rupsha Bridge in all sections in order to maintain consistency and prevent confusion.

	Consulting Services: Interest Rate 0.75%, Repayment Period: 40 years (Grace Period: 10 years), General untied
Borrower / Executing Agency	The President of the People's Republic of Bangladesh / Roads and Highways Department
Final Disbursement Date	July 2008
Main Contractor (Over 1 billion yen)	Shimizu Corporation (Japan)・Italian-Thai Development Public Company Limited (Thailand) (JV)
Main Consultant (Over 100 million yen)	Pacific Consultants International (Japan)
Feasibility Studies, etc.	"The Study on Construction of the Bridge over the River Rupsha (Phase 1)" JICA, March 1999, "The Study on Construction of the Bridge over the River Rupsha (Phase 2)" JICA, March 2000
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: December 2010 – November 2011
Duration of the Field Study: February 21 – March 16, 2011, July 2 – July 14, 2011

2.3 Constraints during the Evaluation Study

In order to assess the quality of the soil tests related to this project, several interviews with the executing agency, the consultant for project supervision, and the contractor for civil works were conducted. Due to a lack of necessary technical knowledge, however, this issue was difficult to evaluate. An interview with resettled residents could not be conducted because monitoring of resettled residents was not carried out and this made it difficult to find out the location of resettlement place. For this reason, the assessment of land acquisition is based on the information provided by the executing agency.

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

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Bangladesh

The national development strategy at the time of the appraisal was the Fifth Fiver Year Plan (FY1997/98 - FY2001/22)[4]. The plan selected 14 policies as key elements in the transport sector strategy. These priority policies included the development of five major corridors[5] and

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ② Fair, ① Low
[4] The fiscal year of the Bangladesh government starts in July and ends in July of a next year.
[5] Dhaka-Chittagong Corridor, Dhaka-Northwest Corridor, Dhaka-Khulna Corridor, Dhaka-Sylhet Corridor, and Northwest-Khulna Corridor

the strengthening of the linkage between Dhaka and two major ports (Chittagong port and Mongla port). The plan referred to the construction of bridges on the section between the Northwest and Mongla as prioritized investment. In addition, investment allocation under the Fifth Five Year Plan paid attention to balanced regional development and investment in the coastal area, including the southwest region. Prioritized investment in the southwest region included the development of network infrastructure, such as in electricity, transport, and telecommunications. As the Rupsha River prevented efficient road transport between Khulna and Mongla port and as it divided the southwest region into two sections, the construction of the Rupsha Bridge would contribute to the strengthening of the regional transport network.

The national development strategy at the time of the ex-post evaluation was the National Strategy for Accelerated Poverty Reduction II (NSAPRII), which included the construction of Padma Bridge as part of the development strategy for the transport sector. Through NSAPRII it was intended that transport between the eastern region and the western region would be made smoother by bridging the Padma River, aiming at the improvement of access from Dhaka to Khulna /Mongla port. Furthermore, NSAPRII saw the development gap in Bangladesh as a major development issue and urged that development resources such as investment should be preferably allocated to the Khula Division as the underdeveloped area.

This project was relevant to the development strategies in Bangladesh at both the times of the appraisal and the ex-post evaluation. The construction of the Rupsha Bridge was in line with the investment strategy of the Fifth Five Year Plan at the time of the appraisal. At the time of the ex-post evaluation, the national development strategy has led to greater efficiency in east-west traffic. In addition, investment in the southwest region, an underdeveloped area, is still regarded as a priority policy of the national development strategy.

3.1.2 Relevance with the Development Needs of Bangladesh

At the time of the appraisal, more efficient road transport between Mongla port and Khulna by the bridging the Rupsha River was expected to facilitate trade not only in Bangladesh but also in the landlocked countries of Nepal and Bhutan. In addition, traffic crossing the river poured into the urban area of Khunla City through the existing road network. In the southern area of Khulna City, ferry crossing caused traffic jams which had become an issue for urban transport. There was a significant necessity to solve this problem by a reduction in the traffic using ferries and flowing into the urban area of Khulna City, the countermeasure which the construction of the Rupsha Bridge could achieve.

At the time of the ex-post evaluation, the Bangladesh government, the Nepal government and the Bhutan government were continuing to discuss the further utilization of Mongla port. Furthermore, an intergovernmental agreement on the Asian Highway (AH) Network[6], to which Bangladesh was a party, was signed in 2004. Based on this agreement, the development of AH is on-going in Bangladesh. The development of AH has progressed since the 1950s but member countries have accelerated efforts after the signing of the intergovernmental agreement. The road section between Khulna and Mongla is part of AH41 and is connected to AH1 and AH2 which cross Bangladesh in an east-west direction. Facilitating access to Mongla port continues to be essential for the improvement of regional transport. The development need for a smooth crossing over the Rupsha River still remains.

Table 1: Population under the lower poverty line

Unit: %

Division	2000	2005
Bangladesh	34.3	25.1
Barisal Division	34.7	35.6
Chittagong Division	27.5	16.1
Dhaka Division	34.5	19.9
Khulna Division	32.3	31.6
Rajshahi Division	42.7	34.5
Sylhet Division	26.7	20.8

Source: Bangladesh Bureau of Statistics "Report of the Household Income and Expenditure Survey 2005"

[6] The Asian Highway is an international road network with a length of approximately 140,000 km which runs through 32 countries.

The poverty rate in the Khulna division was substantially higher than the national average in 2005, though it showed a marginal improvement between 2000 and 2005. In terms of the stimulus of the regional economy and income generation through employment creation, the investment in the region was quite meaningful.

3.1.3 Relevance with Japan's ODA Policy

Japan's Official Development Assistance (ODA) Charter, the preceding charter, which was approved in 1992, referred to the close relationship between Japan and Asia in terms of history, geography, politics, and economy, and placed a special emphasis on assistance to the Asian region. The charter defined infrastructure as a basic condition of social and economic development and prioritized assistance in infrastructure investment. The Country Assistance Strategy for Bangladesh of 2000 saw the region between Dhaka and Khulna/Mongla Port as a centre for growth and included support for the development of economic infrastructure. In 1999, the Japan Bank for International Cooperation approved the Medium-Term Strategy for Overseas Economic Cooperation Operation which also put special emphasis on the Asian region and on economic and social infrastructure to support economic growth.

This project assisted infrastructure development in the Asian region by constructing a bridge over the Rupsha River, which prevented efficient transportation in the Dhaka–Khulna Corridor. At the time of the appraisal, Japanese ODA policy placed importance on assistance to Asian countries, in particular in terms of infrastructure development in the region between Dhaka and Khulna / Mongla Port. Thus, the project was considered to be highly relevant to Japan's ODA policy.

The Rupsha Bridge is one of the longest bridges in Bangladesh today. At the Japan-Bangladesh Summit Meeting in November 2010, Prime Minister Hasina mentioned the bridge as an example of Japanese ODA in Bangladesh. This project was meaningful not only in terms of improving traffic conditions but also in strengthening the bilateral relationship.

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

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

The plan and actual results for the output of this project are shown as follows:

Table 2: Project Output

Plan (at the time of the appraisal)	Actual (at the time of ex-post evaluation)
(1) Civil Works 1) Rupsha Main Bridge: Length 1,360m, Wide 16m 2) River Revetment: East Side 150m 3) Approach Roads: West section 5,880m, East Section 2,799m 4) Canal Bridges: 2 Bridges 5) Related Facilities: 1 Toll Plaza and 2 Bus Bays (2) Consulting Services International: 222 M/M National: 639 M/M Scope: Tendering Assistance, Detailed Design Review, Construction Supervision, Environmental Monitoring etc.	(1) Civil Works 1) Same as planned 2) River revetment 145m, Protection by stones 37m 3) Same as planned 4) Same as planned 5) Same as planned (2) Consulting Services International: 249.9 M/M National: 689 M/M Scope: Same as planned

Source: Project Completion Report, RHD

The output of this project was almost as planned, though there were modifications in technical specifications. As the load bearing capacity of piles was insufficient due to soft soil, additional works such as grouting under and around the piles were implemented to the piling work. In order to reduce the time for the procurement of consulting services, the executing agency selected consultants to provide services, including construction supervision, by direct appointment. The consultants who had conducted the feasibility study, the detailed design, and tendering assistance also carried out construction supervision[7].

3.2.2 Project Inputs

3.2.2.1 Project Cost

While the planned cost was JPY 10,549 million, the actual cost was JPY 12,151 million. The project cost was slightly higher than planned (115% of the original plan). This increase in the project cost was due to the cost of civil works, inflation of material costs, and taxes and duties paid to the Bangladesh government which were not an eligible portion for the ODA loan. The increase in the cost of the civil works was caused by several reasons such as additional works for piling and soil treatment for the construction of two small bridges on the approach roads.

3.2.2.2 Project Period

The project period was slightly longer than planned (119% of the original plan)[8]. Due to soft soil, difficulties in construction work resulted in a longer period for civil works. However, the delay was reduced through changes in technical specifications and construction methods. In order to shorten a delay in a construction period, technical specifications of piles were changed. The diameter of piles was reduced from 2500mm to 900mm but the number of piles increased to 16 units. The change in the diameter of pile allowed the use of pile driver which required less time for installation by easier setup.

Table 3: Project Period

	Plan (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
L/A Signing	March 2001	March 2001
Consulting Services	July 2000 – September 2004[9]	June 2000 -June 2006
Procurement of Main Contracts	September 2000 – March 2001	June 2000 - April 2001
Civil Works	March 2001- September 2004	May 2001 - May 2005
Project Completion (Project Period)	September 2004 (43 months)	May 2005 (51 months)

Source: Appraisal Documents, RHD

Prior to the implementation of the project, a soil test was carried out as a part of JICA's "A Study on the Construction of a Bridge over the River Rupsha (Phase 2)". The contractor for the civil work conducted an additional soil test after the commencement of the project. According to the consultant for construction supervision, estimating the firmness of ground soil only with soil tests in the feasibility study had limitations in its accuracy[10]. For this reason, a load test to determine pile length was deliberately included at the planning stage. The initial load test

[7] Prior to the implementation of this project, JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)/ (Phase 2)" conducted the feasibility study and detailed design.

[8] The commencement of the project is defined as the L/A signing. The completion of project is defined as the end of civil works.

[9] The Bangladesh government employed the consultants before the L/A signing. As the appraisal documents do not explicitly set an end for consulting services, the end of consulting service is defined as the end of civil works.

[10] According to the consultant for construction supervision, N-value, an indicator to show the firmness of ground, might be overestimated because the stratum which was expected to have higher surface friction was in a deeper area.

resulted in deeper sinking and revealed that the piles did not have sufficient load bearing capacity and so additional works were added to the piling works as aforementioned.

Both project cost and project period slightly exceeded the plan, therefore efficiency of the project is fair.

3.3 Effectiveness[11] (Rating: ②)

3.3.1 Quantitative Effects

Since the project supported the construction of a new bridge, not only traffic volume but also time savings were regarded as project outcomes to be assessed. While the target level for traffic volume was set at the time of the appraisal, in the first year after opening (FY2005/06), this reached approximately 40% of the target level. The above rating was determined, given that traffic volume increased after FY2006/07 with accompanying time savings attained as planned.

3.3.1.1 Results from Operation and Effect Indicators

(1) Traffic Volume

Since the northern section of the Khulna Bypass[12], which was connected to the Rupsha Bridge, was incomplete, the traffic volume for the first year after opening was approximately 40% of the target level. However, traffic volume showed an upward trend after the completion of the bypass road. Compared with the forecast in the Economic Internal Rate of Return, traffic volume at the time of the ex-post evaluation remained at almost 50%. ing) in FY 2009/10[13].

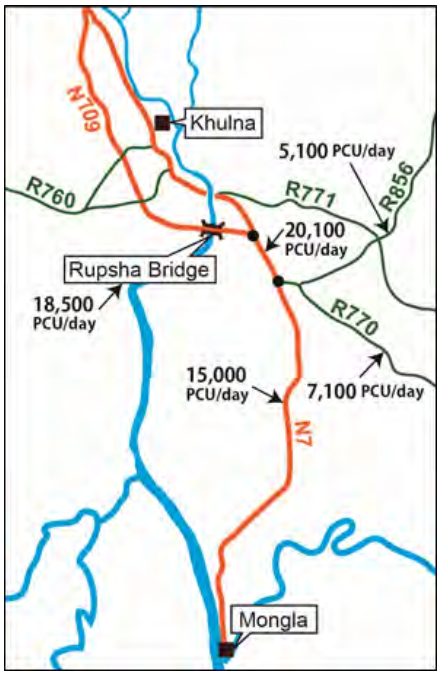


Figure 2:Traffic Distribution (2015 Forecast)

One factor which explains why traffic volume did not meet the forecast at the time of the appraisal is that cargo handling at Mongla port, in particular cargo handling at the jetties, was below forecast[14]. The forecasted traffic distribution for 2015 shows that traffic in the section starting from or ending at Mongla port significantly affects the traffic volume on the Rupsha Bridge (see Figure 2)[15]. While cargo handing at Mongla port was 2.87 million tons in FY1997/98, the forecast at the time of the appraisal suggested that it would reach 5.81 million tons in 2015. The actual figure for cargo handling at Mongla port in FY 2009/10, however, recorded only 1.65 million tons. Assuming the containerization of cargo, the forecast for cargo handling at jetties should increase from 0.16 million tons (6% of total cargo handling) in FY 1997/98 to 2.13 million tons (37% of total cargo handling) in 2015. The actual cargo handling at jetties was 0.22 million tons (13% of total cargo handlAt the time of the ex-post evaluation, the construction of a long bridge over the Padma River was planned. After

[11] For the judgment for Effectiveness, the findings in Impact are also taken into consideration in the rating.
[12] The northern section of the Khulna Bypass was constructed by RHD.
[13] Based on the interview at Mongla Port Authority
[14] The ex-post evaluation report on the Paksey Bridge Construction Project (I)/(II) in Bangladesh mentioned that the traffic volume between Khulna/Mongla and the northwest was relatively small and that the stagnation of Mongla port was one of the reasons behind a slower growth of the traffic between Mongla and the Northwest.
[15] The forecast was prepared in JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)." PCU (Passenger Car Unit) shows traffic volumes when all vehicle types are translated into passenger car equivalent.

completion, which is planned for 2016, the bridge will contribute to an increase in traffic volume between Dhaka and Khulna. A further increase in traffic volume on the Rupha Bridge is also expected.

Table 4: Traffic volume per day (plan and actual)

Plan		Actual		Actual/Plan
Year	Traffic Volume	Year	Traffic Volume	%
2005	6,243	2005/06	2,552	40.9%
2006	6,606	2006/07	3,024	45.8%
2007	6,990	2007/08	3,930	56.2%
2008	7,396	2008/09	4,007	54.2%
2009	7,827	2009/10	3,913	50.0%

Source: Appraisal documents, RHD

Photo 1: Vehicles on the Rupsha Bridge

Compared with the forecast at the time of the appraisal, traffic volumes for buses and auto rickshaws accounted for smaller portions of the total traffic than expected. On the other hand, the portion of motor cycles was larger. The use of motorcycle as an individual mode of transport had become more prevalent than before. Although the ferry service on National Highway No. 7 was terminated after the completion of the project as planned, boats for pedestrians and bicycles are still operating. Users of the bus terminal for long and medium-distance buses on the east side of the Rupsha River still use the boats. This may also explain why the traffic volumes of buses and auto rickshaws do not reach the forecast.

Table 5: Traffic per day by type of vehicles (Planned and Actual)

- Planned

	Motor Cycles		Auto Rickshaws		Cars		Buses		Trucks	
Year	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%
2005	664	10.6%	1409	22.6%	627	10.0%	2060	33.0%	1484	23.8%
2006	701	10.6%	1486	22.5%	661	10.0%	2173	32.9%	1585	24.0%
2007	739	10.6%	1568	22.4%	697	10.0%	2293	32.8%	1693	24.2%
2008	780	10.5%	1654	22.4%	736	10.0%	2419	32.7%	1808	24.4%
2009	823	10.5%	1745	22.3%	776	9.9%	2552	32.6%	1931	24.7%

- Actual

	Motor Cycles		Auto Rickshaws		Cars		Buss		Trucks	
Year	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%
2005/06	819	32.1%	83	3.3%	309	12.1%	757	29.7%	583	23%
2006/07	1028	34.0%	109	3.6%	348	11.5%	891	29.5%	647	21%
2007/08	1509	38.4%	159	4.0%	393	10.0%	1103	28.1%	765	19%
2008/09	1543	38.5%	172	4.3%	388	9.7%	1104	27.6%	799	20%
2009/10	1568	40.1%	223	5.7%	362	9.3%	980	25.0%	774	20%

Source: Appraisal documents, RHD

- Planned

- Actual

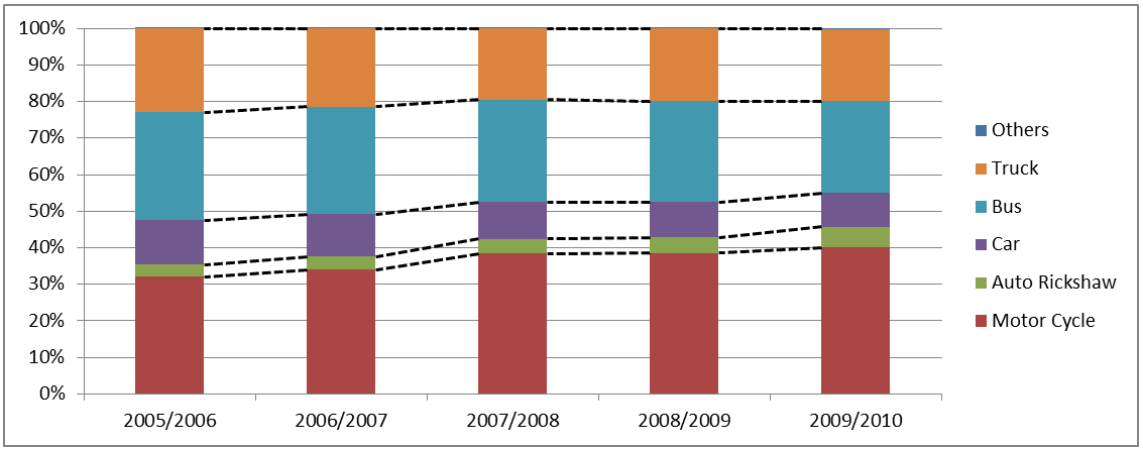


Figure 2: Percentage of total traffic by types of vehicle (Planned and Actual)

(2) Travel Time for River Crossing

The Rupsha Bridge has sufficient capacity, given the forecast traffic volume at the time of the ex-post evaluation. The travel time for river crossing decreased almost as planned. Interviews with long-distance bus operators and a truck driver union also confirmed the reduction in the travel time for river crossing[16]. The travel time including waiting time for a ferry was 30 minutes under usual traffic and 2 hours at peak time before the opening of the Rupsha Bridge. At the time of the ex-post evaluation, the travel time to pass the Rupsha was 2.5 minutes and the travel time for river crossing was substantially reduced.

Table 6: Travel Time for Crossing the Rupsha River

Actual (2001)	Target (2005)	Actual (2010)
(Ferry crossing) Approx. 30 min. 2 hours at peak time	(Passing through the Rupsha Bridge) Approx. 2 min.	(Passing through the Rupsha Bridge) 2.5 min.

Source: Appraisal documents, RHD

[16] Interviewed with the Mongla Export Processing Zone (EPZ) Office, a truck drivers' union, five long-distance bus operators and one private enterprise in order to find out about changes in regional transportation after the opening of the Rupsha Bridge.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

(1) Financial Inter Rate of Return (FIRR)

As a result of the recalculation at the time of the ex-post evaluation, FIRR is a negative number and below the plan (2.4%). Project costs increased. As traffic volumes, except that of motorcycles, did not reach the forecast, the actual toll revenue is below the original forecast. O&M costs became almost threefold of the assumptions at the time of the appraisal and this is one of the factors to decrease FIRR. If one assumes that toll fees increase 1.5 times of the assumptions in the ex-post evaluation, FIRR turns positive.

Table 7: Assumptions for the calculation of FIRR

	At the time of the appraisal	At the time of the ex-post evaluation
Costs	Project costs (only bridge), and O&M costs	Project costs (only bridge[17]) and O&M costs (FY05/06 - FY09/10:actual data, FY10/11 - FY29/30: forecasted by RHD - 2% increase per annum)
Benefits	Toll revenue from the bridge	Toll revenue from the bridge (toll revenue FY05/06-FY10/11: actual data, toll fees after FY11/12: the same assumption as in the appraisal, traffic volume for FY10/11-FY14/15: forecasted by RHD, traffic volume for FY15/16 - FY29/30: estimated by growth rate until FY14/15)
Project Life	Until 2029 (25 years after completion)	Until FY29/30 (25 years after completion)

Source: Appraisal documents, RHD

(2) Economic Internal Rate of Return (EIRR)

As a result of the recalculation at the time of the ex-post evaluation, EIRR is 0.8% and below the plan (26.2%)[18]. Higher project costs, an increase in O&M costs, and smaller volume of traffic did not allow EIRR to reach the forecasted level at the time of the appraisal as these factors did so in FIRR. Because of the difficulty in estimating unit costs for vehicle operating costs and unit costs for travel time costs, the same assumptions are used for this recalculation. The calculation assumes the project life of this project to be 16 years after completion. If the same assumption as for FIRR (Project life: 25 years) is used, the result of EIRR improves to 5.1%.

Table 8: Assumptions for the calculation of EIRR

	At the time of the appraisal	At the time of the ex-post evaluation
Costs	Project Cost (Bypass roads and Bridges) and O&M costs	Project Cost (Bypass roads and Bridges) and O&M costs (FY05/06- FY09/10): actual data, FY10/11- FY29/30: forecasted by RHD - an increase 2% per annum)
Benefits	Reduction in vehicle operating costs and benefits from reduction in travel time	Reduction in vehicle operating costs (unit costs for vehicle operating costs is the same data as at appraisal) and benefits from reduction in travel time (unit costs for travel time costs is the same data as at appraisal). The same assumptions for traffic volume were used for the estimation of benefits.
Project Life	Until 2020 (16 years after completion)	Until FY20/21 (16 years after completion)

Source: Appraisal documents, RHD

[17] For a fair comparison with the calculation at appraisal, the same assumption (bridge only) is used. However, it is desirable that all project costs for the computation of FIRR are included.

[18] For EIRR, both unit costs for vehicle operating costs and unit costs for travel time costs are the same data as at appraisal). The benefits reflect a change in traffic volume only. Because of incomplete updates in benefits, the results of EIRR are not used in the determination of the rating.

3.3.2 Qualitative Effects

(1) Resolving the Problem of Traffic Jams Caused by Traffic Waiting for Ferry Boats

The completion of the Rupsha Bridge allowed the termination of ferry service on National Highway No.7 and this resolved the traffic jams nearby the ferry terminal. According to residents, traffic jams at the ferry crossing sometime reached an intersection several hundred meters away and caused traffic congestion. At the time of the ex-post evaluation, the site survey found that there was no traffic jams, though buses were passing by and waiting for passengers near the ghat on the Khulna side (the west side of the Rupsha River) as boats for pedestrians and bicycles were still under operation.

(2) Larger Trucks and a Decrease in Logistics Costs

The interview at the truck drivers' union revealed that the ferry crossing had limited the weight of trucks and that drivers were able to use heavier trucks after the construction of the Rupsha Bridge. Interviewees at the cement factory near Mongla port stated that the travel time to Khulna had decreased from 2 hours to 1 hour after the completion of the bridge and that logistics costs had declined by approximately 40%. This decrease in logistics costs was due to reductions in fuel costs and labour costs attended by the reduction in travel time.

This project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts

(1) Impact on Local Residents' Livelihood and Living Environment

In order to understand the project effects, focus group discussion (FGD) sessions with Khulna side (West bank) residents and Rupsha side (East Bank) residents were carried out. Voting was held after opinions on the discussion topic were drawn out in order to quantify qualitative opinions. Outlines of the FGD sessions are as follows:

- Location: Khulna City
- Date/Time: Khulna side residents - March 2, 2011, Rupsha side residents - March 3, 2011
- Participants: Khulna side residents - 9 participants (7 male and 2 female), Rupsha side residents - 8 participants (6 male and 2 female)
- Discussion topic: "How has the project changed your life?"
- Voting method: After consolidating to five (or so) opinions, each participant cast three votes. (Multiple votes for the same opinion were allowed if the voter strongly agreed)

As the result of voting, the Khulna side residents supported the opinion that "Social problems have arisen" most of all, while the Rupsha side residents most of all agreed that "Travel became easier". The Khulna side residents lived in the urban area of Khulna City and had relatively few chances to cross the river. The Khulna side residents pointed out negative effects such as traffic accidents and the lack of parking space, recognizing fewer direct benefits from the improvement in transport. On the other hand, the Rupsha side residents recognized improvements in transport as the Rupsha Bridge had enabled the smooth flow of traffic from the eastern bank to the urban area of Khulna City. Some Rupsha side residents highly valued the convenience of the Rupsha Bridge as they commuted to factories built on the Khulna side. Both Khulna side and Rupsha side residents supported the opinion that the "Scope of business is expanded" but the Khulna side residents supported this more strongly. The appreciation of land prices and an increase in the number of pedestrians has significantly improved the business environment for Khulna side residents. A few participants pointed out silting on inland

waterways[19] and a decrease in the amount of fish caught as impacts on the natural environment.

Table 9: Results of Focus Group Discussion

Khulna side (West bank) residents			Rupsha side (East Bank) residents		
Rank	Opinion	Vote	Rank	Opinion	Vote
1	Social problems have arisen.	15	1	Travel became easier	8
2	Scope of business is expanded	7	2	The bridge became a tourist spot	5
3	Travel became easier	3	3	Scope of business is expanded	4
4	Environmental problems have arisen	2	4	Employment opportunities increased	4
	Total	27	5	Environmental problems have arisen.	3
				Total	24

(2) Cargo Handling at Mongla port

Cargo handling at Mongla port decreased by approximately 40% from FY2000/01 to FY2009/10. Mongla port, as a river port, requires a long approach from the Bay of Bengal and insufficient dredging had made the anchoring of larger vessels difficult. Moreover, the export of jute, a major export item, decreased during the same period. As a result, the downward trend of cargo handling continued until FY2007/08. Since the Bangladesh government implemented the policy that a certain portion of grain import should be made via Mongla port at the time of the export evaluation, cargo handling at Mongla port was recovering.

Table 10: Cargo handling at Mongla port

Year	Ship calls	Cargo handling (ton)
2000/2001	313	2,766,461
2001/2002	268	2,252,880
2002/2003	291	1,800,516
2003/2004	446	1,494,231
2004/2005	455	1,476,172
2005/2006	385	1,482,644
2006/2007	193	914,375
2007/2008	128	722,834
2008/2009	151	1,137,826
2009/2010	190	1,649,283

Source: Mongla Port Authority

An interview with the Mongla Port Authority revealed that approximately 90% of export/import cargo was transported by inland waterway. A relatively small portion of land transport became a factor in preventing the incidence of project effects.

As stated in "3.3.2 Qualitative Effects", logistic conditions improved. Nevertheless, ship calls and cargo handling at Mongla port were affected by factors other than the implementation of this project. It can be seen that external conditions such as insufficient dredging by the port authority, a reduction of jute export, and the dependency on inland waterways prevented this project from generating its project effects.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

The consultant for construction supervision conducted environmental monitoring during the project implementation period and submitted the results to the executing agency. The executing agency shared the information on environmental monitoring with JICA when it was requested to do so. According to the executing agency, residents complained about dust from an asphalt plant. The design of the chimney was modified but it did not effectively prevent dust. After project completion, environmental monitoring was not conducted. At the FGD sessions, a few mentioned that the amount of fish caught had decreased. However, the causality between these incidents and the construction of the bridged was not confirmed as detailed studies had not

[19] A few people mentioned that the construction of the bridge affected silting on the riverbed and prevented the smooth operation of inland waterways. However, other factors such as insufficient dredging of waterways might explain the negative effect on inland waterways.

been conducted.

(2) Land Acquisition and Resettlement

Both the area of acquired land and the number of relocated households are higher than the plan. While the area of acquired land was 774,500m^2, the number of relocated households was 94 households. The reasons for these changes were that the design change for frontage roads required additional land and that it was difficult to identify appropriate land owners because of unreliable land registration. The increase in the amount of acquired land prolonged the period needed for land acquisition. Cash compensation was paid to land owners and resettlement to alternative land was not carried out.

Table 11: Land Acquisition and the Number of relocated households

	Plan	Actual
Acquired land (unit: m^2)	755,000	774,500
Number of relocated households	53	94

Source: RHD

RHD employed a NGO in order to obtain support for the review of the land acquisition plan, budgeting for land acquisition, and payment of compensation. Cash compensation to land owners was in accordance with Bangladesh regulations in principle but the amount paid was 150% of the average value of land in the vicinity of the project site (government price). When the market price was far above the government price, additional payment was allowed. Because of several problems such inaccurate land titling and inappropriate preparation of documents, it took more time to identify proper land owners. For this reason, compensations were paid after the commencement of civil works in some cases. The executing agency decided that land acquisition had involved no problems as the NGO had identified land owners and paid an adequate amount of compensation to them.

(3) Traffic Accidents

After the opening of the bridge, traffic accidents where vehicles hit a fence dividing non-motorized vehicles from motorized vehicles occurred frequently. Based on an inquiry conducted by the executing agency, it was found that the improvement of approach roads allowed a higher speed of vehicles while the width of carriage way suddenly became narrower with the fence at the curve. It was concluded that these factors had caused the accidents where vehicles hit the fence. After FY2009/10, the police cracked down violations of traffic rules more severely and at night an O&M contractor[20] guided traffic at black spots where accidents were prone to occur. As a result, the number of accidents started to decline. At the time of the ex-post evaluation, reflectors were sited at road sides for the prevention of accidents at night. For a further reduction in accidents, the executing agency planned to implement improvement works such as the extension of the fence and the shortening of traffic islands in order carriage ways not to become narrower suddenly.

Table 12: Traffic Accidents on the Rupsha Bridge*

Year	Number of Accidents	Number of Injuries	Number of Deaths
2005/2006	18	9	7
2006/2007	35	24	11
2007/2008	41	55	7
2008/2009	42	86	7
2009/2010	16	10	3

Source: RHD
Note: * Including approach roads

[20] Routine maintenance of the Rupsha Bridge was outsourced to a private company. See “3.5.1 Structural Aspects of Operation and Maintenance” for further details.

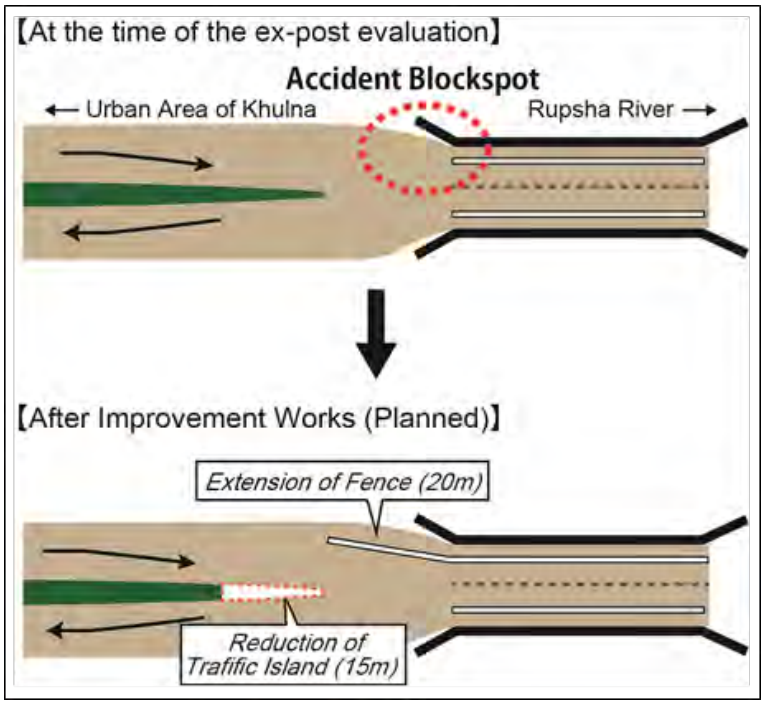


Figure 3: Accident Blackspot on the Rupsha Bridge

(4) Impact on Local Residents through the Termination of the Ferry Service

The ferry service on National Highway No.7 was no longer being operated at the time of the ex-post evaluation. Although it was planned that shuttle buses would be operated at the time of the appraisal, the operation of buses had not started. The Ministry of Communications (MoC) decided that the operation of shuttle buses was not appropriate as the fee charged by boats was cheaper than the bus fares and so bus services were unlikely to have enough users. Nevertheless, the operation of boats allowed pedestrians and cycles to cross the river. Thus, the termination of the ferry service did not negatively affect the mobility of local residents.

The construction of the Rupsha Bridge presumably contributed to an improvement in the livelihood of local residents. A few residents referred to a possible effect on the natural environment but the causality between these incidents and the Rupsha Bridge has not been proved. The executing agency concluded that land acquisition was conducted properly.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

The responsibility for operation maintenance was clearly defined. Under the supervision of the MoC, RHD was in charge of the maintenance of the Rupsha Bridge and the approach roads together with toll collection for the bridge. RHD carried out routine maintenance by outsourcing this type of maintenance to the O&M contractor. While RHD periodically inspected the bridge as part of its contract management, the O&M contractor was directly in charge of the implementation of routine maintenance including inspection and repair of road surface, cleaning, and the inspection and replacement of road lights and vessel guiding lamps. The O&M contractor, which was NEA-TEC JV[21] at the time of the ex-post evaluation, was selected by

[21] Joint venture between EFCON AG (Austria), National Civil Engineers Limited (Bangladesh), Asian Traffic Technologies Ltd. (Bangladesh)

tender. There was no significant change in the number of staff at the O&M contractor. In 2010 there were 117 maintenance staff, out of which 95 employees were directly engaged in operation and maintenance. Periodic maintenance was not outsourced and RHD assume direct responsibility of this type of maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

As for the collection of tolls, a computer system to record numbers of vehicles was sited at the toll plaza. Based on the comparison of toll revenue and actual traffic, efforts to minimize leakages in toll collection took place. One of the JV members had developed and supplied a toll collection system in other countries and had a sufficient technical capacity in toll collection system. At the beginning of the O&M outsourcing, the O&M contractor trained the employees engaged in O&M for toll collection. It can be concluded that the O&M contractor had the appropriate technical capacity for toll collection.

It is a reasonable judgement that that the activities for routine maintenance such as inspection and light repair did not require advanced technical capability. At the beginning of the O&M outsourcing, the O&M contractors trained its employees for routine maintenance. It can be concluded that the O&M contractor had the appropriate technical capacity for routine maintenance.

There were an issue in the maintenance of long bridges. RHD did not have a sufficient training budget and could not assign bridge specialists to maintenance. There were unexpected damage at bridges on trunk roads after maintenance works[22] and this suggested an issue in the supervision for the quality of maintenance works in long bridges.

3.5.3 Financial Aspects of Operation and Maintenance

While the road master plan, which was prepared by the Bangladesh government, assumed that the required total budget for routine and periodic maintenance would be 12. 2 billion taka per annum, the actual budget allocation was almost half the required amount. RHD faced constraints in its maintenance budget. The actual O&M budget for the Rupsha Bridge was used for payment to the O&M contractor, paying for routine maintenance and toll collection. As aforementioned in “3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)”, O&M costs substantially surpassed the estimation at the time of the appraisal. Since the opening of the bridge in 2005, the costs of periodic maintenance had not been included in the O&M budget. As for periodic maintenance of the Rupsha Bridge constructed by this project, the appraisal assumed this type of maintenance every seven years. As only six years had passed since the completion of the bridge, budget for periodic maintenance had not been since project completion.

Table 13: O&M Budget

Unit: million taka

Year	RHD’s O&M budget	The requited O&M budget for the Rupsha Bridge	The actual O&M budget for the Rupsha Bridge
2007/2008	6,178.21	45.60	42.95
2008/2009	5,143.84	40.13	40.73
2009/2010	6,094.74	40.13	37.73

Source: Project Completion Report, RHD

Since toll revenue is a part of the general budget for the Bangladesh government, RHD was not able to directly allocate the revenue to maintenance activities. Toll charges were set before

[22] According to the O&M contractor, at the Meghuna Bridge and the Meghuna-Gumti Bridge, expansion joints which were supposed to last for more than 10 years were broken within 2 years after their replacement. Given the negative effect on the life of the bridge body, early repair work was appropriate. However, the damage remained unrepaired for more than a year.

the opening of the bridge in March 2005. Since then, they have not been revised. As toll charges were set so that there could be no substantial increase from ferry tariffs, they were relatively inexpensive in comparison with those for Meghuna Bridge / Meghuna-Gumti Bridge and the Paksey Bridge. This comparison shows that pricing of tolls may not have prevented the use of the Rupsha Bridge.

Table 14: Toll charges for major types of vehicles

Unit: Taka

	Rupsha Bridge	Meghuna Bridge Meghuna-Gumti Bridge	Paksey Bridge
Motor Cycles	5	10	10
Cars	30	50	50
Buses	150	150	215
Trucks	150	400	215

Source: RHD

3.5.4 Current Status of Operation and Maintenance

No serious damage negatively affecting the incidence of the project effects was observed during the site survey. There was no damage in the expansion joints and scouring was not found.

Cracks appeared on the piers (MP2 and MP7) during project implementation. According to the executing agency, the cracks were narrow hair cracks and within RHD's standards. The contractor for civil works periodically inspected the cracks even after the completion of civil works and conducted painting and water proofing work on the piles at the beginning of 2011.

The site survey showed that routine maintenance was properly implemented. According to the O&M contractor, RHD routinely inspected the bridge (Surface 5-6 times annually and bridge body twice annually) as a part of contract management for routine maintenance. As neither RHD nor the O&M contractor had a bridge inspection vehicle, binoculars were used for inspection of the bridge body.

As aforementioned in "3.5.3 Financial Aspects of Operation and Maintenance", periodic maintenance had not been implemented for the period from the project completion to the ex-post evaluation because it did not reach the number of years which the appraisal assumed for this type of maintenance.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project has been relevant to the development plans of Bangladesh and has been meaningful in terms of the country's development needs. Difficult construction works required longer time than the plan due to the treatment of soft soil were but changes in the technical specifications and construction methods limited the delay to a short period only. In tandem with the reduction of cargo handling at Mongla port, traffic demand grew less than it had been forecasted. For this reason, the traffic volume at the time of the ex-post evaluation remained at almost 50% of the forecast. Serious damage which could negatively affect the incidence of the project effect was not observed in the site survey. However, in long run, the tight maintenance budget of the executing agency and insufficient experience in the supervision of the maintenance works for long bridges are issues for sustainability.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(To assess countermeasures for traffic accidents)

Traffic accidents on the Rupsha Bridges remained at notable level from the opening to FY2009/10. Khulna side residents regarded the increase in traffic accidents as a social problem. Since the increase in traffic accidents after the completion of the bridge was not foreseen at the time of the appraisal, measures for the prevention of traffic accidents were not assessed. Traffic accidents frequently occurred where there were several contributing factors (an increase in traffic speed, curved carriageway, and narrower road width with fence). During the project formation and implementation stages, it is desirable that measures to prevent traffic accidents (such as a traffic safety campaign for drivers, traffic safety education for local residents, and the assessment of road design and warning signs) are assessed from several different aspects.

(To assess the assumptions for forecasting traffic volume)

The forecast for traffic volume on the Rupsha Bridge assumed an increase in cargo handling at the jetties in Mongla port. This in turn assumed both an increase in cargo handing at Mongla port and containerization stimulating a shift from inland waterways to land transport. As these assumptions were not fully met, this severely affected traffic volume. In the case that a forecast for traffic volume is based on important assumptions, it is desirable to estimate how non-attainment of assumptions would affect traffic volume and to use the estimate for sensitivity analysis in the calculation of IRR and assessment of countermeasures.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs	(1) Civil Works 1) Rupsha Main Bridge Length 1,360 m, Wide 16 m 2) River Revetment East Side 150 m 3) Approach Roads West section 5,880 m East Section 2,799 m 4) Canal Bridges 2 Bridges 5) Related Facilities 1 Toll Plaza and 2 Bus Bays (2) Consulting Services International: 222 M/M National: 639 M/M	(1) Civil Works 1) Same as planned 2) River revetment 145 m Protection by stones 37m 3) Same as planned 4) Same as planned 5) Same as planned (2) Consulting Services International: 249.9 M/M National: 689 M/M
2.Project Period	March 2001 – September 2004 (43 months)	March 2001 – May 2005 (51 months)
3.Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 8,045 million yen 2,504 million yen (1,160 million Taka) 10,549 million yen 8,300 million yen 1 Taka = 2.16 yen (As of May 2000)	 7,766 million yen 4,385 million yen (2,160 million Taka) 12,151 million yen 7,966 million yen 1 Taka = 2.03 yen (Average between January 2001 and December 2005)

Bangladesh

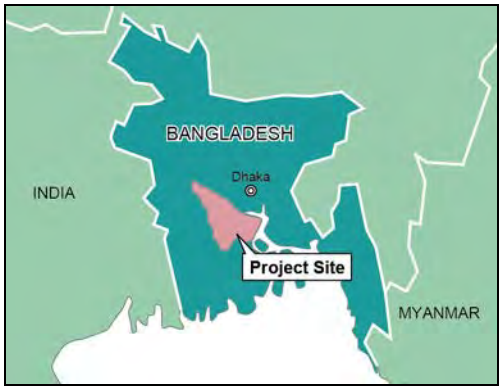
Ex-Post Evaluation of Japanese ODA Loan
"Greater Faridpur Rural Infrastructure Project"

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

Considering the focus points of the national development strategy, it can be seen that this project was relevant to development policy at both appraisal and ex-post evaluation. There was a strong development need for the construction of infrastructure in rural areas in order to stimulate the regional economy in the Greater Faridpur Area. An increase in project outputs having been provided, the project cost was within the plan although the project period was slightly delayed. The improvement of roads brought about not only an increase in traffic volume but also an increase in motorized traffic and, thus, a change in the quality of traffic. The improvement of roads also led to an increase in employment and business opportunities contributing to livelihoods as well as to better conditions for agricultural production. No serious damage negatively affecting the incidence of project effects was observed during the site survey of the facilities constructed by this project. The actual allocation of the maintenance budget had been under the required amount, and the setting of roads as a priority showed that the appropriate distribution of the maintenance fund had been taken into consideration. In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Location

Improved Upazila Road (Rajibari District)

1.1 Background

In the last half of the 1990s, approximately 80% of the total population (approximately120 million people) of Bangladesh lived in rural areas with half of these living under the poverty line. For this reason, rural development and poverty reduction were at the core of the development strategy set by the Bangladesh government. The Local Government Engineering Department (LGED) continuously made efforts to develop infrastructure, in particular rural roads, in rural areas. The development of rural roads would promote the agricultural sector and, moreover, contribute to income generation through an increase in employment opportunities. This would also improve living standards through easier access to social services including health and education.

The target area of this project was five districts in the Greater Faridpur area (Faridpur district, Rajibari district, Gopalgonj district, Madaripur district and Shariatpur district). Because of the geographical nature of the area, which is surrounded by great rivers, floods made roads

impassable in the rainy seasons and the interruption of logistics had prevented social and economic development in the area. The development of the transport infrastructure was a development issue with considerable urgency in this area.

It was within this context that this project implemented the improvement of rural roads in the Greater Faridpur area. In addition to rural roads, the project also constructed facilities which would enhance the effects of rural roads such as Growth Centers (rural markets) and Union Parishad Complexes.

1.2 Project Outline

The objective of this project is to reduce traffic costs and improve accessibility to social services by constructing rural infrastructure such as roads, Growth Centers and Union Parishad Complexes in the Greater Faridpur Area, thereby contributing to improvement of livelihoods and the living standards of residents.

Loan Approved Amount/ Disbursed Amount	4,055 million yen / 3,978million yen
Exchange of Notes Date/ Loan Agreement Signing Date	August 2000 / March 2001
Terms and Conditions	Civil Work, etc.: Interest Rate 1.0%, Repayment Period: 30 years (Grace Period: 10 years), General untied Consulting Services: Interest Rate 0.75%, Repayment Period: 40 years (Grace Period: 10 years), General untied
Borrower / Executing Agency	The President of the People's Republic of Bangladesh / Local Government Engineering Department
Final Disbursement Date	July 2008
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	Engineering and Planning Consultant (Bangladesh)・Engineering Consultants and Associates Limited (Bangladesh)・Devconsultants Limited (Bangladesh)・DHV Consultants BV (Netherlands)・WSP International (UK) (JV)
Feasibility Studies, etc.	"SAPROF for Greater Faridpur Rural Infrastructure Development Project" JBIC, 2000
Related Projects	JICA "Participatory Rural Development Project", JICA " Rural Development Engineering Center Setting-up Project"

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: December 2010 – October 2011
Duration of the Field Study: February 21 – March 16, 2011, July 2– July 14, 2011

2.3 Constraints during the Evaluation Study

As the period of site survey was limited due to unstable political situation, it was not possible to interview with affected residents about land acquisition during the filed study. For this reason, the assessment of land acquisition was based on the information provided by the executing agency.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Bangladesh

The national development strategy at the time of the appraisal was the Fifth Fiver Year Plan (FY 1997/98-2001/02[3]). The plan recognized that poverty reduction required the stimulation of economic activities and it promoted both Growth Centers and rural roads providing access to Growth Centers. The development for rural areas accounted for more than 10% of the total investment which was higher than the 5% of the Forth Five Year Plan. This large-scale investment was aimed at the construction and improvement of 600 rural markets called Growth Centers, 7,500km of Feeder Roads[4] and 15,000km of Rural Roads[5] during the plan period.

The national development strategy at the time of the ex-post evaluation was the National Strategy for Accelerated Poverty Reduction II (NSAPRII), which regarded growth aiming at poverty reduction as a key policy and which emphasized that a larger number of people throughout the country would participate in growth. The strategy noticed that rural towns play a vital role in growth with broader participation and it continued to focus on upazila and union roads which connect rural towns with highways[6]. Although NSAPRII placed a priority on maintenance, it was planned that upazila roads of 2,200km and union roads of 14,000km would be developed during the project period (FY2009/10-2011/12) with continual improvement of Growth Centers as well.

The national development strategy at the time of the ex-post evaluation emphasized poverty reduction as a policy goal more strongly than the one at the time of the ex-post evaluation. It also paid serious attention to the benefits that people in rural areas might have from economic growth. NSAPRII attached importance to the maintenance of rural roads rather than to new construction. With the importance of the existing road network in mind, this policy emphasized the sustainability of the results of development. This does not mean that the need for the development of rural roads diminished. A development approach which combined Growth Centers and the improvement of roads providing access to Growth Centers still continued. The main components of this project were the development of rural roads and that of Growth Centers with the intention that more people would benefit from economic growth. Given the focus points of the national development strategy, this project could be seen to be relevant to the development strategies at both the times of appraisal and ex-post evaluation.

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[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ② Fair, ① Low
[3] The fiscal year of the Bangladesh government starts in July and ends in June of a next year.
[4] Roads to connect Growth Centers with major highways. This type of road was classified as "upazila" at the time of the ex-post evaluation.
[5] This type of road was classified as" union roads" at the time of the ex-post evaluation.
[6] Administrative hierarchy of Bangladesh is Division - Zila - Upazila - Union.

3.1.2 Relevance with the Development Needs of Bangladesh

At the time of the appraisal, people living in rural areas made up 80% of the total population of Bangladesh. A half of these (Upper Poverty Line Head Count Rate in 2000: 52.3%)[7] were under the poverty line – a significantly higher proportion than in urban areas (35.2%). Undeveloped infrastructure in rural areas had prevented the improvement of living standards and of livelihoods. The Greater Faridpur Area (Faridpur district, Rajibari district, Gopalgonj district, Madaripur district and Shariatpur district), the target area of this project, is adjoined by great rivers on its northwest, east, and west sides, and the area was prone to be flooded and thus disconnected from the capital city Dhaka by the Padma River, a major river without a bridge. A lack of employment within the region had led to a great number of migrant workers moving to major cities.

Figure 1: Greater Faridpur Area

At the time of the ex-post evaluation, the population under the poverty line accounted for approximately 40% of those living in rural areas (Upper Poverty Line Head Count Rate in 2005: 43.8%). Although the poverty rate in rural areas had improved, it was still higher than that of urban areas (28.4%). This suggested that poverty reduction in rural areas continued to be a development issue. The executing agency, LGED, was implementing a rural infrastructure project in the Greater Faridpur Area (Union Road & Other Infrastructure Development Project: Rajbari, Faridpur, Gopalganj, Shariatpur & Madaripur District). Through this project it was planned that infrastructure would be developed between FY 2008/09 and FY 2012/13 including Growth Center of 15 markets and roads of 95 km.

At the time of the appraisal, poverty reduction in rural areas was an important development issue. In particular, there was the need for the development of infrastructure and the stimulus of the regional economy in the Greater Faridpur Area where sufficient employment had not yet been generated. At the time of the ex-post evaluation, the poverty rate in rural areas was still relatively high, though the situation had improved. The succeeding project is on-going in the Greater Faridpur Area, which implies that the development issue still needs to be addressed.

3.1.3 Relevance with Japan's ODA Policy

Japan's Official Development Assistance (ODA) Charter, the preceding charter, which was approved in 1992, referred to the close relationship between Japan and Asia in terms of history, geography, politics, and economy, and placed a special emphasis on assistance to the Asian region. The charter defined infrastructure as a basic condition of social and economic development and included assistance in infrastructure investment in its priorities.

The Country Assistance Strategy (CAS) for Bangladesh in 2000 selected agricultural and rural development as one of the major issues in development. Agricultural and rural development, especially infrastructure development including rural roads, was among the priorities of the assistance strategy. For further participation on the part of local residents, CAS regarded collaboration with NGOs as an important point requiring serious attention in the implementation of development projects.

This project supported the development of various types of infrastructure in the rural area (the Greater Faridpur Area) and was consistent with Japan's ODA policy. NGOs were employed

[7] Bangladesh Bureau of Statistics "Report of Household Expenditure Survey 2005"

for the training of local residents, showing that due attention had been paid to this point in the implementation of assistance.

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 Efficiency (Rating: ②)

3.2.1 Project Outputs

The planned and actual outputs of this project were as follows:

Table 1: Project Outputs

At the time of the appraisal (Plan)	At the time of the ex-post evaluation (Actual)
(1) Civil Work · Feeder Road B: Improvement 496.4km, bride & culvert 4,328m, tree plantation 360km · Rural Road: Improvement 150km, bride & culvert 1,500m, tree plantation 120km · Growth Center: 62 markets · Union Parishad Complex: 27 units · Earth road maintenance 4,070 km, Pipe casting 2,300 units, culvert 230 units	(1) Civil Work · Upazila Roads (Former Feeder Road B): Improvement 562 km, bride & culvert 6,051m, tree plantation 360km · Union Roads (Former Rural Road): Improvement 217km, bride & culvert 1,867m, tree plantation 120 km · Growth Center: 62 markets · Union Parishad Complex: 20 units · Earth road maintenance more than 4,070km · Flood Damage Rehabilitation: Pavement of Upazila Roads 75km, Pavement of Union Roads 65km, Growth Centers 7 markets
(2) Equipment and Vehicles · Construction equipment, etc.	(2) Equipment and Vehicles · Construction equipment, etc.(construction equipment - as planned, an increase in 4WD, an decrease in motor cycles)
(3) NGO Activities · Training	(3) NGO Activities · Training
(4) Consulting Services · Scope: Procurement Assistance, D/D Review, Construction supervision, monitoring, etc. · International: 69 M/M, National: 1,080 M/M	(4) Consulting Services · Scope: Procurement Assistance, D/D Review, Construction supervision, monitoring, etc (as planned) · International: 59.21 M/M, National: 1,391.3 M/M
(5) Others · Research (Social Survey) · Training of LGED employees	(5) Others · Research (Social Survey) · Training of LGED employees

Source: Appraisal documents, Project Completion Report

For civil works, the actual outputs except the Union Parishad Complex were as planned or were above the planned outputs. The actual outputs included flood damage rehabilitation, which was not included in the plan. This portion took advantage of the on-going project for faster recovery and coped with damage of the infrastructure during a flood in the Greater Faridpur Area in 2004. Embankments were constructed in some sections of the rehabilitation works so that through this work roads could be made passable throughout the year. The difficulty in land

acquisition for building sites[8] and the lack of counterpart finance in unions caused delays in project implementation and meant that is was not possible to achieve the planned target for the Union Parishad Complex.

The scope of consulting services was in line with the plan at the time of the appraisal. In order to cope with a prolonged implementation period, the executing agency increased the man/month for consulting services. Training by NGOs had two phases. The first phase was training for trainers consisting of local NGO staff. The planned target was fully achieved, based on the frequency of training. The second phase was training for local residents and this achieved 97% of the planned target based on the number of training days. However, training for women shopkeepers was could not be carried in accordance with the plan because of a delay in the construction of Growth Centers[9].

Table 2: Training which NGOs provided to local residents

Target Population	Training
Union Parishad members	Role of Union Parishad Members, Planning and Financial Management, Gender, Participatory Methods, etc.
Union Parishad female members	Role of Union Parishad Female Members, Women's rights, Hygiene & Environment, etc.
LCS[10] members	Health & Hygiene, Animal rearing. Saving management, Small businesses, etc.
Growth Center stakeholders	Operation and Maintenance of Growth Centers, Gender, Participatory Planning, etc.
Growth Center Women Shopkeepers	Business Management, Marketing, Accounting, etc.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost computed at the time of the appraisal was JPY 8,713 million. Reflecting an increase in project outputs such as the extension of improved road sections, the adjusted planned project cost was JPY 10,176 million. The actual project cost was JPY 8,577 million and was lower than both the unadjusted and adjusted planned project costs (84% of the adjusted planned project cost). The project cost in Japanese yen was below the plan at the time of the appraisal due to appreciation of the Japanese yen against the local currency and a decrease in costs derived from competitive tenders. The size of contracts was relatively small so that medium-sized contractors could easily participate in tenders.

3.2.2.2 Project Period

The project period at the time of the appraisal was at 58 months. Reflecting an increase in project outputs, the adjusted planned project period was 82 months, which was slightly longer than planned (107% of the adjusted planned project period). The main reasons for the delay in the project period were the slower than planned commencement on union roads (former rural roads) caused by a delay in the selection of consultants.

[8] There were several reasons. Local resident could not agree on the location of building site. Union Parishad could not obtain land for building site.

[9] At the time of the ex-post evaluation, the executing agency was trying to complete the women's corner prior to the construction of Growth Centers in a similar project.

[10] Abbreviation of Labor Contracting Society. LCS is a women's organization to contract and conduct road maintenance.

Table 3: Project Period

	Plan (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
L/A signing	March 2001	March 2001
Consulting services	Q1 2001-Q2 2005	Q3 2001-Q2 2008
Civil works	Q1 2001-Q2 2005	Q4 2001- Q2 2008
Project Completion (Project period)[11]	December 2005 (58 months)	June 2008 (88 months)

Source: Project Completion Report

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

3.3 Effectiveness[12] (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Rural Roads (Upazila Roads)

Based on traffic surveys which took place at the time of the project commencement (2003) and after project completion (2010), analysis for comparable sections shows that the total traffic volume for all sections increased after the improvement of roads. The traffic volume of motorized vehicles (motor cycle, passenger car, bus etc.) also increased and this suggests a qualitative change in traffic following the improvement of roads. Traffic volume decreased in three sections but that of motorized vehicles increased even in these sections. It can be presumed that the sections which recorded a decrease in traffic experienced a transition period from non-motorised traffic (bicycles, rickshaws, carts, etc.) to motorized traffic

Table4: Traffic Volume per Day for the Improved Sections[13]

• 2003

No	District	Section	Hat/ Motorized	Hat/ Non-Motorized	Total	Non Hat/ Motorized	Non Hat/ Non-Motorized	Total
1	Faridpur	Nagarkanda - Chandhat	169	936	1,105	166	866	1,032
2	Faridpur	Madhukhali - Gopaldi	35	492	527	42	661	703
3	Madaripur	Kalkini - Kasherhat	145	466	611	134	730	864
4	Madaripur	Ghatokchar - Tribagdi	148	1,169	1,317	13	139	152
5	Gopalganj	Khanderpar - Majigati	4	198	202	139	1,118	1,257
6	Shariatpur	Bhojesshwar - Golar Bazar	109	591	700	83	511	594
7	Shariatpur	Balar bazar - Subochoni - Moderhat	74	670	744	104	511	615
	Total		684	4,522	5,206	681	4,536	5,217

Source: LGED

• 2010

No	District	Section	AADT Motorized	AADT Non-Motorized	Total
1	Faridpur	Nagarkanda GC - Chandhat GC road	640	1,641	2,281
2	Faridpur	Gopaldi GC - Khalipur GC road	192	173	365
3	Madaripur	Kalkini Upazila HQ - Khasherhat GC	661	2,994	3,655
4	Madaripur	NHW - Tribhagdi	508	756	1,264
5	Gopalganj	Khanderpara - Majhigati - Ramdia GC	467	777	1,244
6	Shariatpur	Bhojeswar - Golar Bazar	197	111	308
7	Shariatpur	Balar Bazar - Subhochani - Moderhat - Negerpara	137	97	234
	Total		2,802	6,549	9,351

Source: LGED

[11] The project completion is defined as the end of the payment of construction and consulting services.
[12] On the judgment for Effectiveness, the findings in Impact have also been taken into consideration in the rating.
[13] The same number in the tables for 2003 and 2010 is for corresponding sections.

In addition to that of 2003, another traffic survey for improved sections was conducted at the mid-point of project implementation in 2005. The questionnaire survey for road users showed that travel length increased except for travels by rickshaws while minutes per km were reduced for both motorized and non-motorized traffic. The improvement of roads increased travel length and road users could move efficiently in a shorter time. Shorter travel for rickshaws may be explained by the fact that motorised traffic had taken over longer journeys.

Table 5: Travel Length and Travel Time

Type of Vehicle	Travel Length (km)		Travel Time (min./km)	
	2003	2005	2003	2005
1. Motorized				
Auto Rickshaw	10	18	6.5	3
4WD	15	35	3.57	3
Motor Cycle	25	21	3.5	2.8
Pick-up Van/Microbus	9.5	11	5	3
Bus	20	30	5.2	3
Truck	12	27	6.2	4.25
2. Non-Motorized				
Bicycle	2.25	6	7.25	6.5
Cart	4.6	8	20.25	17.5
Rickshaw	10	5	12.45	8.5

Source: LGED

(2) Growth Centers

While data collection was carried out at one market from every district where the project implemented both at the times of the project commencement (2003) and the mid-point (2005), comparable data was collected at the time of the ex-post evaluation. At the Growth Centers where data were collected, the number of permanent shops had increased from “before” to “after” of project implementation. As this project supported the expansion of market facilities, a greater number of vendors benefited from the Growth Centers. In addition, there was also a substantial increase in the number of motorized vehicles in the Growth Centers comparing “before” to “after” project implementation. This increase implies that farmers are able to bring their products to the markets more effectively and that there are now more buyers from outside their communities. It can thus be seen that the strategy of developing both rural roads and Growth Centers simultaneously was effective.

Table 6: Permanent shops in Growth Centers

District	Growth Centers	2003	2005	2011
Faridpur	Hat Gazaria	61	87	120
Rajbari	Khankhanapur	439	491	500
Gopalganj	Bhatiapara	240	370	302
Madaripur	Mathabanga	34	39	35
Shariatpur	Chandrapur	155	182	300
	Total	929	1,169	1,257

Source: LGED

Table 7: Motorized Traffic in Growth Centers

District	Growth Centers	2003		2005		2011	
		Hat	Non-hat	Hat	Non-hat	Hat	Non-hat
Faridpur	Hat Gazaria	66	52	95	125	182	114
Rajbari	Khankhanapur	185	122	252	145	250	100
Gopalganj	Bhatiapara	58	47	484	92	405	255
Madaripur	Mathabanga	32	56	51	78	225	200
Shariatpur	Chandrapur	64	52	70	67	250	115
Total		405	329	952	507	1,312	784

Source: LGED

(3) Union Parishad Complexes

Among the Union Parishad Complexes (UPC), the number of meetings and the number of participants at the UPC in the most populous union from each district is shown in the following table. Meetings per 1000 residents and participants per 1000 residents in Chhaygoan UPC and Amgram UPC, where LGED implemented the Local Development Coordination Program, were higher than in other UPCs. The program intended that local residents' access to administrative information be improved, developed the scheme to consolidate administrative information at union level, and supported local residents in organizing groups. According to Union Parishad members in the Chhaygoan union, coordination meetings of stakeholders for the allocation of development budgets and the identification of issues continued even after the above program was completed in June 2008.

UPC had local branches of administrative departments in addition to a meeting room and an office for the chairman of the union parishad. These also provided services such as land registration and advice on agricultural techniques and internet connection to local residents

Table 8: Number of Meetings and Number of Participants

District	UPC	Number of Meetings	Meetings per 1000 residents	Number of Participants	Participants per 1000 residents
Faridpur	Gajirtek	12	0.41	124	4.24
Rajbari	Nadabpur	11	0.33	128	3.80
Gopalganj	Kalabari	12	0.51	146	6.15
Madaripur	Amgram	25	0.96	240	9.25
Shariatpur	Chhaygoan	17	1.22	179	12.82

Source: LGED

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

As the nature of this project, where scattered project sites did not allow an accurate grasp of the incidence of project effects, made a quantitative estimation of benefits difficult, a quantitative analysis of the internal rate of return was not possible.

3.3.2 Qualitative Effects

(1) Improvement in Mobility

The questionnaire survey[14] for residents near the upazila roads improved by this project showed that the improvement of roads had stimulated economic activities among local residents. Out of the respondents, approximately 90% replied that their frequency of leaving the village had increased after project implementation. More than a half of the respondents visited markets,

[14] A questionnaire survey with 105 samples (35 samples x 3 villages) for residents living near the upazila roads improved by this project was carried out in the districts of Faridpur, Gopargonj, and Madaripur. The results of the survey were used in "3.4.1 (2) Improvement of Livelihoods" and "3.4.1 (3) Contribution to the Agricultural Sector."

hospitals, and friends/relatives more frequently, and in particular there had been a significant increase in the frequency of visiting markets. Although the main mode of transport was still rickshaw or on foot, an increase in the use of motorized traffic was obvious. The most common answer for the main mode of transport was rickshaw (including vans with a loading platform) while use of motorized vehicles accounted for approximately 10% of the total. Nevertheless, the use of mechanized three wheelers such as auto rickshaws had become more frequent. The use of buses increased in villages where a bus service was operated.

Table 9: Changes in Frequency and Purposes of Visits after the Improvement of Roads

Purpose		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	Total
Travel out of village	Respondents	77	23	5	0	0	105
	% of Total	73%	22%	5%	0%	0%	100%
Visiting Market	Respondents	86	17	2	0	0	105
	% of Total	82%	16%	2%	0%	0%	100%
Visiting Hospital	Respondents	46	52	7	0	0	105
	% of Total	44%	50%	7%	0%	0%	100%
Visiting Friends/Relatives	Respondents	42	31	21	5	6	105
	% of Total	40%	30%	20%	5%	6%	100%

Table 10: Main Mode of Transport at the Time of the Ex-post Evaluation

Mode	On foot	Bicycle	Rickshaw/Van	Motorcycle	Mechanized Three Wheeler	Total
Respondents	24	0	74	3	4	105
% of Total	23%	0%	70%	3%	4%	100%

Table 11: Use of Motorized Vehicles after the Improvement of Roads

		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	Total
Use of Mechanized Three Wheeler	Respondents	99	6	5	0	0	105
	% of Total	94%	6%	5%	0%	0%	100%

		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	No bus	Total
Use of bus	Respondents	28	2	5	0	0	70	105
	% of Total	27%	2%	5%	0%	0%	67%	100%

(2) Results of Training for Local Residents

In the interviews with Union Parishad members, some interviewees said that members frequently used their knowledge of their role and of planning/financial management. Some also mentioned that they had experienced difficulties in applying their knowledge and that they needed greater proficiency in administrative procedures for planning/financial management matters being at present dependent on secretaries commissioned from district commissioners' offices. This implies a need for refresher courses on these topics.

Interviews with members of the Union Market Management Committee (UMMC) revealed that UMMC members were frequently changed and, therefore, it was difficult for any knowledge obtained from training to take root in UMMC.

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

3.4 Impact

3.4.1 Intended Impacts

(1) Employment Generation

This project generated employment in civil works and road maintenance. This was estimated to be 8.59 million man/days through construction works implemented by the project[15]. While direct employment by LCS for road maintenance was estimated to be 1.4 million man/days at the time of the appraisal, the actual direct employment reached 1.8 million man/days and achieved the planned target. LCS consisted of poor women and this project brought them cash income which was very precious in the rural areas. A part of the income was saved as capital for income generation activities in the future.

(2) Improvement in Livelihoods

In the questionnaire survey for residents living near the upazila roads improved by this project, more than 90% of the respondents replied that opportunities for income generation such as employment and new business had "increased" or "slightly increased." Similarly, more than 70% said that their household income had "increased" or "slightly increased." For expenses, the price of groceries increased but availability improved.

As the economic expansion of Bangladesh in the last decade affected this result, other factors apart from this project clearly affected the increases in household incomes and the opportunities for income generation. Nevertheless, it can be concluded that the improvement of logistics, as mentioned in "3.3 Effectiveness" above, created an environment in which local people in the project areas could benefit from the economic growth of Bangladesh. The increase in grocery prices was affected by general inflation in Bangladesh. It can be presumed that the factors behind these changes were the reduction in logistics costs, resulting in more products in markets nearby, and the improvement in mobility allowing local residents to purchase and carry products from other markets.

Table 12: Changes in Livelihoods after the Improvement of Roads

		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	Total
Total household income	Respondents	23	54	28	0	0	105
	% of total	22%	51%	27%	0%	0%	100%
Employment Opportunity	Respondents	65	39	1	0	0	105
	% of total	62%	37%	1%	0%	0%	100%
Opportunity of starting a business	Respondents	67	37	1	0	0	105
	% of total	64%	35%	1%	0%	0%	100%

Table 13: Price and Availability of Groceries

		Yes, very much	Yes to some extent	Same	No, not so much	No, not at all	Total
Availability of Groceries	Respondents	64	34	6	1	0	105
	% of total	61%	32%	6%	1%	0%	100%
Cheaper Price of Groceries	Respondents	5	8	14	11	67	105
	% of total	5%	8%	13%	10%	64%	100%

(3) Contribution to the Agricultural Sector

In the questionnaire survey for residents living near the upazila roads improved by this project, residents with income from agriculture were asked additional questions about the conditions of agricultural production. While the price of agricultural inputs had increased,

[15] The estimation of employment generation is based on working days required for each type of construction work.

availability had improved for all types of inputs. The reason that availability had improved can be presumed to have been the efficient transport of agricultural inputs by motorized vehicles such as trucks. On the other hand, the prices of agricultural inputs increased in line with the inflation of general prices. While opinion was divided on transport costs, more than 90% of the respondents said that they had experienced less spoilage during transportation.

Half of the respondents increased cultivation of commercial crops and this was presumably one of the factors which can explain the increase in agricultural income. It can be conjectured that more commercial crops were cultivated because more buyers came from outside the villages[16].

Table 14: Availability of Agricultural Inputs after the Improvement of Roads

		Yes, very much	Yes to some extent	Same	No, not so much	No, not at all	Total
Fertilizers: More Available	Respondents	43	32	1	1	0	77
	% of total	56%	42%	1%	1%	0%	100%
Pesticides: More Available	Respondents	38	37	1	1	0	77
	% of total	49%	48%	1%	1%	0%	100%
Seed: More Available	Respondents	38	32	3	2	2	77
	% of total	49%	42%	4%	3%	3%	100%

Table 15: Price of Agricultural Inputs after the Improvement of Roads

		Increased	Moderately Increased	Same	Moderately Decreased	Decreased	Total
Price of Fertilizers	Respondents	56	13	6	2	0	77
	% of total	73%	17%	8%	3%	0%	100%
Price of Pesticides	Respondents	49	21	7	0	0	77
	% of total	64%	27%	9%	0%	0%	100%
Price of Seed	Respondents	55	16	5	1	0	77
	% of total	71.4%	20.8%	6.5%	1.3%	0.0%	100.0%
Transport Costs	Respondents	34	11	0	29	3	77
	% of total	44%	14%	0%	38%	4%	100%

Table 16: Spoilage during Transportation after the Improvement of Roads

		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	Total
Spoilage during Transportation	Respondents	0	0	4	31	42	77
	% of total	0%	0%	5%	40%	55%	100%

Table 17: Agricultural Income and Commercial Crops after the Improvement of Roads

		Increased	Slightly Increased	Same	Slightly Decreased	Decreased	Total
Agricultural Income	Respondents	18	36	19	4	0	77
	% of total	23%	47%	25%	5%	0%	100%
Increase in Commercial Crops	Respondents	17	29	29	1	1	77
	% of total	22%	38%	38%	1%	1%	100%

[16] For example, in an interview with farmers in the Gopalgonj district, some suggested that the improvement of logistics had stimulated the cultivation of water melons.

(4) Development for Women Shopkeepers

Women's corners were built in 21 Growth Centers and approximately 100 women started their businesses there. As mentioned above (3.3.2 (2) Results of Training for Local Residents), local NGOs trained women shopkeepers. Through commercial activities in the Growth Centers, women shopkeepers found a way of obtaining cash income which was rare in rural areas. A participatory approach for the stakeholders of Growth Centers was used to decide the scope of markets. The strong opinions of influential male participants resulted in the exclusion of women's corners in some markets despite the advice of LGED that one should be included.

Photo 1: Women Shopkeeper

3.4.2 Other Impacts

(1) Impacts on the natural environment

The consultant who supervised the project implementation also conducted environmental monitoring and the results of the monitoring were shared with the executing agency and JICA. Impacts on the natural environment were negligible as the infrastructure constructed was small-scale and a major part of the civil works was the improvement of existing roads. Impacts on the natural environment were not observed during the site survey. According to the executing agency, the infrastructure of this project was designed so that, in wet lands, impact on river flows could be minimized and drainage could not be prevented.

(2) Land Acquisition and Resettlement

According to the executing agency, land acquisition was made along with roads but resettlement was not required. As resettlement was likely to have caused delays in project implementation, LGED minimized land acquisition and avoided resettlement through flexible design changes. The acquired land area was reduced from 50 ha, the planned area at the time of the appraisal, to 14 ha in actual implementation. According to the executing agency, land acquisition for this project required 10.25 million taka. Compensation was paid before land acquisition and in accordance with the regulations of Bangladesh.

Following the improvement of roads, the means of making a livelihood such as employment and business opportunities increased. The improvement in logistics contributed to better conditions for agricultural production. As the infrastructure constructed by this project was small-scaled and the executing agency made efforts to minimize land acquisition and avoid resettlement, impacts on the natural and social environments were negligible.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

In addition to its headquarters in the capital city Dhaka, LGED had branch offices at three levels: Regional[17], District, and Upazila. In the five districts where this project was implemented, 1041 LGED staff engaged in maintenance in 2010 and the number of maintenance staff has remained at a similar level for the last three years. While LGED was directly responsible for the maintenance of upazila and union roads, it has also had an advisory role for the operation and maintenance of Growth Centers and UPC. This arrangement suggests

[17] LGED divided Bangaldesh into to 10 regions (Chittagong, Rajshahi, Khulna, Sylhet, Barisal, Dhaka, Mymensingh, Faridpur, Comilla, and Rangpur) and placed an office in each region.

that the responsibility for maintenance has been clearly defined. The institutional arrangements for the maintenance of each type of infrastructure are as follows:

- Upazila Roads (former Feeder B roads) and Union Roads (former Rural Roads)

After the improvement of roads, LGED was responsible for roads, bridges and culverts. While LGED's upazila offices conducted routine maintenance of pavements, the routine maintenance of off-pavement areas, such roadside trees and embankment slopes, was contracted to LCS. Contractors for periodic maintenance and emergency maintenance were selected by tender.

- Growth Centers

According to the regulations, a lease holder selected by tender was responsible for operation and routine maintenance such as cleaning and minor repairs. Major repairs were the responsibility of local government. UMMC supervised maintenance and its members were elected by stakeholders such as shopkeepers every few years. LGED gave advice on maintenance to UMMC members but it was not directly involved in maintenance.

- Union Parishad Complexes

Union Parishad were responsible for routine maintenance and major repairs after the completion of UPC. Union Parishad members were elected by residents in a union. LGED gave advice on maintenance to Union Parishad members but it was not directly involved in maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

In FY 2009/2010, a total of 3,661 LGED employees participated in training for 10,481 days in total. Training covered various areas including public procurement, construction supervision, management of road maintenance, maintenance of equipment, and inspection of construction materials. Training placed emphasis not only on the attainment of engineering skills for maintenance but also on the skills necessary to efficiently contract out maintenance activities such as procurement, contract management, and the inspection of materials.

LGED established a Road Asset Management System (RAMS) which could be used for maintenance programming. Road conditions (sections, type of road surface, International Roughness Index[18], traffic volume) and facilities near roads (schools, markets and hospitals) were included in the data base of the RAMS. According to the executing agency, data collection was carried out periodically.

LGED has laboratories for the quality control of civil works and materials at its headquarters (1 laboratory), at regional level (10 laboratories), and at district level (54 laboratories). The laboratories were used to control the quality of civil works conducted by contractors. LGED selected construction sites and assessed the quality of materials such as gravel, sand, brick chips, cement and cement products. In some cases, the quality of the materials did not satisfy standards, and reconstruction was required.

The JICA technical assistance projects, the "Rural Development Engineering Center Setting-up Project (Phase 1) / (Phase 2)", contributed to improvements in skills in the form of improved technological ability for planning, design, quality control, maintenance of rural roads in LGED. The above technical assistance projects supported the development of manuals on the procedures for inspections and road maintenance works, as well as carrying out instruction based on the manuals, and the implementation of equipment related to the database (PC, GIS equipment, and software).

Through the acquisition of technical skills via the training systems and the technical assistance projects, LGED gained the technological capability required for the routine maintenance of roads and the supervision of maintenance works.

[18] The index which shows the roughness of road surfaces. It is used for the assessment of surface conditions.

3.5.3 Financial Aspects of Operation and Maintenance

• Upazila Roads and Union Roads

LGED's annual report for FY 2010/11 showed that the road maintenance budget was 5.7 billion taka of the general budget and that the budget allocation from the Annual Development Programme available for heavy maintenance was 2.14 billion taka. Although the budget allocation from the Japan Debt Cancellation Fund was terminated in FY 2010/11, the budget allocation from the general budget is expected to increase in FY2011/12.

Table18: Budget Allocation for Road Maintenance (Required and Actual Allocation)

Unit: million taka

Year	Required Budget Allocation		Actual Budget Allocation	
	Rehabilitation	Maintenance	Annual Development Programme	General Budget
2008/09	8,343.0	9,778.0	3,806.9	4,898.3
2009/10	9,830.0	11,501.0	3,596.3	5,084.8
2010/11	11,531.0	13,470.0	2,138.1	5,700.0

Source: LGED

The maintenance budget has been increasing but was still under the budget allocation required to maintain road maintenance at the appropriate conditions[19]. As mentioned above, budget constraints were taken into consideration in the distribution of the maintenance fund through the utilization of RAMS. Specifically, the budget allocation prioritized upazila roads in which the project mainly invested, laying emphasis on various factors such as road class, surface conditions, traffic volume, and source of funds. The executing agency implemented the remarkable measure so that it could effectively maintain a more valuable type of road assets under severe budget constraint.

• Growth Centers

According to the regulations, it was required that a lease holder elected by tender should pay the expenses related to the operation and routine maintenance of Growth Centers (such as cleaning and minor repairs). The lease holder would collect rent from the owners of permanent shops and from temporary vendors and use the rent to fund maintenance. However, some markets did not follow the regulations. The site survey revealed that UMMC took responsibility for routine maintenance budget in some markets. UMMC members were not necessarily familiar with administrative procedures. For this reason, they had no specific plan to obtain additional funds for major repairs from local governments. As elections for new members of UMMC were held frequently, knowledge of administrative practices hardly took root. To cover major repairs, local governments accumulated a part of the fees collected from the lease holders.

• Union Parishad Complexes

Union Parishad conducted routine maintenance and major repairs from revenue. According to interviews conducted during the site survey, however, some unions said that they faced tight budget constraints which allowed only routine maintenance and that they had no specific plan to obtain additional funds for major repairs. Union Parishad members were not necessarily familiar with administrative procedures and, therefore, they had no specific plan to obtain additional funds for major repairs from the central government and local governments despite shortages of maintenance budget. It was pointed out that a union did not necessarily collect tax in accordance with government regulations and, as a result, suffered from a lack of funding.

[19] Based on the Rural Road Master Plan

3.5.4 Current Status of Operation and Maintenance

• Upazila Roads and Union Roads

No serious damage negatively affecting project effects was observed during the site survey. In tandem with the improvement of roads, the traffic volume of trucks increased. While the increase in the volume of trucks enhanced the project effects, there was concern that it might lead to more damage of roads. LGED coped with this by more frequent maintenance works on the road sections used by many heavy vehicles. On the upazila roads improved by this project, the International Roughness Index was measured in 40 sections, out of which 16 sections were classed as "Fair" (6 m/km - 8 m/km) and 24 sections were classed as "Slightly Poor"(8 m/km - 10m/km) [20]. Given the actual use of upazila roads, the current condition of road surfaces was considered acceptable. However, it would be sensible to take precautions against the further deterioration of road conditions in the long and mid term

Photo 2: Union Parishad Complex

• Growth Centers

No serious damage negatively affecting project effects was observed during the site survey. The site survey revealed that the cleaning of market places and toilets were conducted in all Growth Centers but that some markets could not manage maintenance works which required further labour and funds (such as the repair of drainage systems). LGED sporadically conducted monitoring on the status of facilities but not on the usage of facilities.

• Union Parishad Complexes

No serious damage negatively affecting the project effects was observed during the site survey. LGED sporadically conducted monitoring on the status of facilities but not on the usage of facilities.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Considering the focus points of the national development strategy, it can be seen that this project was relevant to development policy at both appraisal and ex-post evaluation. There was a strong development need for the construction of infrastructure in rural areas in order to stimulate the regional economy in the Greater Faridpur Area. An increase in project outputs having been provided, the project cost was within the plan although the project period was slightly delayed. The improvement of roads brought about not only an increase in traffic volume but also an increase in motorized traffic and, thus, a change in the quality of traffic. The improvement of roads also led to an increase in employment and business opportunities contributing to livelihoods as well as to better conditions for agricultural production. No serious damage negatively affecting the incidence of project effects was observed during the site survey of the facilities constructed by this project. The actual allocation of the maintenance budget had been under the required amount, and the setting of roads as a priority showed that the

[20] According to the LGED classification, this was "Good" for sections below 6 m/km, "Fair" for sections between 6 m/km and 8m/km, "Slightly Poor " for sections between 8 m/km and 10m/km, "Poor" for sections above 10m/km

appropriate distribution of the maintenance fund had been taken into consideration.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

The actual allocation of the maintenance budget was below the required amount. It is desirable that road maintenance is continuously based on priories in light of traffic volume and road conditions with an attention paid to budget constraints.

Members of Union Parishad and UMMC were not necessarily familiar with administrative procedures. For this reason, they had no specific plan to obtain additional funds for major repairs from central and local governments despite shortages in the maintenance budget. One reason behind this was presumably that elections for new members of Union Parishad and UMMC were held regularly and, therefore, knowledge of administrative practices hardly took root. In order the members of Union Parishad and UMMC to continuously acquire practical knowledge, it is desirable that LGED to make efforts such as that sharing information Union Parishad requiring training with National Institute of Local Government, the government agency which is in charge of training for Union Parishad members, and organizing meetings for UMMC members to disseminate knowledge on how to obtain administrative supports and on good practices across them.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

This project defines the scope in improvement of Growth Centers by using a participatory approach. In some markets, women's corners were not constructed due to opposition from influential men. In a project where the participatory approach defines the scope, it is desirable that the appropriate constitution of participants is confirmed, that the voice of socially marginalized people is heard through measures such as voting, and that their opinions are reflected in the scope of the projects.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs	(1) Civil Works Feeder Road B: 496.4 km Rural Roads: 150 km Growth Centers: 62 Union Parishad Complexes: 27 Maintenance of Earth Roads: 4,070 km (2) Equipment and Vehicles Construction equipment, etc. (3) NGO Activities Training (4) Consulting Services International: 69 M/M National: 1,080 M/M (5) Others	(1) Civil Works Feeder Road B: 562 km Union Roads :217 km Growth Centers: 62 Union Parishad Complexes: 20 Maintenance of Earth Roads: More than 4,000 km (2) Equipment and Vehicles Construction equipment, etc. (3) NGO Activities Training (4) Consulting Services International: 59.21 M/M National: 1,391.3 M/M (5) Others
2.Project Period	March 2001 – December 2005 (58 months)	March 2001 – June 2008 (88 months)
3.Project Cost		
Amount paid in Foreign currency	3,710 million yen	3,614 million yen
Amount paid in Local currency	5,003 million yen (2,316 million taka)	4,963 million yen (2,606 million taka)
Total	8,713 million yen	8,577 million yen
Japanese ODA loan portion	4,055 million yen	3,978 million yen
Exchange rate	1 taka = 2.16 yen (As of May 2000)	1 taka = 1.904 yen (Average between January 2001 and December 2008)