Ex-Post Project Evaluation 2011
（Package Ⅳ-3 (Afghanistan, Pakistan, Bangladesh))

November 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

T.& Associate, Inc.

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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 2009, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2008. 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 2012
Masato Watanabe
Vice President
Japan International Cooperation Agency (JICA)

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Afghanistan

Ex-Post Evaluation of Japanese Grant Aid Project

The Project for Constructing of the Terminal of Kabul International Airport

External Evaluator：Yosuke Oneda, T. & Associates, Inc.

0. Summary

The objective of this project is to contribute to stabilizing and improving lives of Afghan people by constructing an international terminal building at Kabul International Airport. The objective is expected to be realized through improving transportation of passengers and luggage, providing better services for passengers and improving the air transportation system in this country, which would be brought by the project implementation.

Formation of a safe and comprehensive transportation network is one of the goals of development policy in Afghanistan, and the Kabul airport is considered a primary international airport which contributes to economic development and social stability of the country. By constructing an international terminal building, Afghanistan seeks to strengthen security measures of the airport and to expand its functionality as an international airport, thus this project is in conformity with such development needs. Moreover, the project is consistent with Japan's assistance policy towards Afghanistan and the relevance of implementing this project is high. Although there was a delay in making the terminal building operational, the project has brought a significant increase in the number of international flights, passengers and cargos by new entry of foreign airline companies, thus both effectiveness and impact of the project are considered high. Efficiency is considered fair because project outputs resulted in being modified and the actual project period exceeded the planned period, while the project cost came within the estimate. Operation and maintenance of facilities and equipment are carried out by external contractors under a management system controlled by the Ministry of Transport and Civil Aviation (MoTCA) and the Kabul International Airport (KIA). Since several concerns, such as an unsatisfactory storage management system for basic statistical data, are identified in the field, sustainability of the project effect is considered fair.

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

1. Project Description

Project Location

International Passenger Terminal Building at Kabul International Airport

1.1 Background

Afghanistan has advanced a peace and reconstruction process following the Bonn Agreement after longstanding conflicts, and national reconciliation has become one of the urgent issues for achieving a lasting peace for the country. For achieving the goal, Japan has implemented assistance projects for reconstruction of Afghanistan. In order to carry out assistance activities for reconstruction without any interruption, it is essential to ensure a smooth circulation of people and products between Afghanistan and donor countries, since Afghanistan is landlocked. Although Kabul International Airport has provided Afghanistan's international air transportation services as the capital city airport, its airport facility was small and airport security measures were lacking. Furthermore, a situation under which passengers of international flights and domestic flights were all mixed created a problem that strict security measures against terrorism were not implemented.

Under these circumstances, the government of Afghanistan planned this project by which a terminal building dedicated to international flights would be constructed at the western side of the existing terminal of Kabul International Airport. The new construction is expected to improve a circulation of transporting passengers and products at the airport and to provide better services for passengers. In addition, the project is aimed at strengthening passport control for departure and entry by making the existing terminal building exclusively dedicated to passengers for domestic flights.

1.2 Project Outline

The objective of this project is to contribute to stabilizing and improving lives of Afghan people by constructing an international terminal building at Kabul International Airport as

well as facilities attached to the building, and procuring materials and equipment necessary for constructing the terminal building and facilities. The objective is expected to be realized through improving a circulation of transporting passengers and luggage, providing better services for passengers and improving the air transportation system in this country, which would be brought by the project implementation.

Grant Limit / Actual Grant Amount	87 million yen / 87million yen (detailed design) 3,000 million yen / 2,876 million yen (main construction work)
Exchange of Notes Date (Grant Agreement Date)	Auast 2004 (detailed design) August 2004 (main construction work)
Implementing Agency	Ministry of Transport and Civil Aviation
Project Completion Date	August 2008
Main Contractor	Dai Nippon Construction
Main Consultant	Ehira Architect & Engineers, Inc.
Basic Design	March 2004
Detailed Design	March 2005
Related Projects	Project for Improving Equipment of Kabul International Airport (May 2003-December 2004), Project for Renovating Taxiways at Kabul International Airport (March 2010-), Group training on Afghanistan Airport Management (June 2008).

2. Outline of the Evaluation Study

2.1 External Evaluator

Yosuke Oneda (T. & Associates, Inc.)

2.2 Duration of Evaluation Study

The ex-post evaluation study in question was conducted as follows.

Duration of the Study: December 2011 – September 2012

Duration of the Field Survey: January 23 – February 1, 2012 and May 28 – June 2, 2012

2.3 Constraints during the Evaluation Study

Maintenance of facilities in the international terminal building constructed under this project was outsourced to an external entity, and this contract expired in June 2012. It is assumed that a new entity to be contracted was already chosen and the maintenance system was updated until the completion of this ex-post evaluation study. At the time of

the second field study, however, the new contractor and the updated system were not in place yet. Therefore, the progress and result of the new outsourcing are not discussed in this report, in particular in the section concerning sustainability.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Afghanistan

The document entitled "Securing Afghanistan's Future," which was developed in May 2004, stated that air transportation played a very important role, along with road transportation, in economic development and national unification in Afghanistan that has strived for reconstruction of its society. In the same document, the Afghanistan's air transportation system, including its airports, was recognized fragile and requires redevelopment.

"Interim Afghanistan National Development Strategy", which began being developed in 2004 and was completed in 2005, also said that the air transportation system in Afghanistan was not able to respond to domestic and international demands for the aviation sector. Recognizing the strengthening of the air transportation system as a necessary, it also said that the Kabul airport, which provides international air transportation, should be improved so as to meet international standards of the International Civil Aviation Organization (ICAO).

In "Afghanistan National Development Strategy (2008 - 2013)", the formation of a safe and comprehensive transportation network is stated as a purpose of its transportation section covering road and air transportation, and the network is expected to provide low-cost and reliable means for domestic and international transportation of people and goods. Projects improving the Kabul airport are especially identified in the National Development Strategy as contributors to economic growth and social stability in Afghanistan. Through the projects, as the major international airport in the country, its systems and facilities should be developed to comply with ICAO's criteria, and the improvement is expected to stimulate business activities related to passenger and cargo transportation.

The above shows that the project in question is consistent with the development plan of Afghanistan at the points of both ex-ante and ex-post evaluation.

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

[2] ①: High, ② Fair, ③ Low

3.1.2 Relevance with the Development Needs of Afghanistan

Prior to this project, the "Project for Improving Equipment of Kabul International Airport" was implemented (completed in December 2004) through a grant aid from Japan, and this aid provided equipment and facilities for passenger handling and ground handling services[3]. The passenger terminal building, however, remained too small to cope with international passengers. In addition, facilities and equipment needed for security inspections were not sufficient and international passengers and domestic passengers were mixed at the terminal building. These situations caused problems to implement strict security measures against terrorism. This project is aimed at solving these problems and expanding functions of the international airport as a gateway to Afghanistan. The project therefore meets development needs of the country[4].

During the same period, other projects directly targeting the Kabul airport were implemented by other donors as indicated on Table 1. With the premise that Japan provides its grant aid, the "Preparation Study for the Project for Renovating Taxiways at Kabul International Airport" was commenced in 2010, and expansion of taxiways and aircraft parking aprons as well as installation of taxiway lights have been currently implemented. After the completion of the project in question, Kabul airport functions have been continuously planned to be strengthen. It can be therefore considered that development needs in this field still exit even at the moment of this ex-post evaluation study.

Table 1: Assistance Projects by Other Donors

Donor	Assistance
Financial assistance from the United Nations Development Programme (UNDP) and assistance from GTZ, Germany	Renovation of bonded warehouses Renovation of the existing international passenger terminal building
World Bank	Renovation of runways at Kabul International Airport Equipment and facilities for flight control and communication at Kabul International Airport Equipment for the passenger terminal building at Kabul International Airport Equipment for ground support at Kabul International Airport

[3] Ground support services provided for airline companies at airports, such as traction and movement of airplanes at aprons, loading and unloading of baggage and cargos, etc.

[4] Apparatus and equipment supplied and offered under the "Project for Improving Equipment at Kabul International Airport" do not share the same purpose of use as radiographic inspection machines and metal detectors, which were supplied and offered under this project, are intended to do.

3.1.3 Relevance with Japan's ODA Policy

Japan held the "International Conference on Reconstruction Assistance to Afghanistan" in Tokyo in January 2002, and promised to assist with 500 million dollars over the upcoming two and a half years. Since then, Japan has provided assistance in all areas, such as in the peace process, in safety improvement and in reconstruction, under the vision of "establishment of peace." In order to provide steady reconstruction assistance to Afghanistan, sound circulation of people and products is essential. From this viewpoint, the project corresponds to the fundamental policy of Japan's assistance to Afghanistan.

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

3.2 Effectiveness[5] (Rating : ③)

3.2.1 Quantitative Effects

3.2.1.1 Promotion of Movement of People and Distribution of Goods

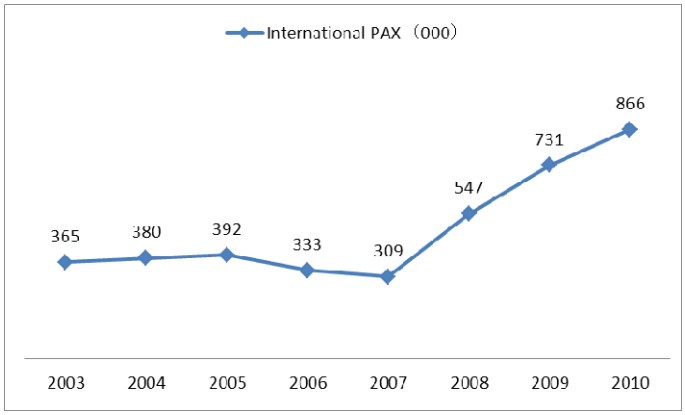
In 2005 when the project had not launched yet, only three Afghanistan-based airline companies (Safi Airways, Kam Air, and Ariana Airlines) offered international flights from and to Afghanistan. As of year 2010, seven foreign airline companies (Fly Dubai, Al Arabia Airlines, Gulf Air, Air India, Turkish Airlines, Iran Aseman Airlines, and Pakistan International Airlines) entered the business, and even after the completion of this project, a number of foreign airlines went into service. As of February 2011, 14 routes and 161 flights per week were in service, including 62 departing flights and 79 arriving flights.[6]

Along with the increase in international flights, the number of passengers has been also increasing. The number of passengers of international flights had decreased from 390,000 in 2005 to 300,000 in 2007, which was before the completion of the project. By the time of the project completion in 2008, however, the number of passengers had increased to 540,000, and to 730,000 in 2009 when the international terminal building began service. Constant growth further continued and the number of passengers reached 860,000 in 2010, which marked a 220% increase from 2005. Since demand foreseen for 2010 or the year set in the basic design study was 680,000[7], the actual situation showed

[5] The rating of effectiveness is given with consideration of evaluation on project impact.
[6] Document provided by JICA.
[7] Based on the result in 2002 (130,000 people), the report of the basic design study foresaw that the number of passengers for international flights in 2010 would be approximately 340,000 people. By referring to numbers concerning passengers on data provided by JICA, it however turned out that these numbers only indicate outgoing passengers. With assumption that the number of incoming passengers is same as the

that the number of passengers in 2010 exceeded the forecast.

Although data on the quantity of international cargos as of 2005 is not available, an increase of one thousand ton was observed from the time before starting the service to 2010. From this observation, it can be concluded that this project has greatly contributed to promoting transportation of people and goods.



Source: data provided by JICA

Figure 1: The Number of International Passengers at Kabul International Airport

Table 2: Transition of the Volume of International Passengers and Handled Cargos

	2005	2008	2010
Number of passengers (000 people)	392	547	866
Volume of cargos (000 t)	N/A	4.3	5.3

Source: Document provided by JICA

3.2.1.2 Time Reduction for Check-in and Passport Control Procedures

In the basic design study, three quantitative indicators, i.e. “waiting time for check-in procedure,” “waiting time for passport control for departure” and “waiting time for passport control for entry” are identified and a targeted value for each indicator is set.

On the occasion of the field survey during this ex-post evaluation study, a simple measurement was conducted for certain hours to quantify the above indicators. As shown on the following table, the targeted values of “waiting time for check-in procedure” and “waiting time for passport control for departure” have not been achieved. Seeking a reason why the waiting time for check-in procedure cannot be shortened, it

outgoing passengers, “340,000 people” on the report should be read as “680,000 people”.

would be mainly attributed to the number of people lining up for the procedure. In general, the number of people in line depends on the number of check-in counters of each airline company. The number of passengers is influenced by the size of an airplane to be used unless the airline handles several flights during the same period. As the size of the airplane becomes bigger, the number of passengers increases and check-in counters become crowded with the passengers. The international terminal at the Kabul airport has only two fixed check-in counters for each airline, regardless of the size of an airplane to be used. This situation makes people waiting longer for check-in procedure for flights to Dubai as these flights carry many passengers with medium-size airplanes.

Measured values for these indicators have tendency to significantly fluctuate depending on situations under which airport facilities are operated and/or timing when the survey is conducted. Thus, in order to apply these indicators for benchmarking, measurement conditions must be defined. Since such conditions are not specified in the basic design study, the result is considered only as a reference in this ex-post evaluation.

Table 3: Time Necessary for Check-in Procedure and Departure and Entry Formalities

	Actual (2003)	Targeted (2007)	
Check-in	Average 11 min.	Less than 4 min.	About 16 min.
Passport Control (Departure)	Average 11 min.	Less than 4 min.	About 6 min.
Passport Control (Arrival)	Average 17 min.	Less than 6 min.	About 4 min.

Source: Data from the “Pre-project Schedule” and actual measurement during the field survey

Hall where people are checking in

3.2.2 Qualitative Effects

3.2.2.1 Security Measures for Passport Control for Departure and Entry

While an international terminal building was constructed apart from the domestic terminal building, passengers for international flights are separated from those for domestic flights in the airport premises. This situation enables the airport to conduct different security measures in each terminal building, such as passport control for departure and entry at the international terminal building. Therefore, strengthening of security measures, which is one of the objectives of the project, has been considered achieved.

Considering security measures other than the passport control, another action was taken for a route between a public parking lot and the international passenger building that are located separately. On the route accessible either on foot or by shuttle bus, the Afghanistan Border Police (ABP) inspects at four checkpoints whether people have airline tickets and/or their entry visas are appropriate.

3.2.2.2 Delay in Starting Terminal Operations

Although the international terminal building was completed on August 31, 2008, a procedure of contracting for consignment of facility maintenance was delayed and the contract was finally executed on June 22, 2009. The international terminal building therefore began to offer services on June 23, 2009. From the completion of the terminal building to the commencement of the services, the international terminal building constructed under this project remained unused and the Kabul airport kept the existing passenger terminal building being used for international passengers as well. It should be therefore said that the effects of this project did not emerge during about ten months from the completion of the international terminal building to the commencement of the services.

3.2.2.4 Unused Facilities

After the international terminal building became operational, a tenant started business at a restaurant space next to the departure gate area on the second floor. The restaurant, however, was closed down for not making enough profit.[8] At the time of the field survey, the restaurant space including its kitchen as well as a restroom adjoining the restaurant were not in use, and no new tenants were expected to move in[9].

[8] Based on interview survey during the field study
[9] Based on observation during the field study.

3.3 Impact

3.3.1 Intended Impacts (Contribution to stabilizing and improving people's lives)

The objective of this project is to "contribute to stabilizing and improving lives of Afghan people." The majority of the revenue in Afghanistan's budget comes from foreign donors: in the 2011-2012 budget, 44% of management and operation costs and 74% of development project costs are dependent on foreign donors. This situation implies that support from international society still remains indispensable for overall social activities in the country including development of facilities necessary for the social infrastructure. In other words, assistance from international society is an important means for stabilizing and improving Afghan people's lives. Given the situation, air transportation plays a very important role for people who are engaged in assistance activities, such as professionals and technical experts, and it would be impossible to implement international assistance activities without the air transportation.

Since this project results in expanding functions of the airport that provides international air transportation at the capital city Kabul, it can be considered that the project has also contributed to assistance activities from international society.

Source: 1390 National Budget, Ministry of Finance

Figure 2: Transition of the National Budget

3.3.2 Other Impacts

According to MoTCA, this project does not make any negative impacts including those on the natural environment as the project was implemented within the airport premises where neither residences nor protected animals and plants exist.

Although the commencement of offering services at the terminal building was delayed, this project ended up obtaining effects exceeding results initially expected, such as new operations of many foreign airline companies and a large increase in passengers and

freight. Since the security measures have been also strengthened, effectiveness and impacts of this project are considered high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

Outputs planned and those actually completed by this project are shown in Table 4.

With regard to outputs related to facilities and equipment, construction works on, for example a parking lot, surrounding roads, and parking pavement, were excluded from the project as a result of unsuccessful bidding and the following review of the project plan. Construction of a high voltage power receiving system and procurement of vehicles for towing airplanes and towing bars became out of the project scope, and contents of soft components of the project were also changed. These modifications caused a situation in which initially planned outputs were not produced.

Table 4: Outputs provided by the grant aid (planned/actual)

<table>
<tr><th colspan="2"></th><th colspan="3">Actual outputs (modifications)</th></tr>
<tr><td rowspan="8">Facilities</td><td rowspan="2">Construction of a new international passenger terminal building</td><td colspan="3">[During the detailed design study]</td></tr>
<tr><td colspan="3">As a result of re-examination and reconsideration of cost and performance of materials, slight changes in material selection and construction methods were made for concourse roof frames, materials under airside roofs, waterproofing methods for roof-decks, etc.</td></tr>
<tr><td rowspan="3">Expansion of the apron (in order to park two medium size jet planes and two small size jet planes at the same time)
Expansion of roads and parking lot</td><td colspan="3">[Modifications during the second feasibility study]</td></tr>
<tr><td>Areas modified</td><td>Contents modified</td><td>Reasons for the modifications</td></tr>
<tr><td>Construction works (parking lot, surrounding roads, pavement for parking)</td><td>The construction works were separated from the facility development of this project. Instead, the Afghan government carried out the works by using collateral funds.</td><td>The construction works were excluded as the feasibility study revealed that local prices for the works were soaring.</td></tr>
<tr><td>Construction of a utility building</td><td colspan="3">Carried out as planned</td></tr>
<tr><td rowspan="3">High voltage substation</td><td colspan="3">[Modifications during the second feasibility study]</td></tr>
<tr><td>Areas modified</td><td>Contents modified</td><td>Reasons for the modifications</td></tr>
<tr><td>Construction of a high voltage power receiving</td><td>Excluded from the project scope</td><td>It was expected that the World Bank would finance and</td></tr>
</table>

		system		conduct a construction for a power supply system in the city
	Sewage and effluent treatment facility	[Modifications at the commencement of the activity]		
		Areas modified	Contents modified	Reasons for the modifications
		Sewage and effluent treatment facility	Modification of the location	Parking lot and waiting areas were built on the planned site
Equipment and apparatus	Vehicles for towing airplanes, towing bars	[Modifications during the review prior to the first bidding]		
		Areas modified	Contents modified	Reasons for the modifications
		Two towing vehicles Two sets of towing bars	Excluded from the project scope	It was needed to reduce the project cost in order to address fluctuation of the exchange rate.
	Radiographic inspection machine for checked baggage	[Modifications at the commencement of the activity]		
		Areas modified	Contents modified	Reasons for the modifications
		Two radiographic inspection machines for checked baggage	The installation area of the machines and layout of the baggage handling belt were modified.	To comply with a revision of ICAO Annex 17 (passengers are kept from touching checked baggage while it is delivered from security inspection areas to airplanes.)
	Boarding bridge, radiographic inspection machine for carry-on baggage, metal detector, flight information display, etc.	Equipped as planned		
Soft components	Development of a plan for relocation Holding of a committee for relocation	[Modifications at the commencement of the activity]		
		Areas modified	Contents modified	Reasons for the modifications
		Development of a plan for relocation	Preparation of contract documents for outsourcing	Operation of the terminal building was outsourced.
		Holding of a committee for	After a committee for relocation was organized, a committee	

		relocation	for examining outsourcing was held instead.	

X-ray inspection machine for checked baggage

Passenger boarding bridge

3.4.2 Project Inputs

3.4.2.1 Project Cost

The grant limit set for the project (main construction work) was 3,000 million yen; however, the actual cost was 2,876 million yen, meaning the actual cost is within the plan (96% compared to the planned cost).

Since the result of bidding was unsatisfactory due to a steep increase of consumer prices and fluctuation of exchange rates, contents of the project were reviewed and construction works, installation of a high voltage power receiving system, airplane towing vehicles and towing bars were excluded from the expected outputs. It should be noted that the actual project cost was brought by these modifications. While the project cost came within the grant limit, initial expected outputs were not generated.

Table 5: Project Cost (Planned/Actual)

Items	Planned (million yen)	Actual (million yen)
Construction cost (Direct construction costs) (Other construction costs)	3,000	2,770 (2,369) (401)
Design and supervision cost (Soft components)		106 (8)
Total		2,876

Source: Document provided by JICA

3.4.2.2 Project Period

Following the basic design study, project duration was foreseen before the project implementation and it was approximately 35 months including a detailed planning period prior to the bidding as well as an implementation period for the soft components, the completion of which would occur concurrently. In reality, however, 48.5 months were needed from the signing of exchange of notes on August 21, 2004 to the completion of the project on August 31, 2008, which is 138% of the initial plan. Following would be the reasons why the actual project duration exceeded the planned one:

1) Failure of the First Bidding and its Follow-up Actions

Although possible unit prices of facilities were set based on the detail design survey, bidding prices exceeded the estimated prices due to a steep increase of local unit prices. This situation resulted in the failure in the bidding. Following the unsatisfactory result, the second feasibility study was carried out and the second bidding was then conducted. An additional time of three and half months was therefore needed from the announcement of the first bidding result on March 13, 2006 to the completion of the second feasibility study on July 31, 2006.

2) Preparation Period for Implementation

From the signing of the exchange of notes to the completion of the project, there are time slots dedicated to preparation of activities to be implemented and they in total account for 14 months. Concretely, it includes seven months from the completion of the detailed design survey in March 2005 to the commencement of the first feasibility study in September 2005, four months from the completion of the feasibility study in October 2005 to the public notice on the first bidding in January 2006, and three months from the announcement of the bidding result in March 2006 to the commencement of the second feasibility study in May 2006.

As mentioned above, the actual project period exceeded the planned period. This is attributed to the failure of the bidding caused by a drastic increase in local unit prices. This unsuccessful result required additional time for follow-up activities, which includes the time needed for administrative procedures of their preparation.

Although the project cost was within the plan, outputs of the project had been changed beforehand and the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance[10]

3.5.1.1 Structural Aspect of Operation and Maintenance for Facilities and Equipment

In June 2008 which is prior to the completion of the international terminal building, advisors of MoTCA, KIA and ICAO and consultants discussed together and decided to outsource three areas concerning airport management, i.e. security, operation and maintenance. The decision was made because MoTCA could neither easily hire and increase its staff nor develop its own system for operation and maintenance of the international terminal building.[11]

Currently, security matters are managed by Global Strategy Groups, operational matters including ground handling by Ariana Afghan Airlines, and maintenance matters on the terminal building equipment and facilities by the Harirod Construction Company[12]. Security operation in the airport, excluding that of the international terminal building, is handled by ABP.

MoTCA and KIA are supervising these outsourced corporations as explained in the section below. This supervising system for facility maintenance has been operated smoothly and any particular concerns have not been noted.

◆ Daily Management

- 13 maintenance staff members of KIA patrol the airport, and when they found problems or conditions needed to be fixed, they report the situations and provide instructions for repairs to the outsourced companies, namely the Harirod Construction Company, through their maintenance supervisor.

◆ Monthly Report

- The Project Implementation Unit (PIU) is composed of a supervisor, a Planning Division staff member and an Engineering Division staff member. KIA carries out monthly reports and submits them to PIU belonging to the Planning Division of MoTCA.

[10] Based on results of an interview survey conducted during the field survey and document provided by MoTCA

[11] Source: Document provided by JICA

[12] The contract with the Harirod Construction Company on the outsourcing expires on June 21, 2012.

3.5.1.2 Storage Management System for Basic Statistical Data

For basic statistical data on air transportation regarding airplanes using at the Kabul airport, KIA's control tower collects their initial information and KIA's Statistics Division compiles them. Since there is, however, no system in MoTCA to centrally manage the basic statistical data, the data cannot be necessarily reflected in its long-term planning.

3.5.2 Technical Aspects of Operation and Maintenance

A private company selected following the result of the public bidding (Harirod at the time of the field survey for this ex-post evaluation study) is engaged in maintenance of apparatus, equipment and facilities of the international terminal building. It was confirmed that the level of technical aspects for maintaining building facilities and equipment is in general satisfactory at the time of an inspection and an interview survey carried out during the field survey.

Repairs on elevators, information systems, air conditioning systems, fire alarms and other electrical equipment, however, depend on each of the foreign manufacturers. When such products need to be repaired, including a case that some parts are necessary to be supplied, it is unavoidable to contact each overseas manufacture concerned. Since no spare parts are kept in Afghanistan, it is difficult to make repairs swiftly[13].

In addition, a maintenance manual has been kept in a locked shelf and maintenance staff cannot have a free access to it. A periodical training for maintenance staff has not been conducted either.

3.5.3 Financial Aspects of Operation and Maintenance

Under this project, operation and maintenance of the international terminal building is, as mentioned above, conducted by external entities outsourced by MoTCA. These companies carry out their tasks under the supervision of KIA. Any financial concerns on the operation and maintenance were pointed out on the occasion of the interview survey on the spot.

While revenue from airline-related operational fees is paid to the Afghan government, expenses related to the operation and maintenance at the Kabul airport are covered by the government, based on a budget allocation by the Ministry of Finance. The budget of the Afghan government for the fiscal year 2009 – 2010 is 215,880 million Afghani including foreign aid. The sum of 950 million Afghani, in other words 0.4% of the national budget

[13] Based on results of an interview survey conducted during the field survey

was allocated to MoTCA, and it expended 801 million Afghani out of the allocated budget.[14]

From the budget allocated to MoTCA, the air transportation sector received, in total, 726 million Afghani, 105 million Afghani of which were used for operation and 621 million Afghani for development and improvement.

The budget allocated by the Ministry of Finance includes revenues from airline-related usage fees such as landing fees. However, neither the proportion of the revenues to the allocated budget nor purposes of use of the budget are defined. ICAO recommends that airport fees be set properly in accordance with expenses for airport operations. In order to demonstrate that the revenue from the airport is appropriately invested into the air transportation sector, transparency in accounting for airport management is required. At the time of the field survey, however, it was not observed that such a system was established. Instead, MoTCA introduced in April 2011 a system for transferring revenues coming from the airport operations to an account of MoTCA at the Bank of Afghanistan, and this system has been managed by the Treasury Division of MoTCA. Although MoTCA needs to obtain approval from the Ministry of Finance whenever the revenues from the airport operations are used, it shows that certain measures for complying with the above-mentioned ICAO's recommendation have been gradually installed. Further, by pursuing transparency in the accounting system for airport management, it is expected that a discussion on how to use airline-related usage fees as a resource for future airline and airport facility improvement projects would be well stimulated.

Table 6: National Budget of the Afghan Government

(2009 – 2010 fiscal year: million Afg.)

			Operational cost	Development cost	Total
MoTCA	Revenue (Budget)	Air transportation sector	104.9	621.4	726.3
		Land transportation sector	77.0	5.6	82.6
		Management and operational sector	141.3	-	141.3
		Total	323.2	627.0	950.2
	Expenditure[15]		371.6	429.9	801.5
All governmental organizations			97,027.3	118,852.9	215,880.2

Source: Afghanistan Statistical Yearbook 2010 – 11

[14] As MoTCA's operational cost for the fiscal year 2010 - 2011, 316.9 million Afghani was allocated. Out of the amount, 189.5 million Afghani was allocated to payroll and 127.3 million Afghani to other items.

[15] Afghanistan Statistical Yearbook 2010 - 11

3.5.4 Current Status of Operation and Maintenance

The following were confirmed through the field survey.

3.5.4.1 Maintenance, Repair and Procurement of Electrical Equipment

Maintenance and repair of elevators, information systems, air conditioning equipment, fire alarms and other electrical equipment rely on each of the foreign manufactures. When such products need to be repaired or some parts are necessary to be supplied, the requests need to pass to each manufacture outside the country. The situation where the airport neither keeps any spare parts nor easily finds them inside Afghanistan hampers it from addressing the problems swiftly.

3.5.4.2 Leaking from Water Distributing Pipes

A problem of leaking from water distribution pipes under the floor occurs mainly in winter. As airport staff has addressed this problem by draining the water out with a power pump, it has not become a serious concern. However, the situation in which a fundamental solution is not sought always remains. It is because the low ceiling of the space under the floor does not allow the airport staff to carry out repair works while the airport is operational. This water leakage problem has been observed since 2009 when the terminal building started to be used.[16]

As mentioned above, external contracted companies take the responsibility for operation and maintenance of facilities and equipment of the international terminal under the supervision of MoTCA and KIA. Since the current contracts will expire, new contracts for outsourcing are in the process of preparation. While the Ministry of Finance allocates a part of its budget for covering MoTCA and KIA's operational cost, it needs to approve how they use the allocated budget. Since a bank account was open in the name of MoTCA that has managed airport fees and airline-related revenues, it could be said that the management of airport revenues has been improved.

Some concerns, however, are still identified as follows. A system for storing and managing basic statistical data needs to play a fundamental role for airport operations, but it has not been established. Electrical equipment cannot be easily and quickly repaired and procured. For the water leaking from distribution pipes under the floor, any foundational measures have not been taken.

The above observation explains this project embraces major systematic and technical

[16] Based on results of an interview survey with KIA's staff in the Maintenance Division

problems in the field of maintenance, therefore sustainability of the project effect is considered fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project is to contribute to stabilizing and improving lives of Afghan people by constructing an international terminal building at Kabul International Airport. The objective is expected to be realized through improving transportation of passengers and luggage, providing better services for passenger and improving the air transportation system in this country, which would be brought by the project implementation.

Formation of a safe and comprehensive transportation network is one of the goals of development policies in Afghanistan, and the Kabul airport is considered a primary international airport which contributes to economic development and social stability of the country. By constructing an international terminal building, Afghanistan seeks to strengthen security measures of the airport and to expand its functionality as an international airport, thus this project is in conformity with such development needs. Moreover, the project is consistent with Japan's assistance policy towards Afghanistan and the relevance of implementing this project is high. Although there was a delay in making the terminal building operational, the project has brought a significant increase in the number of international flights, passengers and cargos by new entry of foreign airline companies, thus both effectiveness and impact of the project are considered high. Efficiency is considered fair because project outputs resulted in being modified and the actual project duration exceeding the planned duration, while the project cost came within the estimate. Operation and maintenance of facilities and equipment are carried out by external contractors under a management system controlled by MoTCA and KIA. Since several concerns, such as an unsatisfactory storage management system for basic statistical data, are identified, sustainability of the project effect is considered fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

MoTCA's air transportation sector and KIA have taken the responsibility for management and operation of the Kabul airport, but their current situations do not allow them to function in a satisfactory manner, for example, in light of the maintenance and management system of the basic statistical data and training for technical experts that

supervise operations on the spot. In the future, the maintenance and management system for the basic statistical data should be enriched by appropriately dealing with detailed data concerning airline traffic and the number of departure and arrival flights. Technical experts should be also well trained in maintenance of facilities and equipment, and a system for maintenance and protection concerning electrical equipment should be strengthened.

4.2.2 Recommendations to JICA

Nothing particular

4.3 Lessons Learned

4.3.1 Method for Setting Quantitative Evaluation Indicators

At the time of ex-ante evaluation, three quantitative indicators, i.e. “waiting time for check-in procedure,” “waiting time for passport control for departure” and “waiting time for passport control for entry” were identified and a targeted value for each indicator was set. Measured values for these indicators, however, have tendency to significantly fluctuate depending on conditions when they are measured. Especially, when actual volume of airport usage exceeds the planned volume as observed after the completion of this project, measured values would tend to result in scoring greatly lower than the targeted values.

When these indicators are adopted for the ex-post evaluation, measurement methods and target values should be well defined at the time of ex-ante evaluation, installing notions such as “measured values at peak hours,” and “daily average,” etc.

Since the early 1990s, customer satisfaction survey has been used as an indicator to evaluate the quality of airport services. It is expected to examine possibilities of using such survey as a measurement method of project results when targeted facilities and beneficiaries (people who evaluate) are easily defined, like this project.

4.3.2 Prior Establishment of an Operation Implementation Structure

Maintenance of the international passenger terminal building constructed under this project was carried out by an external contractor. Since the decision of the outsourcing was made at the last minute before completing the building, contents of the soft components of this project had to change on very short notice. A delay in processing the outsourcing also became a main cause of detaining the international passenger terminal building from offering its services. Given such a situation, additional training for

technical experts in maintenance for facilities and equipment were urgently included and carried out.

The adjustment was made because a structure initially planned turned out unsatisfactory to conduct maintenance tasks for the international terminal building just before its completion. Advisors from MoTCA, KIA and ICAO and consultants therefore discussed the problem and reached an agreement to make this adjustment.

In order to avoid such a situation, a maintenance system for facilities and equipment should be analyzed prior to project implementation and a plan for conducting maintenance for facilities and equipment should be then developed. In addition, closer coordination with other concerned parties should be further sought, in particular, when a project targets an entity which embraces a weak system in this field. .

Pakistan

Ex-Post Evaluation of Japanese Grant Aid Project

The Project for the Rehabilitation of Gates of Taunsa Barrage

External Evaluator: Yosuke Oneda, T. & Associates, Inc.

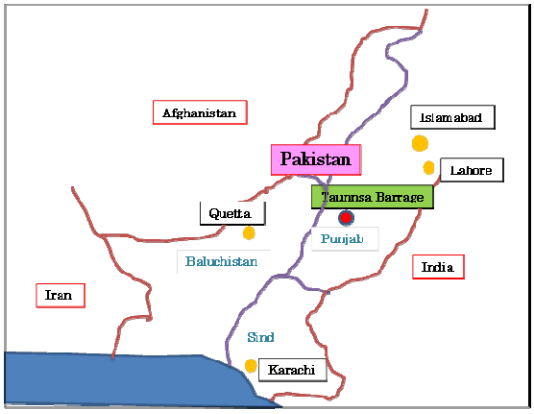
0. Summary

The objective of this project is to provide stable irrigation water for areas surrounding the Taunsa Barrage by renovating its facilities. For this objective, the project seeks to reduce the risk of collapsing dikes at the surrounding areas as well as the barrage itself when the water level rises, and to secure the amount of intake water brought by the barrage. By doing so, the project is expected to contribute to improving fundamentals of local people's lives.

After nearly 50 years had passed since the construction of the Taunsa Barrage, its gates as well as hoists for opening and closing the gates needed to be urgently renovated and a maintenance system of the barrage required its improvement. Since this project corresponds to a priority area of Japan's ODA policy as well, its relevancy is high. As for effectiveness and impact of this project, they are considered high as expected results of this project, such as "recovery of the quantity of intake water for irrigation" and "improvement in gate operations and reduction of flood damage by motorizing the gates", have been achieved. In addition, there was no significant change in the outputs of the project, and both project cost and project period were within the plan, thus efficiency is high. For sustainability, some minor problems were observed in the current status of operation and maintenance, therefore it is considered fair.

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

1. Project Description



Project Location

Taunsa Barrage

1.1 Background

Agriculture is the key industry in Pakistan's economy. In 2003, it accounted for approximately

one fourth of its GDP and a half of its work force. Since irrigated agriculture covers 90% of the agricultural industry, irrigation facilities have been functioning as a vital infrastructure for Pakistan's economy.[1] The irrigation sector, however, faced a number of problems, such as shortage of water resources due to a rise of population as well as a decrease in irrigation efficiency due to decrepit irrigation systems.

The Taunsa Barrage was constructed in the D.G. Khan area of the Punjab province, and it has been operational for almost 50 years since its completion. As the gates and related facilities of the barrage became decrepit, a significant amount of water, in other words, approximately 50% of the flow needed for irrigation canals, was leaking. When the water level rose, the malfunctioning gate control system could not provide a smooth operation for discharging the water and such a defect caused dikes to collapse and villages and agricultural lands to ruin. It was also pointed out that the barrage itself would have been broken down if it had remained unrepaired. These circumstances, therefore, required that the gates as well as their opening and closing hoists should be urgently renovated and a maintenance system of the barrage should be appropriately improved.

1.2 Project Outline

This project is aimed at providing more stable irrigation water for areas surrounding the Taunsa Barrage by renovating its facilities. Through the implementation of this project, it is expected to reduce the risk of collapsing dikes at the surrounding areas as well as the barrage itself when the water level rises, and to secure the amount of intake water brought by the barrage.

Grant Limit / Actual Grant Amount	129 million yen / 129 million yen (detailed design) 5,165 million yen / 4,861 million yen (main construction work)
Exchange of Notes Date	February 2005 (detailed design) April 2005 (main construction work)
Implementing Agency	Irrigation Department, Government of Punjab
Project Completion Date	December 2008
Main Contractor	Consortium of Kurimoto, Ltd. and Taisei Corporation
Main Consultant	Consortium of Sanyu Consultants Inc. and Yachiyo Engineering Co., Ltd.
Basic Design	December 2004
Detailed Design	August 2005
Related Projects	"The Taunsa Barrage Emergency Rehabilitation and Modernization Project," The World Bank (Replacement of under-sluice gates, improving of weir gates, electrification of gate hoists, renovation and upgrading of

[1] Source: "Basic Design Survey Report"

	decks on superstructure and central operation control room: 1,577 million Pakistan Rp.)[2]

2. Outline of the Evaluation Study

2.1 External Evaluator

Yosuke Oneda (T. & Associates, Inc.)

2.2 Duration of Evaluation Study

Duration of the Study: December 2011 – September 2012

Duration of the Field Study: February 2 – 17, 2012, May 21 – 27, 2012

2.3 Constraints during the Evaluation Study

A category concerning "financial aspects of operation and maintenance" in this ex-post evaluation study is one of the components necessary to evaluate sustainability of this project. It should be noted that observation for this category mainly relies on results of interview surveys carried out during the field study. Such a situation happened because quantitative data on planned budget and actual expenditure needed for operating a barrage management office, Taunsa Barrage Division Kot Adu, was accessible only for the fiscal year 2010. During the interview surveys, no particular concerns were identified on operational cost for the management office.

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

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance with the Development Plan of Pakistan

At the time of ex-ante evaluation, the Government of Pakistan was, as a part of its National Ten -Year Plan (2001 - 2011), aiming at enhancing efficiency of farmland utilization by, for example, improving irrigation facilities.

The government also prepared a document entitled "Pakistan in the 21st Century Vision 2030" in August 2007. In this document, it stated as a future vision in the field of agriculture "an efficient and competitive sustainable agriculture ensuring food security", and "an ability to contribute to the economic development of Pakistan." It also recognized necessity of enhancing production of agricultural crops so as to address a rise of population and to support their export. While the government needs to ensure water provision for agriculture, it should cope with an expected increase of demand for industrial and drinking water. The document,

[2] Based on an interview survey at the Project Management Office (PMO), Irrigation Department, Government of Punjab.

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

[4] ③: High, ②: Fair, ①: Low

therefore, mentioned necessity of developing comprehensive measures to manage water resources, and one of the proposed measures is to upgrade irrigation systems in the country.

The above shows that the project in question is consistent with development strategies in Pakistan at the points of ex-ante and ex-post evaluation.

3.1.2 Relevance with the Development Needs of Pakistan

The province of Punjab has arable lands of 16,640,000 hectares excluding fruit farms and irrigated farmlands account for its 88%.[5] Main products of the province are wheat, cotton, rice and sugar cane, and 92%, 99%, 99% and 100% of farmlands for these products respectively are irrigated.[6] Irrigation facilities have therefore played a very important role in Punjab's agriculture.

Arable lands in the D.G. Khan area cover 1,960,000 hectares, occupying 10% of the entire land of the Punjab province.[7] Out of the arable lands in this area, 830,000 hectares are used for harvesting wheat and its 96% is irrigated. This percentage is higher than that of the entire Punjab province as seen above, and it indicates that that D.G. Khan area more depends on irrigated agriculture than other areas of the Punjab province.

Since almost 50 years had already passed after the construction of the Taunsa Barrage, its gates and adjoining facilities were decrepit. The aging facilities caused various problems such as serious water leakage from the barrage. When the water level rose, the malfunctioning gate control system could not provide a smooth operation for discharging the water. As mentioned earlier, urgent renovation of the gates and gate hoists as well as development of a maintenance system for the barrage were indispensable.

Water leakage from the spillway gate

Manual operation for the gate

(It is impossible or difficult for some gates to be opened or closed due to damage to the gate hoists.)

[5] Punjab Development Statistics 2011, Bureau of Statistics, Government of Punjab, Value measured from 2009 to 2010, p. 63.
[6] Ibid. Value measured from 2009 to 2010, pp. 66 - 67.
[7] Ibid. Value measured from 2009 to 2010, p. 62.

Source: Basic Design Survey Report

In parallel with this project, the World Bank replaced under-sluice gates, renovated weir gates and electrified gate hoists on the right half of the barrage. It also developed a central operation control system and additionally installed facilities for receiving electricity as well as stand-by generators. The projects implemented by the World Bank and this project, which targeted rehabilitation mainly on the left half of the barrage, complemented each other for pursuing an integral facility renovation at the Taunsa Barrage. The effects of this project should be therefore recognized in combination with those brought by the World Bank.

Table 1: Division of Responsibilities between JICA and the World Bank for the Entire Renovation of the Taunsa Barrage

Items		JICA (left side)	World Bank (right side)	Total
Construction for renovating the gates	Replacement of under-sluice gates	7 gates	4 gates	11 gates
	Rehabilitation of Main Weir Gates	22 gates	31 gates	53 gates
	Motorization of gate hoists	29 gates	53 gates	82 gates
	Renovation of decks on superstructure	65 gates	19 gates	84 gates
Central operation control room		-	1 set	1 set

Source: Data provided from the Basic Design Survey Report for the left side (JICA) and data provided by the Project Management Office (PMO), Irrigation Department, Government of Punjab for the right side (World Bank).

3.1.3 Relevance with Japan's ODA Policy

Japan's "Country Assistance Plan for Pakistan" developed in February 2005 demonstrated directions and priorities of Japan's economic assistance to the country, and development of agriculture and rural villages aimed at expanding capacity of employment and mitigating poverty was considered one of the priority areas. The document further identified some major fields, as a part of the policy toward the development, namely, securing of water resources for irrigation, rehabilitation of irrigation facilities and sustainable usage and management of water.

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

3.2 Effectiveness[8] (rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

3.2.1.1 Recovery of the Amount of Intake Water for Irrigation[9]

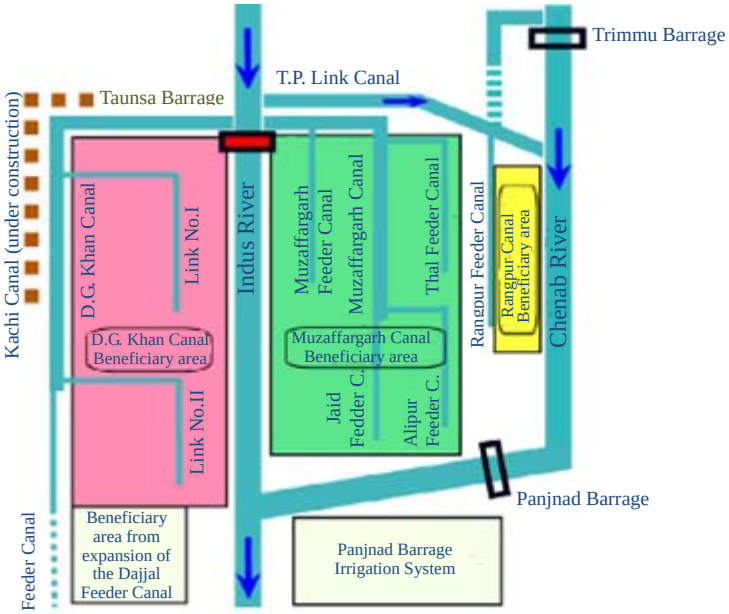
[8] Sub-rating for Effectiveness is to be put with consideration of Impact

[9] As mentioned in Section 1 for "Project Description", the purpose of this project is to provide more

The Taunsa Barrage delivers water to beneficiary areas of both banks of the Indus River. The D.G. Khan Canal is located on the right bank of the upper stream from the barrage while the Muzaffarugarh Canal and the T.P. Link Canal on the left bank.

The basic design survey indicated that expected direct effects of this project would be "recovery of the amount of intake water to irrigation canals till the value originally designed for the barrage and the securing of its stable supply." It also set, as targeted values for the improvement (planned values), 11,564 ft^3/second for the D.G. Khan Canal and 8,300 ft^3/second for the Muzaffarugarh Canal.

Results of the interview surveys during the field study show that the amount of water at intake ports of the Muzaffarugarh Canal and the D.G. Khan Canal reached the targets values, thus the project accomplished the objectives set in the basic design survey.



(Source: Basic Design Survey Report)

Figure 1: Layout of Irrigation Canals of the Taunsa Barrage

Out of the entire amount of the intake water for the D.G. Khan Canal, however, only 9,200 ft^3/second water is used for irrigation as sand and water are removed through its flow.

Table 2: Quantity of Possible Water Intake (ft^3/sec)

Canal name	Baseline value (pre-project)	Planned value	Actual intake value for irrigation (2012)
D.G. Khan Canal	9,047	11,564	9,200*
Muzaffarugarh Canal	7,476	8,300	8,300

Source: "Ex-ante Evaluation Sheet" for the baseline values and planned values, and results from an interview survey at the Irrigation Department, Government of Punjab for the actual values.

*: The amount of possible intake water designed for the gate facilities has been improved to 11,564 ft^3/second. Since water is drained off at two points on the canal route so as to protect its stream bed, the remaining of 9,200 ft^3/second is used for irrigation.

3.2.1.2 Speed of Opening and Closing the Gates

The decrepit facilities lost their ability to smoothly open and close the gates. Since these gates

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stable irrigation water for areas surrounding the Taunsa Barrage. This project was planned, in particular, taking into consideration necessity of rehabilitating decrepit gates of the barrage and its associated facilities, but not due to a shortage of water delivered to the beneficiary areas.

were operated manually, they could not close without delay when floods occurred. Seeking solutions for the problems, gate hoists were motorized and the speed needed to open and close the gates was improved by 60 ft/hour (0.30 m/minute). If floods occur, the renovation would make it possible to operate the gates safely and to flow swollen water down to the lower reaches of the river in a safe and secure manner. According to the data collected during the basic design survey, the speed of gate operation was 0.05 m/minute at the time when the water level was high while 0.10 m/minute when the water level became low[10].

During the field study, an interview survey was carried out at the Taunsa Barrage Division Kot Adu and situations of operating the gates were inspected on spot. Results of the interview and inspection confirmed that the planned speed of 0.30 m/minute was achieved at the time when the gates were opened and closed. In addition, smoothly conducted operations on the site were directly observed by the evaluator.

3.2.2 Qualitative Effects

3.2.2.1 Decreasing Risks of the Barrage and Dikes Collapsing at the Time of Floods

It was understand at the time of the basic design survey that a delay of the manual gate operation created floodwater passing dikes and inundating farmlands and residences behind the dikes. With the understanding, the survey demonstrated its expectation that the motorization of the gate hoists would improve the speed of gate operations and it would eventually prevent disasters caused by floods.

As mentioned in the section on the quantitative effects, the targeted speed of gate operations was achieved under the implementation of this project. This improvement would make it possible to swiftly open the gates at the time of heavy downpours.

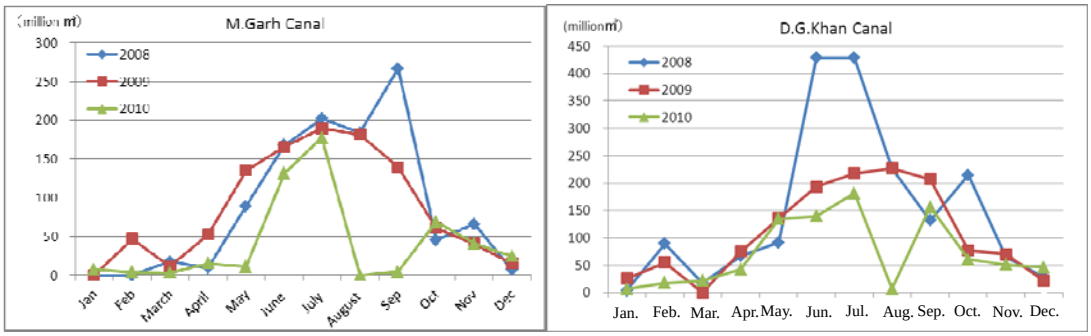
A large-scale flood in August 2010 damaged a broad area behind dikes located at upper reaches approximately 10 km away from the barrage. This disaster was caused by a heavy rainfall over the widespread area, which had not happened in recent years. As mentioned earlier, the motorized hoists were able to rapidly open the gates. However, the flood ended up damaging the area due to collapse of fragile parts of the dikes that had not been covered by this project.

Although the area behind the dikes resulted in suffering from the flood, there was no damage to the barrage itself thanks to the enhancement of the barrage structure and the electrification of the barrage gates, which enabled them to open swiftly. The renovations enhanced the safety of the barrage and allowed it to avoid excessive water pressure from the swollen river.

[10] Source: Basic Design Survey Report

3.2.2.2 More Stable Supply of Irrigation Water to the Surrounding Areas

Results from the interview surveys at the Irrigation Department in the Government of Punjab as well as the Taunsa Barrage Division Kot Adu show that both the D.G. Khan Canal and the Muzaffarugarh Canal have received water for irrigation as much as the project was targeted. The figures below show actual water conveyance to the irrigation canals. The quantity of the water to be conveyed into the canals are decided taking into account the amount of water flowing into the Taunsa Battage as well as requests made by local residents receiving the water.



Source: Data provided by the Taunsa Barrage Division Kot Adu

Figure 2: Actual Volume of Monthly Water Supply

3.2.2.3 Improvement of Barrage Safety

Since the barrage structure did not get any damage at the time of flooding in 2010, it can be considered that the safety of the barrage is improved by this project.

In addition, the beneficiary[12] survey mentioned above demonstrates high appreciation to this project, in particular, its effects brought by the renovation of the current conditions of the barrage.

Table 3: Results of the Beneficiary Survey
(Evaluation for the effects brought by this project and the current conditions of the barrage)

	Excellent	Good	Fair	Poor	Very Poor
Evaluation for the current conditions of the barrage	39	56	0	0	0

[12] The beneficiary survey was carried out targeting the following two groups available for the interview survey at the Taunsa Barrage Division Kot Adu; farmers who live within beneficiary areas surrounding the Taunsa Barage and who have received water for irrigation from the barrage, and farmers who live in areas along the Indus River, in particular the upper reaches of the barrage. The interview survey for the farmers who live along the upper stream was conducted so that the survey can take into consideration influence of the project to the occurrence of floods in their areas. The numbers of answerers in each area are: 37 people from Tahsil Kot Adu, 13 people from Basti Akhtar Wand, two people from Kot Sultan, seven people from Mouza Khokhar Walla, one person from Layya, 27 people from Tahsil Muzaffargarh and nine people from Khan.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Stabilization of Local Agricultural Production

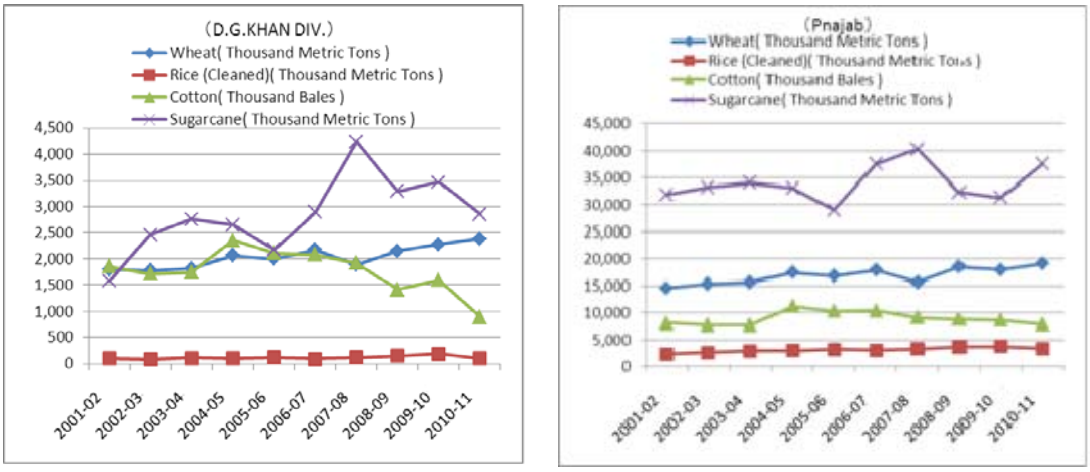
As indicated on Table 4, the above-mentioned beneficiary survey reveals people's high satisfaction with "the impact on agricultural production", "the impact on increase in agricultural revenues" and "the impact on increase in the sales amount of agricultural products", thus impact of the project is considered high.

Considering a transition of the volume of the major corps produced at the D.G. Khan area that covers a beneficiary area of this project, wheat and rice production have been generally well increasing, as shown on Figure 3. Cotton production, however, has been decreasing since the production year 2004 - 2005. As for sugar cane, the amount of its production has largely fluctuates year by year.

Although direct impact of this project on the volume of entire production cannot be easily determined, it is observed that the wheat production has been growing while the rice production has become slightly greater.

Table 4: Results of the Beneficiary Survey (Benefits brought by the Project)

	Excellent	Good	Fair	Poor	Very Poor
Impact on increase in and stabilization of entire agricultural production	51	44	0	0	0
Impact on increase in wages and earnings of crops, etc.	59	36	0	0	0
Impact on increase in the sales amount of agricultural products	63	32	0	0	0



Source: "Statistics on Punjab Development", Bureau of Statistics, Government of Punjab

Figure 3: Transition of the Production Volume of the Major Agricultural Products

3.3.1.2 Utilization of Bulkhead Gates for Other Barrage Rehabilitations

According to the basic design survey, bulkhead gates[13] used under this project can be reused for rehabilitations of the Jinnah Barrage and/or the Trimmu Barrage in the Punjab province. It is expected that the redeployment would contribute to shortening project periods and reducing project costs to be needed for renovating these barrages.

Until June 2012 when the field study was carried out, any usage of the bulkhead gates were not reported other than at the Taunsa Barrage. During the interview surveys, it was heard that a rehabilitation project would be implemented at the Jinnah Barrage in 2012 with support by the World Bank, and a plan of using the bulkhead gates on that occasion would exist.[14] As of the beginning of August 2012, however, the information was not confirmed.

3.3.1.3 Provision of Barrage Functions other than for Irrigation

According to the basic design survey, the Taunsa Barrage fulfils several infrastructural functions other than water intake for irrigation. They includes provision of water for daily life and production, a road bridge and railroad bridge as an important junction of local transportation, pipelines for oil and gas and facilities for electrical power and communication. A railroad and road constructed passing through the Taunsa Barrage have played an important role as a major transportation facility connecting Kashmore on the right bank and Kot Adu on the left bank. A high pressure oil pipeline from Karachi to the Mahmood Kot Terminal, which is owned by PARCO, was also installed on the barrage. The ensuring of the barrage functions under this project therefore resulted in stabilizing these infrastructural functions.

Since the Taunsa Barrage is an enormous infrastructure, many visitors, including groups of students from schools come to see it. Taking into consideration a situation in which the Taunsa Barrage is located on the important junction of the local transportation and the widely extended area around the barrage does not have any major recreational facilities, the Taunsa Barrage Division Kot Adu is planning to construct a recreational facility near the barrage. Although the Taunsa Barrage Division Kot Adu has not yet developed a conceptual plan for realizing this idea, it is currently looking for ways of doing so by, for example, examining methods of preparing the conceptual plan.

From results of the beneficiary survey, it can be observed that the project is highly appreciated in light of the impact as infrastructural facilities such as the road bridge.

[13] A bulkhead gate is one of the methods needed for barrage rehabilitation and for temporarily damming up water on the upstream side of the barrage. This project adopted the method in light of its air and water tightness and economic efficiency. (source: Basic Design Survey Report)

[14] Results from the interview survey at the PMO, Irrigation Department, Government of Punjab.

Table 5: Results of the Beneficiary Survey
(Impact as Infrastructural Facilities such as the Road Bridge)

	Excellent	Good	Fair	Poor	Very Poor
Usefulness as an infrastructure for road bridge etc.	53	42	0	0	0


Road and Railroad established through the Barrage

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

The upstream area of 2,832.8 hectares, including the Taunsa Barrage, is mainly designated as a nature reserve. An evaluational impact assessment was carried out for an area including the upper stream area and no notable concerns have been identified. As for Indus river dolphins that inhabit around reaches near the barrage and are designated as one of the endangered species, a conservation group has been continuously monitoring them and no negative impact has been reported. The beneficiary survey did not inform any significant impact on the natural environment either.

3.3.2.2 Land Acquisition and Resettlement

There was no land acquisition and resettlement caused by this project.[15]

3.3.2.3 Unintended Positive/Negative Impact

The project that caused changes of the amount of water flowing into the lower reaches did not transform or influence shapes of farmlands and residences in the downstream area. In addition, it did not influence water supply for drinking and agriculture during the construction period[16]. The beneficiary survey did not inform any significant impact on this matter either.

From the above observation, effectiveness and impact of this project is considered high.

Table 6: Result of the Beneficiary Survey (Impact on the Surroundings)

	Excellent	Good	Fair	Poor	Very

[15] Results from the interview survey at the PMO, Irrigation Department, Government of Punjab.
[16] Ibid.

					Poor
Evaluation for the construction process for the rehabilitation	30	64	0	0	0
Impact on farmlands and residences, caused by water flow changes	39	56	0	0	0
Impact on water for drinking and agriculture	26	66	3	0	0
Negative impact on agriculture, caused by water flow changes	30	65	0	0	0
Unintended negative impact	19	75	0	0	0
Negative impact on other natural and social environment	43	51	0	0	0

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

Outputs planned and actually obtained by this project are summarized on Table 7. Targeted gates were changed and structures of facilities and methods of constructing them were also changed or added in order to collaborate with the World Bank project, but these adjustments did not significantly modify the plan itself.

Table 7: Outputs provided by Grant Aid (Planned/Actual)

Items			Planed outputs	Actual outputs
Facilities	Construction works for rehabilitating the gates	Replacement of under-sluice gates	7	[At the time of the detail design survey] • The World Bank carried out barrage renovation during the same period. In order not to make the collaboration with the Bank complicated, gates targeted by this project were changed although the number of the gates to be rehabilitated was not modified. • A method for avoiding water leakage from the spillway gates, materials for filling rocker assembly parts, location for the bulkhead gate stockyard, a method for avoiding water leakage between the bottom of the bulkhead gates and that of the existing barrage and the quantity of gate stoppers for the bulkhead gates were modified. • A winch for pushing out the bulkhead gates was added.
		Rehabilitation of Main Weir Gates	22	
		Motorization of gate hoists	29	
		Renovation of decks on superstructure	65	
		Installation of equipment for an inclined plane	1 set	

				[At the time of the implementation] • Structures of bottom gate stoppers for the under-sluice gates and spillway gates, the number of gate stoppers installed for the bulkhead gates, a method of installing a power line diverting from an existing high-voltage line to a transformer newly set for high-voltage power and a way in which a low-voltage power supply cable crosses the railroad were modified. • Counter-weights for lifting equipment on the inclined plane of the bulkhead gates yard were added.
Equipment	Bulkhead gates Tugboats 150ps Working boats 50 ton truck crane		5 2 3 1	Procured as planned


Motorization of gate hoists (operation board set near the apparatus)


Working Boat Tugboat

3.4.2 Inputs

3.4.2.1 Project Cost

The actual cost expended for this project was 4,861 million yen, while the grant limit set for the project (main construction work) was 5,165 million yen. Thus, the actual cost is lower than planned (94%).

Table 8: Planned and Actual Project Cost (million yen)

				Planned cost	Actual cost
Facilities	Construction works for rehabilitating gates	Replacement of under-sluice gates	Component-1	5,165	4,007
		Rehabilitation of Main Weir Gates Motorization of gate hoists	Construction Cost (Direct cost) (Other cost) Design and administration cost		3,761 (2,909) (852) 246
		Renovation of decks on superstructure			
		Installation of equipment for the inclined plane			
Equipment	Bulkhead gates		Component-2		678
			Equipment cost Design and administration cost		649 29
	Tugboats 150ps Work boats		Component-3		114
			Equipment cost Design and administration cost		109 5
	50 ton truck crane		Component-4		62
			Equipment cost Design and administration cost		60 2
Total					4,861

3.4.2.2 Project Period

At the time of ex-ante evaluation, the project duration foreseen was approximately 50 months, including a period necessary for developing a detailed design of the project. The project, however, actually needed 45.5 months from the signing of exchanges of notes on February 17, 2005 to the completion of the project on December 1, 2008, which is within the planned period (91%).

The project period was shorten because the implementing agency adopted a new strategy for terminating construction work of this grant aid project before the completion of the project financed by the World Bank. Responding to this request and considering the fact that two projects have been implemented in a complementary manner, a method developed by the World Bank for constructing temporary facilities was applied to this project as well, and it results in the shortening of the project period.[17]

[17] Based on an interview survey to a Japan-based consultant

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

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance[18]

Operation and maintenance of the Taunsa Barrage Division has been conducted by the Taunsa Barrage Division, Kot Adu, which is headed by the Executive Engineer, falling in the jurisdiction of the D.G Khan Irrigation Zone, of the Irrigation Department, Government of Punjab. The entity responsible for the maintenance of the barrage remained unchanged.

When the basic design survey was conducted, three Sub Divisions engaged in general affairs, drawing and accounting were observed within the Taunsa Barrage Division Kot Adu that needed to implement this project. Now that the project was completed, the Division is only engaged in management and operation of the barrage and currently functioning with three Sub Divisions dealing with operational management, workshops and dikes. Along with the restructuring, the number of staff was reduced and about 300 staff members, including 27 people responsible for general affairs, are currently working for the Division. Staff members working for each section are supervised by a chef director, and their numbers are 168 people for the Head Works Sub Division, 114 people for the Workshop Sub Division and 21 people for the Dike / Bund Sub Division.

Since this structure was previously used for operating and maintaining the Taunsa Barrage, there are no particular concerns identified.

Table 9: Composition of the Personnel in the Taunsa Barrage Division Kot Adu (people)

	Sub Engineer	Staff members	Total
Head Works Sub Division	6	162	168
Workshop Sub Division	6	108	114
Dike / Bund Sub Division	3	18	21
Total	15	288	303

Source: prepared by using data provided by the Taunsa Barrage Division Kot Adu

3.5.2 Technical Aspects of Operation and Maintenance

The number of staff members who belong to the Taunsa Barrage Division Kot Adu is, in total, 236 people, 120 people of which work for the Head Works Sub Division, 98 people for the Workshop Sub Division and 18 people for the Dike / Bund Sub Division.[19] As for composition

[18] Based on results of interview surveys at PMO, Irrigation Department, Government of Punjab and the Taunsa Barrage Division Kot Adu.

[19] Data provided by the Taunsa Barrage Division Kot Adu

and capability of these staff members, the interview survey at the Irrigation Department did not show any particular concerns. Answerers of the survey indicated that the organizational structure had not so far caused any problems, enough number of staff members had been hired and techniques necessary for the operation and management kept high standard.

Training and technical guidance have been provided as needed, but not regularly. However, a practical training in maintenance for and installation of bulkhead gates is carried out with using tugboats once a year so as to maintain technical levels of the staff members.

Thus, there are no concerns observed in technical aspects related to the operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

Financial resources for operating the Taunsa Barrage Division Kot Adu come from a budget allocated by the Irrigation Department, Government of Punjab and revenues from the road bridge tolls.

The breakdown of the planned budget and actual expenditure in 2010 is shown on Table 10. While the planned budgetary allocation from the state government was 123.863 million Pakistani rupees, the actual expenditure was 117.033 million Pakistani rupees. In other words, the actual expenditure was within the planned budget. Thus financial resources for operating and maintaining the Division are ensured. It is also noted that the cost for purchasing spare parts listed on Table 10 covers cost needed for daily consumables.

The field study as well as the interview survey at the Taunsa Barrage Division Kot Adu did not reveal any concerns on current expenditures used for operating the Division. It is therefore expected that budget related to the Taunsa Barrage Division Kot Adu would be allocated in the same manner in the future.

Table 10: Planned Budget and Actual Expenditure for the Taunsa Barrage Division Kot Adu (FY 2010) (Million Pakistan Rs.)

		Planned budget	Actual expenditure
State government budget allotment		**123.863**	**117.033**
Breakdown	Regular operation cost/recurrent cost (excluding wages and utility cost)	65.19	61.74
	Staff member wages	56.00	52.62
	Utility cost (Electricity, Water, etc.)	1.00	1.00
	Cost for purchasing spare parts	0.05	0.05

	Repair cost (furniture and fixtures)	0.023	0.023
	Telecommunication cost	1.58	1.58
	Others	0.02	0.02

Source: Data provided by the Taunsa Barrage Division Kot Adu

3.5.4 Current Status of Operation and Maintenance

Concerning operations for opening and closing the water gates, no problems were found through interview surveys and inspections conducted during the field study.

In addition, maintenance and inspection for facilities and equipment are conducted based on a checklist itemizing inspection periods and inspection methods in a detailed manner. The list is composed of 41 items on the operation system for opening and closing the gates, 17 items on electric opening and closing operations and 10 items on other general functions. Currently no problems have emerged.

Storage facilities for workshops constructed on the project site were damaged by the flood occurred in 2010 and machine parts and spare parts for electric equipment having been stored there were inundated and unusable. The supply of these parts remains a future challenge.[20]

As mentioned above, some minor problems have been observed in terms of the maintenance of facilities and equipment, therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to provide stable irrigation water for areas surrounding the Taunsa Barrage by renovating its facilities. For this objective, the project seeks to reduce the risk of collapsing dikes at the surrounding areas as well as the barrage itself when the water level rises, and to secure the amount of intake water brought by the barrage. By doing so, the project is expected to contribute to improving fundamentals of local people's lives.

After nearly 50 years had passed since the construction of the Taunsa Barrage, its gates as well as hoists for opening and closing the gates needed to be urgently renovated and a maintenance system of the barrage required its improvement. Since this project corresponds to a priority area of Japan's ODA policy as well, its relevancy is high. As for effectiveness and impact of this project, they are considered high as expected results of this project, such as "recovery of the quantity of intake water for irrigation" and "improvement in gate operations and reduction of flood damage by motorizing the gates", have been achieved. In addition, there was no

[20] Based on results from interview surveys conducted during the second field survey.

significant change in the outputs of the project, and both project cost and project period were within the plan, thus efficiency is high. For sustainability, some minor problems were observed in the current status of operation and maintenance, therefore it is considered fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

The flood in August 2010 did not damage the body structure of the Taunsa Barrage itself. It can be interpreted that the project brought a positive impact on the barrage. The flood, however, demolished left-bank dikes located approximately 10 km upstream from the barrage and caused widespread damage to the surrounding areas, including facilities for barrage management. Considering these situations, it is expected that maintenance of dikes and riverbeds near the barrage would be enhanced, along with continuous maintenance of the Taunsa Barrage itself.

Some equipment and parts having been supplied by this project were ruined by the flood. Since no plans for procuring and replacing them have not been developed so for, measures to address this situation need to be examined in future.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

None

People's Republic of Bangladesh

Ex-Post Evaluation of Japanese Grant Aid Project
The Project for the Establishment of the Meteorological Radar System at Moulvibazar

External Evaluator: Atsuko Kawauchi, T. & Associates, Inc.

0. Summary

The objective of this project is to mitigate damage caused by flooding and severe storms through installing a new metrological radar system in northeastern Bangladesh, which was out of observation range of the existing meteorological radar observation network.

As Bangladesh is a disaster prone country, this project – whose objective is to issue timely flood and storm forecasts and warnings – is relevant to national policies and development needs in Bangladesh and relevance of the project is high. Although observation activities at the Moulvibazar meteorological radar station (hereafter referred to as Moulvibazar radar station) were interrupted several times for the first two and half years, it is now in full operation with regular observation activities. This project enabled the Storm Warning Center (SWC) to carry out meteorological observations for the whole of Bangladesh, as well as mountain areas in Indian Territory. This has contributed to improving the timeliness of various warnings. Nevertheless, forecasts and warnings on flash floods have not yet been achieved. For this reason, the effectiveness of this project is fair. There are no major changes in the outputs of the project, project period or project cost. As the project was completed as planned, efficiency is high. In terms of the operation and maintenance structure of Moulvibazar radar station, some posts were not approved and the total number of personnel decreased compared to the plan. Yet personnel of the Bangladesh Meteorological Department (BMD) have the fundamental technical skills for operation and maintenance of the radar system in general. Additionally, there are various programs aiming at strengthening skills and capacities. Finally, BMD provides a sufficient budget for operation and maintenance of the radar station. Based on this analysis, sustainability of the project is evaluated to be fair.

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

1. Project Description

Project Location

Moulvibazar Radar Tower

1.1 Background

Bangladesh has a number of rivers, including three major rivers which river sources are outside of the country and more than 200 mid-scale ones. Low-lying flat delta is 80% of its land and 50% of the total land is lower than seven meters above sea level. This geography is a major source of widespread flooding every year, which covers at least 20% of the land. Along with this, the country has a huge number of poor people dependent on agriculture for living. These geographical and sociological features have made Bangladesh very vulnerable to natural disasters, which are major setbacks for national economic development and enhancement of poor people's living standard, as well as the improvement of environmental and hygienic conditions.

Despite such a pressing situation, the existing meteorological radar observation network did not allow BMD to collect required rainfall and hydrological data, especially in the northeastern area of Bangladesh, the Meghna upper river basin and the Megharaya Hills, which last are Indian Territory well-known for heavy rain. Current systems installed in the Ranghupur and Dhaka radar stations, in particular, are systems which output precipitation intensity, with no capacity to produce and process the required rainfall data for flood forecasting. Consequently, it was difficult for Bangladesh to issue timely and accurate forecasts and warnings for heavy rain, storms (locally called "Nor'westers"), and flash floods, especially in the northeastern area. Before this project, number of river vessel accidents and casualty toll was increasing due to rain storm with tornado during pre-monsoon. To improve this situation, provision of timely and accurate meteorological information to disaster prevention agency and citizens is of an urgent necessity in Bangladesh.

1.2 Project Outline

The objective of this project is to mitigate damage caused by floods and storms by installing a metrological radar system in northeastern Bangladesh. The radar was expected to make it possible to observe the upper Meghna river basin and the Meghalaya Hills in Indian Territory, which was out of observation range of the existing Doppler radar systems in use at that time. This would allow Bangladesh to conduct necessary rainfall estimation in those areas, as well as the Dhaka Metropolitan areas, to forecasts storms and floods, including flash floods.

Grant Limit / Actual Grant Amount		1000 Million JPY / 999Million JPY
Exchange of Notes Date		June 2007
Implementation Agency		Bangladesh Meteorological Department (BMD)
Project Completion Date		March 2009
Main Contractor	Contractor (Equipment)	Mitsubishi Corporation/Fukuda Corporation JV
	Consultant	Japan Weather Association
Basic Design		13 June 2006 - 22 Feb 2007
Related Project		[Technical Cooperation] "The project on Human Capacity on Operation of Weather Analysis and Forecasting" (2009-2012) [Grant Aid]: The project for Replacement of Weather Surveillance Radars"(1986-88), "The project for Improvement of Weather Warning Services related to Natural Disasters"(1997-99), The project of Improvement of Meteorological Radar System at Cox's

	Bazar and Khepupara (2005-2008)

2. Outline of the Evaluation Study

2.1 External Evaluator

Atsuko Kawauchi (T. & Associates, Inc.)

2.2 Duration of Evaluation Study

Evaluation Period: December 2011 – September 2012
Field Survey: 21 January – 19 February 2012, 12 May – 23 May 2012

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

At the time of the basic design study of this project, Bangladesh was implementing Poverty Reduction Strategy Paper (2005). In this strategy, natural disasters such as floods, heavy storms, and cyclones were recognized as a huge threat to the society and economy of Bangladesh. The strategy highlighted the importance of establishment of a disaster management system, including an early warning system. The National Strategy for Accelerated Poverty Reduction II Revised (2010) is along the same lines, identifying the development of disaster management system and strengthening of capacity in meteorological forecasting with timely forecasts and warnings on cyclones and floods as a national priority.

In The National Plan for Disaster Management 2010-2015, formulated by the Disaster Management Bureau, a report from the Intergovernmental Panel for Climate Change was mentioned, noting an increasing vulnerability to climate change and the risks of heavy storms and floods in the future.

In response to such situations, the 6th 5-Year Plan (2011-2015), shifted the focus of disaster management from provision of assistance in post-disaster situations to prevention of potential damage in the future. For such preventative action, accurate meteorological forecasts are critical and therefore, it can be said that this project has been in line with the development plan of Bangladesh.

3.1.2 Relevance with the Development Needs of Bangladesh

Bangladesh is one of the most disaster-prone countries in the world, with 10 million people affected by natural hazards every year on average. During 1990-2008, the country incurred an annual loss of US$2,189 million (1.8% of annual GDP) from disasters.[3] Each year, the damage caused by floods and flash floods during monsoon and rainy season from November to March is significant, especially for the poor and farmers. The flood of the Meghna river in 2004, for example, affected 38% of the total land of Bangladesh and resulted in the loss of 747 human lives, crop damage equivalent to 330 million USD and the prevalence and outbreak of infectious diseases.[4] In recent years, large scale natural disasters frequently occurred: Cyclone Sidre in 2007 and Cyclone Aila in 2009. Therefore, more accurate meteorological data and early warnings are a life or death matter in Bangladesh. Therefore, the project is consistent with development needs

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③ : High, ② : Fair, ① : Low
[3] Planning Commission of Bangladesh, 6th 5-Year Plan, 2011-2015
[4] Planning Commission of Bangladesh, 6th 5-Year Plan, 2011-2015

in Bangladesh.

3.1.3 Relevance with Japan's ODA Policy

Disaster management was recognized as a priority sector by the Country Assistance Program for Bangladesh (May 2006), of the Government of Japan. Even before issuance of this policy document, Japan provided various assistance in the field of meteorological observation, such as establishment of the Cox's Bazar and Khepupara Radar Systems. This project in Moulvibazar is well positioned in the series of assistance, and sets a new radar system in the northern area of Bangladesh, which was outside of the effective observation range of existing Doppler radar stations. Moreover, this is the key project, which should integrate the previous projects: this project installed a satellite communication system to link all the radar stations – including the one in Moulvibazar. This enables BMD to undertake nation-wide meteorological observation in a unified format. For this reason, the project is highly consistent with Japan's ODA policy as well as its past assistance in the meteorology field. Another on-going technical assistance project, "The project on Human Capacity in Operation of Weather Analysis and Forecasting," is also highly relevant to this project since the technical assistance is aiming at building the capacity of engineers at the radar stations, as well as forecasters.

Based on the above analysis, 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 Effectiveness[5](Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Operation of the Radar Station

Moulvibazar radar station was handed over by Japan on 5 March 2009. Nevertheless, it could not commence full operation for its first year as approval of commercial power supply was not given by the Bangladesh Power Development Board. During that period, the radar station was forced to operate only for limited hours with own generators.[6] The commercial power supply finally started in April 2010 and the radar commenced full operation. However, due to fluctuations in power, and frequent blackouts, defects of some critical equipment in the radar system resulted. These equipment troubles interrupted radar operations from time to time[7].

The actual situation of radar operation is described in Table 1. During the time radar did not have any troubles, two (dry season) to seven times (rainy season) observations were conducted, in principle.

Table 1 Operation Situation of Moulvibazar Meteorological Radar System

Period	Operation
5 March 2009	Completion of the Project
March 2009 – March 2010	No commercial power supply. The radar system operated on generators. Limited operation only (approximately two observation per day).

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

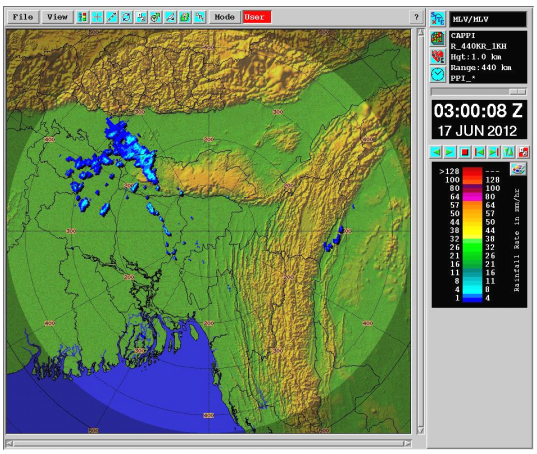
[6] The reason for delay in approval was a nationwide, severe shortage of electricity.

[7] When Moulvibazar radar station was not in operation, BMD conducted observation activities with the existing radar network (Cox's Bazar and Khepupara radar stations etc).

2 – 14 April 2010	Hard disk defect in the radar control system. Repaired by BMD engineers with the technical advice of the manufacturer. Observation activities were disturbed/halted during this period.
15 April 2010 – 3 August 2010	Normal Operation
4 August 2010 – 18 October 2010	Motherboard defect of the radar control system due to frequent power turn over. Repaired by BMD engineers with two Japanese radar manufacturer's engineers dispatched to Bangladesh for 15 days. Observation activities were disturbed/halted during this period.
19 October 2010 – 9 December 2010	Normal Operation
10 December 2010 – 11 July 2011	Defective radar video processor. It was sent to Japan and repaired with support of Japanese consultants of technical cooperation project. Observation activities were disturbed/halted during this period.
12 July 2011 – Present	Normal Operation

Source: BMD

Since July 2011, Moulvibazar radar station has been in full operation with two types of observation activities. One is called "normal observation," in which observations are conducted twice during the dry season and approximately eight times during the rainy season. The other one is called "special observation," and that is for emergency situation, such as heavy rain, storms and cyclones that requires continuous attention. The observations are usually conducted without any breaks until the emergency situation is settled. The observation data is sent to SWC in real time through satellite communication system.

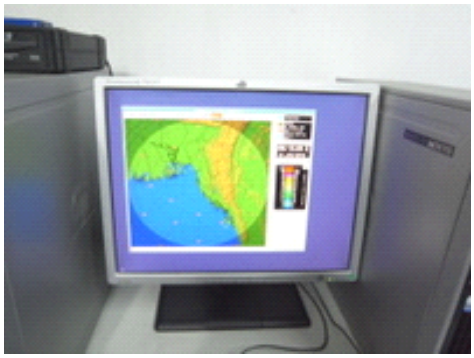


Radar image produced by Moulvibazar Meteorological Radar System
Source: BMD HP

(2) Nation-wide precipitation data and the composite radar picture

One of the expected results of this project is to accomplish observation of rainfall in whole Meghna river basin. The effective observation range of Moulvibazar radar is 200 km, covering not only Bangladesh but also the Meghalaya Hills and upper basin of Meghna River in Indian territory. In parallel to this, the meteorological radar data

produced by the Dhaka and Rangpur Meteorological Radar Systems were upgraded from 3-bit to 8-bit in this project. As a result, the data produced by all the radar systems were unified. This has enabled SWC to generate a composite picture of precipitation intensity by combining the data produced by all the radar stations in the country. Consequently SWC and Flood Forecasting and Warning Center (FFWC) are able to conduct real-time observation of rainfall intensity.[8]



Left: The Doppler radar installed inside the radar tower in Moulvibazar
Right: The meteorological data display system installed at SWC

Colum: Roles and functions of SWC and FFWC in disaster management

Disaster Management in Bangladesh is guided by a number of drivers. Among others, "Standing Orders on Disasters" formulated by Bangladesh Disaster Management Bureau (DMB) defines roles and functions of key actors, such as the Ministry of Defense, the Military, the Ministry of Agriculture, municipalities, NGOs, Media and so on. SWC and FFWC play an important role since warnings issued by them are the first trigger of a series of emergency actions and post-disaster assistance. Particularly in terms of flood warnings, cooperation between FFWC, which monitors hydrodynamics, and SWC, which collects meteorological parameters, is essential to promote rapid action.

<SWC>
SWC is a department of BMD, responsible for providing weather forecasts (regular bulletins) every morning, and for sending to relevant agencies and organizations via Fax and Email. Recipients number approximately 30, including Ministries, FFWC, NGOs, power companies, government agencies and DBM. Special bulletins provided for cyclone are usually sent to 65 organizations. The radar image and weather forecast are posted on the BMD website, available for public access.

<FFWC>
Established as a permanent entity of the Bangladesh Water Development Board, FFWC's functions are to collect hydrological data at the observatories across the country, to manage flood forecasting models, and to provide flood forecasting and warnings via Fax and Email to relevant organizations and agencies. FFWC is active during the monsoon period.

[8] According to the engineers at Dhaka Radar Station, the data communication speed was tremendously improved as a result of the 8-bit improvement and installation of the satellite telecommunication system. The time necessary to send data from Dhaka radar station to SWC is approximately 2.5 minutes including the time necessary for scanning the radar image.

(3) Heavy Rain and Storm Warnings

The basic design of this project expected to provide a warning for Nor'Wester and heavy rainfall within one hour after detection of such phenomena, and update every hour, instead of every six hours, as was the case before the project. According to the personnel of BMD and SWC, the timeliness of warnings has improved after the project. At the time of evaluation (2012), forecasters at SWC usually issued warnings within five to ten minutes after detecting such phenomena by radar. However, there is no systematic database on the timing of forecasts and warnings, and it was difficult to confirm the average timeliness of warnings. Also, the frequency of warning updates after the first one depends on the development of rain clouds and weather conditions. It turns out that frequency of updates does not have to be necessarily every hour.

Just to take one example, one past record of a warning by SWC shows that a Nor'Wester warning was issued on 16 April 2010 to 14 Districts, including Shylet and Mymensingh, based on data collected by the Moulvibazar radar. Shylet was outside of the effective range of the existing radar network before establishment of Moulvibazar radar and this project contributed to more region-specific warnings.

(4) Flood and Flash Flood Warnings

There are four types of floods in Bangladesh,[9] and FFWC was able to issue warnings only on monsoon river floods, based on the current flood forecasting model. One of the expected results of this project is to improve accuracy and timeliness of overall flood warnings. Among all types of flood warnings, flash flood warnings are particularly foreseen as a result: the basic design sets the target, stating "flash flood warnings will be issued every hour to the public by FFWC after detection of heavy rainfall by the meteorological radar system."

The analysis made by this evaluation shows that the project has contributed to improving monsoon river flood warnings since FFWC has been using weather data and precipitation data provided by BMD. However, regionally specific flash flood warnings, which is particularly expected as a result of this project, have not been achieved yet and there are still several steps to be taken.

Table 2 Realization of Flash Flood Warnings

Year	2007 (Baseline)	2010 (Target)	2011	2012
Result	Not able to issue warnings	Not able to issue warnings	Not able to issue warnings	Qualitative Assessment

Source: Based on interviews with FFWC officers

[9] 1) Monsoon River Floods: a slow rise of water levels in the main rivers caused by heavy rainfall in the upper river basins;
2) Flash Floods: mainly caused in the pre-monsoon season by intense heavy rainfall generated by the humid southwest monsoon in the mountainous areas in Indian Territory. These can also occur after the pre-monsoon season;
3) Local Rainwater Floods: caused by local heavy rainfall during the monsoon period. When river level is already high, undischargeable rain water is flooded at low lying delta area. ;
4) Storm Surge Floods: a coastal phenomenon forced by cyclonic storms in Bay of Bengal during the monsoon period. The combination of heavy rainfall and extra high tide caused by tropical cyclones may rise river level of lower Meghna basin, and results in flood by backwater.

There are several obstacles to achieving flash flood warnings; one major issue was the unstable operational condition of the Moulvibazar radar system itself until July 2011. For instance, when a devastating flash flood affected several districts such as Sunamganj district in March 2011, Moulvibazar radar was not in operation as previously mentioned. However, at the time of flash floods in May 2012, FFWC was able to forecast the rise of the river level and the forecast was publicly announced. In this assessment, meteorological information provided by BMD was effectively utilized by FFWC. While this is one achievement of the Moulvibazar project, this forecast was still a qualitative assessment based on forecasters' knowledge, rather than that based in numerical data analysis. In the long run, shifting to forecasting based on a numerical model is desired.

In order to issue accurate flash flood forecasts in the future, both BMD and FFWC point out the necessity to develop a model specializing in flash floods based on numerical analysis. However, before developing such a model, there are still issues to be resolved. Firstly, the meteorological data display system installed at FFWC by the project was still out of operation when FFWC was visited for this evaluation. Naturally, FFWC was not using the data sent by the radar in real time. Instead, FFWC used only BMD's weather bulletin, sent by fax and email every morning. Although troubles with the display system were caused by a minor problem and it could be fixed easily, FFWC was awaiting a technician sent by BMD. It seems that responsibility for O&M of this display system remains unambiguous.

Secondly, it is uncertain whether the current capacity of FFWC and SWC can provide accurate flash flood forecasts and warnings even if troubles with the display system are solved. In theory, it is feasible to forecast flash flood to some extent by inputting meteorological data into the current flood forecast model of FFWC. However, in order to do that FFWC needs to analyze those meteorological data together with hydrological data, such as river levels as collected by FFWC. However it does not seem FFWC has sufficient human resource to do such additional work. Moreover, in order to develop and operate a specialized model for flash floods in the long run, FFWC needs to take water level data at more points and BMD needs to provide calibrated rainfall data to FFWC. BMD is currently working on calibration through Japanese technical cooperation. According to FFWC, the development of a new model for flash flood forecasting will require budget and capacity, and it will take at least three to five years.[10]

3.3 Impact

3.3.1 Intended Impacts

(1) Mitigation of Disaster Damage

The evaluation encounters difficulty in quantitatively assessing how the project has impacted the mitigation of disaster damage mainly for two reasons. First, the Moulvibazar radar had limited hours of operation until July 2011. Secondly, after the completion of the radar in 2009, the overall weather conditions were stable and there were almost no large-scale disasters with heavy rains and flooding.

Yet, according to interviews with some beneficiaries of the project, such as the Department of Agriculture Extension at the Ministry of Agriculture and NGOs,[11] the

[10] According to FFWC, it takes one to two years to develop an initial model and then it requires two monsoon seasons for testing.

[11] Community Managed Disaster Risk Reduction Forum: CMDRR Forum which has worked on community-level disaster management.

overall timing of warnings from SWC and FFWC was improved, and consequently the lead time to floods and storms became longer. The Director of BMD explains this change as a contribution of the Moulvibazar radar station. In Bangladesh, rain clouds tend to move from north to south and the new radar in the northern area helped to detect rain clouds with earlier timing, which enables to lengthen the lead time.

With regards to the accuracy of forecasts, however, there is still room for improvement, as pointed out by DMB, NGOs and the BMD itself. The current forecast by SWC is subjective, based on forecasters' experience and knowledge. In addition, the forecast covers only a short period and is difficult to extend over a few days. To shift forecasting into more objective ones based on a numerical model, it is important to systematically collect past meteorological data, improve calibration analysis and develop the capacity of meteorologists to properly run the whole forecasting system. Currently, the training for development and operation of the model is conducting by Japanese cooperation "The project on Human Capacity on Operation of Weather Analysis and Forecasting". It is expected this project contribute to improving the accuracy of forecast in the long run.

(2) Other Impacts

Dhaka International Airport is within the effective observation range of the Moulvibazar radar. In the airport, a meteorological data display system was installed with funds from Government of Bangladesh (GoB). Before the project, Dhaka International Airport depended on data provided by Dhaka radar, which is not a Doppler system. Now with the Moulvibazar radar, the airport traffic controller can receive various data such as wind speed, direction of wind, and the sudden change of wind in certain areas in real time. This has contributed to improvement in commands from the airport controllers to pilots and airline companies, and the overall safety of aerial navigation.[12]

3.3.2 Other Impacts

The land of Moulvibazar radar station was originally owned by Bangladesh Water Development Board and transferred to BMD specifically for this project. Therefore, there was no acquisition of land or involuntary resettlement. Also no impacts on the environment have been reported.

In summary, although the Moulvibazar radar was not fully operational for the first two and a half years, it is now in full operation and normal observations are being undertaken. This has made it possible for SWC to observe the mountain areas in Indian territory, as well as the whole of Bangladesh. Consequently the timeliness of warnings has improved, which contributed to mitigation of disaster damage to some extent. Also, the project generated a positive impact on the safety of aerial navigation. With regards to flash flood forecasting and warnings, FFWC uses data acquired by Moulvibazar radar for assessment of floods, including flash flood. However, FFWC needs to make more effective use of the installed equipment to attain more accurate forecasts and warnings on flash floods.

Based on the above findings, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

[12] Interview with BMD Head Office and Ministry of Defence.

Table 3 Major equipment and facilities

Equipment and Facilities	Location of Installed Equipment	Change from the Basic Design
Meteorological Radar System	Moulvibazar Meteorological Radar Observation Station	None
Meteorological Radar Data Display System	Moulvibazar Meteorological Radar Observation Station, Dhaka Meteorological Radar Observation Station, SWC, FFWC	None
Meteorological Data Satellite Communication System	Moulvibazar Meteorological Radar Observation Station, SWC, FFWC, Rangpur Meteorological Radar Observation Station	None
Existing Radar System 8-bit Improvement	Dhaka Meteorological Radar Observation Station, Rangpur Meteorological Radar Observation Station	None
Meteorological Radar Tower	Moulvibazar Meteorological Radar Observation Station	Slight Modification (Pavement area of exterior ditch, etc.)

Source: JICA

There were no major modifications to the project made from the basic design. With regards to the facility of the radar tower, however, there were several minor changes as shown in Table 3.[13] Those changes have no effect on the technical capacity of the radar itself and it appears that those are reasonable changes based upon necessity. Other components such as the installation of meteorological display systems for SWC and FFWC, as well as the improvement to 8-bit at the Dhaka and Rangpur radar stations were completed as planned. The installation of meteorological display systems at the Prime Minister's office, TV Center, and Dhaka International Airport were completed by GOB, as planned.

3.4.2 Project Inputs

3.4.2.1 Project Cost

Compared to the planned project cost of 1,000 million JPY, the actual project cost was 999 million JPY (99.9 percent compared to the plan); the project was completed within the planned cost. There was no change in the GoB side and the actual cost was 208 million Yen, as planned. The components which GoB was responsible for were to secure bank fees, to provide exemption from customs duty, removal of existing facilities, ground leveling of the site, and to obtain the VSAT user license, which cost approximately 204 million yen. The installation of display systems at various locations such as the Prime Minister's office, Bangladesh TV Centre and Dhaka International Airport cost 2.4 million yen.

3.4.2.2 Project Period

This project was initiated in August 2007 and completed in March 2009. The entire project period was 20 months, (100% compared to the plan) and it was completed as planned.

[13] Documents provided by JICA.

Both project cost and project period were mostly as planned, therefore efficiency of the project is high.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

(1) Operation and Maintenance (O&M) Structure of Moulvibazar Radar Station

The basic design study of this project suggests that Moulvibazar radar station be operated with 27 personnel/posts. However, the approval process for establishment of posts by relevant ministries was delayed. In response, BMD assigned eight temporary staff members to start up the operation. After the resignation of one, the radar was operated by the remaining seven at the time of ex-post evaluation. There has been no problem with this number, at least during the dry season, as observation hours are limited. In the rainy season, however, when observation hours are longer, the workload for the staff is quite heavy. Besides, some tasks, such as cleaning, have to be done by technical staff, as the janitor post is still vacant. There are no guards either to dates.

In May 2012, 15 posts were finally approved by the Ministry of Finance, instead of 27 posts. The whole operation structure is compact, with assistant positions (e.g., electronic assistants) and support staff such as drivers, abolished.

Table 4 Number of planned and approved posts in Moulvibazar Radar Station

Posts	Planned Number	Approved Number
Senior Electronic Engineer	1	1
Assistant Electronic Engineer	1	0
Assistant Communication Engineer	1	0
Assistant Meteorologist	1	1
Electronic Assistant	6	3
Foreman	1	1
Mechanic	5	3
MLSS	3	1
Guards	5	3
Gardener ・ Janitor	2	2
Driver	1	0
Total	27	15

Source: BMD

Compared to the operation structure of the Khepupara and Cox's Bazar radar stations, the structure of Moulvibazar radar station does not differ significantly. Khepupara and Cox's Bazar radar stations are operated by 18 personnel and 15 personnel respectively. BMD originally requested 27 personnel, considering the possible disapproval of certain posts. Therefore in the view of the Director of BMD, 15 personnel should be adequate for the operation of Moulvibazar radar station.[14]

After recruiting and assigning staff for those 15 posts, the current seven will be transferred after a transition period. BMD explains that the current staff will provide OJT to new staff on the O&M of the radar. Only after confirming smooth operation by the new staff member, the transfer of the current staff member is carried out. Obviously,

[14] The current radar operator of Moulvibazar confirmed that it is possible to operate the Moulvibazar radar with 15-17 personnel.

sustainability of the project depends highly on the progress of recruitment and the consolidation of the operation structure. Therefore, completion of the recruitment and assignment process is desirable.

(2) O&M Structure of FFWC
FFWC is composed of seven management staff and 15 regular staff, a total of 22 personnel.[15] For emergency situation caused by floods, 14 additional staff members are usually assigned and 36 can be engaged in total. However, it seems there are frequent transfers of staff at FFWC, and job hand-over and technical skills transfer does not take place in a systematic manner.

3.5.2 Technical Aspects of Operation and Maintenance
(1) Operation and Maintenance capacity of Moulvibazar Radar Station
In general, there is little concern about BMD's technical capacity since many personnel have engaged in O&M of the two Doppler radar systems at Cox's Bazar and Khepupara. In the case of Moulvibzar radar station, at least two engineers previously worked in Cox's Bazar and Dhaka radar station, and also received training when the Moulvibazar project was completed.

The radar system in Moulvibazar experienced some major breakdown which forced the radar system to stop its operation during first two years. According to BMD, these problems had nothing to do with management or the technical capacity of BMD, but were caused by the frequent turn-down of electricity. It was difficult for BMD engineers alone to deal with problems of delicate equipment (e.g., with hard disks and video processors) so the repair work was requested of the manufacturers and the agent in charge of after-sales care. Other minor troubles were solved by the engineers and technicians at Moulvibazar. This demonstrates their O&M capacity to a certain degree.

In the future, if a major breakdown occurs again, it might be difficult for BMD alone to deal with it, depending on the nature of the problem. However, as discussed in section 3.5.4., BMD has already taken some precaution measures. Besides, capacity-building activities were undertaken to strengthen O&M capacity. First, lecture and OJT on O&M of Doppler radar were conducted as a part of an on-going technical cooperation project; personnel at Moulvibazar took this training. Secondly, a handy summary of the O&M manuals for the radar were prepared in the same project. Lastly, almost all the Moulvibazar personnel participated in the training session of O&M recording system.

BMD HQ also initiated a capacity development program called “Knowledge Exchange Program.” Its purpose is to share knowledge on O&M and troubleshooting among experienced staff and new staff across different radar stations.

(2) Operation and Maintenance capacity of FFWC
The staff who participated in OJT for this Moulvibazar project were already transferred and it seems FFWC currently does not have adequate capacity to carry out O&M of the equipment installed by the project. At present, BMD always sends technicians to deal with any kind of malfunction, but this needs to be handed over to FFWC in the long run. However, FFWC has good capability at maintaining databases on hydrologic data compared to SWC, and it seems there is high potential to effectively utilize the equipment if proper training is provided. In 2012, there is a plan to send two personnel from FFWC

[15] From FFWC HP.

to JICA training in Japan on disaster management training which is expected to contribute to strengthening capacity of FFWC.

3.5.3 Financial Aspects of Operation and Maintenance

In the basic design study, the annual O&M budget for Moulvibazar radar station was estimated as 5.31 million Taka. The actual budget of FY 2010 was 4.05 million Taka, below the estimate. However, the FY 2011 budget was 7.03 million Taka which is more than the estimate. In 2011, 1.43 million Taka was specifically secured for O&M of the radar. This is the largest budget among all the radars. In the last three years, BMD HQ budget shows steady increase and therefore no budget issue is foreseen.

Table 5 Annual Budget of BMD Head Office and Moulvibazar Radar Station

(BDT 1,000)

	2009-10	**2010-11**	**2011-12**
BMD HQ			
Personnel Expense	45,000	46,000	50,000
Consumable Cost	3,500	4,000	5,500
Utility Cost	4,000	4,100	4,500
Spare Parts	37,000	41,000	65,000
Telecommunication	9,000	9,500	10,000
Space Segment	1,500	1,700	2,500
Total	**100,000**	**106,300**	**137,500**
Moulvibazar Radar Station			
Personnel Expense	N/A	2,500	3,880
Consumable Cost	N/A	300	710
Utility Cost	N/A	450	1,010
Maintenance Cost	N/A	800	1,430
Total	**N/A**	**4,050**	**7,030**

Source: BMD

Note: Recurrent expenses in 2009 were covered by the development cost of Moulvibazar radar station. The budget was provided from FY 2010 only.

3.5.4 Current Status of Operation and Maintenance

The radar tower and facility of Moulvibazar is in generally good condition and even entering with one's shoes on is prohibited. The equipment is kept clean, as cleaning is periodically done by staff at the radar station. Maintenance, check-ups and inspection of the facility and equipment are conducted on a pre-determined cycle (e.g., daily, weekly and monthly). The manuals are properly stored and used, and spare parts such as discs, consumable goods for electronic device, batteries, nails, screws and bolts are properly stored in the cabinets. There is no problem in procurement of spare parts in general.

To avoid further troubles caused by unstable electricity levels, it is planned to operate with not only commercial power supply but also self-generated electricity during observation hours. Fuel for generators has been also adequately secured. BMD also purchased power supply units for future preparation.

Based on the above findings, some problems have been observed in terms of O&M structure, therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendation

4.1 Conclusion

The objective of this project is to mitigate damage caused by floods and severe storms by installing a new meteorological radar system in northeastern Bangladesh which was out of observation range of the existing meteorological radar observation network at that time.

As Bangladesh is a disaster-prone country, this project – the objective of which is to allow for the issue of timely flood and storm forecast and warnings – is relevant to national policies and development needs in Bangladesh and relevance of the project is high. Although the observation activities at the Moulvibazar meteorological radar station (hereafter referred to as Moulvibazar radar station) were interrupted several times for the first two and half years, it is now on full operation with regular observation activities. This project enabled SWC to carry out meteorological observation over the whole of Bangladesh, as well as mountain areas in Indian Territory. This has contributed to improvements in the timeliness of various warnings. Nevertheless, forecasts and warnings on flash floods have not yet been achieved. For this reason, the effectiveness of this project is fair.

There are no major changes in the outputs of the project, project period or project cost. As the project was completed as planned, efficiency is high. In terms of the operation and maintenance structure of Moulvibazar radar station, some posts were not approved and the total number of personnel decreased compared to the plan. Yet personnel of the BMD have fundamental technical skills for operation and maintenance of radar systems in general. Also there are various programs aimed at strengthening skills and capacities. Lastly, BMD provides a sufficient budget for operation and maintenance of the radar station. Based on this analysis, sustainability of the project is evaluated as fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

(1) Consolidation of Operation Structure at Moulvibazar radar station

Currently, Moulvibazar radar station is operated by seven temporary staff and the workload is heavy during the rainy season. An operation structure with fixed staff needs to be established and consolidated to achieve more effective operation in the future. For that, recruitment and assignment of 15 staff members (which was already approved) should be rapidly completed.

(2) Clarification of O&M responsibilities of the equipment installed in FFWC

At the time of the evaluation, the meteorological data display system installed at FFWC was not in use due to some troubles with the equipment. For any kind of troubles in the past, BMD sent technicians to conduct repairs. This is due to lack of clarity as to ownership; it is necessary to clarify responsibility of O&M of the equipment at FFWC. It would be useful to establish close cooperation between BMD and FFWC; preparation of O&M manuals and provision of O&M training to FFWC would also be useful.

(3) Towards issuance of flash flood warnings

In the long run, it is necessary to develop a specific forecast model for flash flood and guidance to formulate effective flash flood warnings. However, several steps need to be taken beforehand. At first, it is necessary to make good use of the meteorological display system at FFWC. Then, rainfall data provided by SWC should be combined with hydrological data collected by FFWC to provide flood warnings. In this context, close cooperation between SWC and FFWC would be indispensable.

4.2.2 Recommendations to JICA

One of the objectives of the project is to mitigate the damage caused by storms and floods including flash floods. To achieve this objective, not only BMD but also various agencies and organizations such as DMB, FFWC, the media, NGOs, other ministries, and municipalities need to perform their roles in an orchestrated manner. In particular, in the case of flash flood warnings, capacity of FFWC is one of the key factors for goal achievement. Therefore, it might be effective that JICA provide more specific assistance to FFWC, on top of the on-going supplemental support as part of the assistance to BMD.

4.3 Lessons Learned

(1) Organizational Analysis of Relevant Organizations such as FFWC

As mentioned, realization flash flood warnings have been hindered by several factors, including maintenance and usage situation of equipment and the capacity of FFWC. When the activities of relevant organizations directly affect achievement of expected results, the capacity of such organizations should be well analyzed and evaluated at the time of planning. Then, the results of organizational analysis should be reflected in project components and approaches or related technical cooperation if necessary.

(2) Provision of Commercial Power Supply

The full operation of Moulvibazar radar station was forced to be on hold, due to the delay in approval of relevant ministries of commercial power supply. For any future projects in Bangladesh which absolutely require commercial power for operation, the application and preparation to obtain approval should be done well in advance to ensure timely operation.

People's Republic of Bangladesh

Ex-Post Evaluation of Japanese Grant Aid Project
The Project for the Provision of Portable Steel Bridges on Upazila and Union Roads

External Evaluator : Atsuko Kawauchi, T & Associates, Inc.

0. Summary

In Bangladesh, where a large percentage of the population live in rural areas, expansion of the road network and bridge development in these areas are vital for economic development and poverty reduction. Bangladesh has continuously engaged in road development projects in rural areas in its development strategy. Hence, the project is consistent with Bangladesh's development strategies and development needs. The direction of this project is also in line with Japanese ODA policies. It is therefore concluded that the relevance of this project is high. To date, 92 bridges, that had already been constructed, have enabled people to cross rivers throughout the year. This has resulted in greatly reducing traveling times and has contributed to local transportation and economic development in those areas. After bridge construction, people in the areas have expanded areas of movement and activity, as well as an increased range of economic activities. Generation of employment opportunities has also been observed. Given these results, this project has largely achieved its objectives, therefore its effectiveness is high. Nevertheless, efficiency of this project is fair. This rating is attributed to the fact that bridge construction work conducted by the Government of Bangladesh (GoB) was delayed at certain sites, while both the project cost and period of Japanese side were within the plan. With regards to the sustainability of this project, notable concerns about the structure and budget of the implementation agency are not identified. In addition, bridge sites requiring large-scale repairs have not been found at this point. However, it is observed that the implementation agency has not identified definite suppliers of high quality spare parts for future maintenance, and guidelines for maintenance were also not provided. Therefore, sustainability of the project effect is fair.

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

1. Project Description

Project Location

A bridge constructed in Sirajganj District

1.1 Background

As the transportation system in Bangladesh is mainly based on road transportation, road network development is very important in supporting social and economic activities. However, in Bangladesh, which is situated on an alluvial delta formed by large rivers such as the Ganges River, road transportation has been frequently disturbed by river flood water. Gaps in road transportation have become one of the factors that hamper stable and active community living for people, as well as being an obstacle to sustained economic activities. Particularly, in rural areas, where approximately 80% of

Bangladeshis population lives, many villages do not have the necessary bridges or cannot be ensured of year-round traffic as existing bridges have been damaged or are aged. Such situations are obstacles for improving access to social and economic activity and for reducing poverty in those areas.

Japan, therefore, supported the GoB for bridge construction through two grant assistance programs implemented from 2000 to 2003 and from 2001 to 2004. These projects were realized by providing materials to construct portable steel bridges on roads controlled by the Local Government Engineering Department (hereafter referred to as LGED) in the Ministry of Local Government, Rural Department and Cooperatives. Yet, as there were still many sites where bridges needed urgent construction, further bridge construction works needed to be implemented in a systematic manner. With the assistance of Japan, the "Master Plan Study for Portable Steel Bridges on Feeder and Rural Roads in Bangladesh" (hereafter referred to as the Master Plan) was developed in 2002. The Master Plan indicated that bridge construction in 17 districts from the central, southeast, northwest and southwest regions would provide the most effective results for rural society and the rural economy. The project, which is subject to this evaluation, was thus implemented in the 17 districts by supplying superstructure materials for portable steel bridges, followed by actual bridge construction.

1.2 Project Outline

The objective of this project is to ensure safe and year-round traffic and to improve people's mobility and the distribution of goods in the areas concerned, by constructing 92 bridges with high priority. By doing so, the project is intended to improve quality of life, to vitalize social and economic activities, to reduce poverty, to generate employment opportunities and to promote infrastructure development.

Grant Limit/Disbursed Amount	679 million yen/419.35 million yen (phase 1) 700 million yen/561.70 million yen (phase 2) 611 million yen/498.03 million yen (phase 3)
Exchange of Notes Date	November 2005 (phase 1) July 2006 (phase 2) August 2007 (phase 3)
Implementation Agencies	Local Government Engineering Department (LGED) in the Ministry of Local Government, Rural Department and Cooperatives
Final Disbursement Date	March 2009
Main Contractor (Over 1 billion yen)	Nishizawa Ltd., Sozitz, Co., Marubeni, Co. (phase 1) Marubeni, Co., Nishizawa Ltd. (phase 2) Sumitomo Co., Marubeni, Co., Nishizawa Ltd. (phase 3)
Main Consultant (Over 100 million yen)	Katahira and Engineers Inc.
Basic Design	August 2005
Related Projects (if any)	Technical cooperation: Study for preparing a master plan for portable steel bridges on rural roads (2002) ODA loan: Project for developing infrastructure in northern rural villages (1999), Project for developing infrastructure of rural villages in Greater Faridpur (2000), Project for developing infrastructure in eastern rural villages (2006) Grant aid: Plan for constructing portable steel bridges on rural roads (2000), Second plan for constructing portable steel bridges on rural roads (2001)

2. Outline of the Evaluation Study

2.1 External Evaluator

Atsuko Kawauchi (T. & Associates, Inc)

2.2 Duration for the Evaluation Study

Duration of the Study: December 2011 to September 2012
Duration of the Field Study: 21 January to 19 February 2012, 12 to 23 May 2012

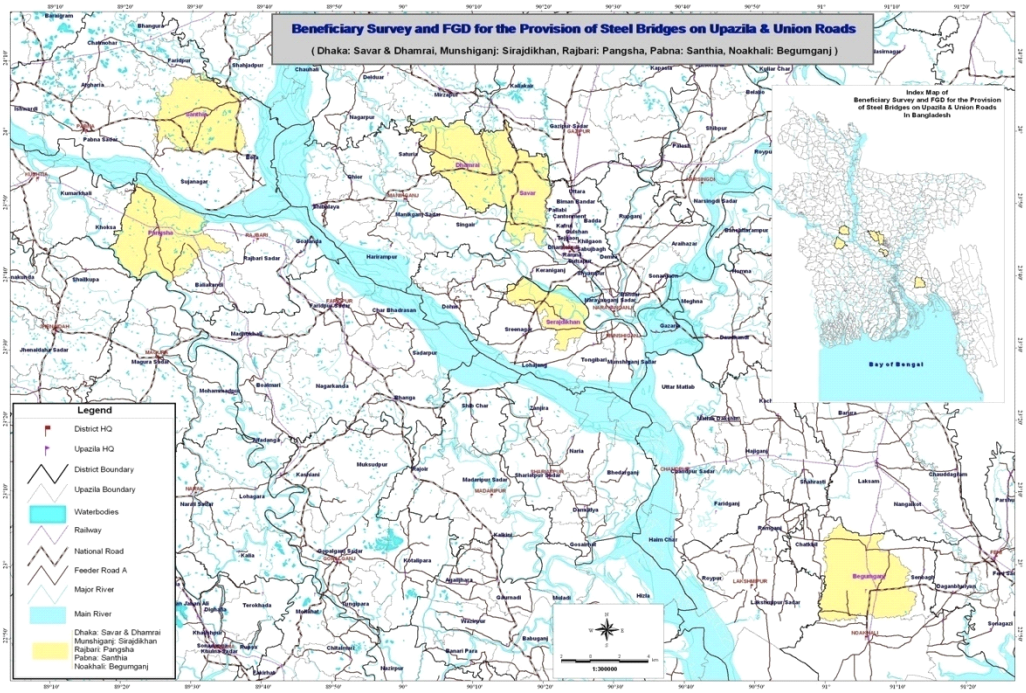
2.3 Constraints during the Evaluation Study

Due to time constraint, all bridges were not subject to site surveys. Instead, eight sites[1] were identified as samples for an on-site survey, and six sites for a beneficiary survey. In total, 13 sites were examined as one site was covered in both surveys. Part of the result of this evaluation study described hereafter is based on the surveys on these 13 sites. For the beneficiary survey, in particular, five districts were chosen, including Dhaka District, to ensure geographical diversity. Both districts near Dhaka and far from Dhaka were in the sample. Then all the bridges in those five districts were categorized according to site location, bridge length and construction phase, and samples were identified from each category. This was the cluster sampling process to ensure that survey result would not be biased. As a result, the following districts and bridges sites were sampled.

Table 1 Sample Bridges in the Beneficiary Survey

	Sample District	The number of sample			The total number of samples
		Phase 1	Phase 2	Phase 3	
1	Dhaka	1	0	1	2
2	Munshiganj	0	0	1	1
3	Noakhali	1	0	0	1
4	Rajbari	0	1	0	1
5	Pabna	0	1	0	1
The number of selected bridges		2	2	2	6

[1] Dhaka District, Manikgonj District, and Sirajganj Districts were chosen for on-site surveys based on consultation with responsible officers at LGED. In Dhaka, the on-going project sites were visited. In the other two districts, a route was identified to visit as many as bridges possible based on discussion with sub-district LGED officers.



Source: Beneficiary Survey Report (prepared for this evaluation study)

Chart 1 – Districts that were subjects of the beneficiary survey
(The areas highlighted in yellow were subjects of the survey)

In the beneficiary survey, 35 residents from the neighboring communities of one site were randomly selected. They were visited and interviewed by researchers, and responses were collected based on the questionnaire prepared for this evaluation. In the end, 210 responses (147 male and 63 female) were collected. To supplement this questionnaire survey, two group discussion sessions were conducted at each site (in total there were 12 discussion sessions).

3. Evaluation Result (Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Bangladesh

When the Master Plan was developed, the GoB implemented a national policy entitled the Fifth Five Year Plan (1997-2002) whose basic strategy included poverty reduction, rural development and increasing agricultural production. This plan aimed at reducing poverty by making socio-economic structures in rural areas more fair and productive, and by improving people's access to various resources. As a follow-up of the plan, the GoB developed the Three Year Plan for National Development (2004-2006). This plan also addressed poverty mitigation, rural development and socio-economic structure changes as critical challenges, with emphasis on infrastructure development in rural areas.

At the point of this evaluation study, the direction of national strategies follows that of the Sixth Five Year Plan (2011-2015), emphasizing the importance of constructing rural roads for rural development. In this plan, rural road development is positioned as an indispensable factor for social and economic development and poverty reduction in Bangladesh. Concretely, the government plans to expand rural road networks and conduct bridge construction works, aimed at creating employment, enhancing the

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

mobility and productivity of the working population, improving the distribution of goods and resources, as well as providing better access to places , such as markets. Since the project has been implemented in order to promote road network expansion in rural areas, and to contribute to developing the rural economy, the relevancy of this project with Bangladesh's national policies is very high.

3.1.2 Relevance with the Development Needs of Bangladesh

In Bangladesh, a large poorest segment of the population resides in rural areas. In these areas, a shortage of bridges crossing over streams and canals is an obstacle to making roads useful. Floods occurring during the rainy season also damage roads and related facilities. It has been pointed out that such situations hinder these areas from social and economic development.

The Master Plan was prepared in 2002 and identified 17 districts in the central, southeast, northwest and southwest regions as districts where bridge construction in the rural areas would provide high socio-economic effects. Requested by the GoB for bridge construction in these 17 districts, the Government of Japan dispatched a study team to develop a basic design for the project and targeted some sites which were then decided based on the basic design. In order to identify targeted sites, those having been judged as incompatible with the project were excluded. The priority of constructing each bridge was also reviewed, and bridges with low evaluations were not selected. The order of priority was decided through technical evaluation and socio-economic evaluation. This identification and prioritization process seems to be appropriate.

3.1.3 Relevance with Japan's ODA Policy

The Japan International Cooperation Agency (JICA) has considered agricultural growth and rural development were indispensable for Bangladesh and placed importance on these fields for its assistance.[3] The country assistance plan prepared in 2005 by the Ministry of Foreign Affairs in Japan also stressed the importance of developing roads and bridges in Bangladesh, which would organically connect the country. The plan also demonstrated the Ministry's intentions of working on development and maintenance of Bangladesh's rural roads and bridges, which would eventually contribute to poverty reduction. Considering these circumstances, the project is highly relevant to Japanese ODA policies.

Following the above-mentioned analysis, 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 Effectiveness[4] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

When the basic design of this project was prepared, safe and year-round road transportation by construction and replacement of bridges, were set as expected direct results of the project. In reality, construction work on certain bridges was delayed and road transportation at 92 sites was finally established by the end of 2011. Since then, year-round traffic has been ensured at each site as planned (Table 2). In general, one of the concerns for bridges in rural areas would be damage caused by rising water and downpours during the rainy season. The evaluation examined the situation at certain bridges and did not find any critical damage or problems that would make the bridges impassable. The above-mentioned observations lead to the conclusion that the expected direct results were basically achieved.

Table 2 Status of Bridge Construction

Indicators	Targeted value	Actual value	Actual value

[3] As described on JICA's homepage.

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

	(March 2011)	(March 2011)	(end of 2011)
Safe and year-round traffic	92 sites	88 sites/95sites	92 sites/95 sites*

Source: LGED
*The final output number was changed to 95.

Along with the bridge construction, roads around the bridges were also developed. It is observed that this enables people to effectively move around the areas using motorized vehicles and motorbikes; thus, general traveling time has been shortened as expected. Although the degree of reduced traveling time differs from site to site, Table 3 shows how people obtain relative travel efficiency on the three routes indicated. For example, as regards a 70-meter bridge (05-04-04) constructed in Manikganj District, travel time becomes approximately one sixth, resulting in a possible 2.5 hour reduction (initially 3 hours by car, now only 30 minutes). Around an area in Gopalganj District, where a 65-meter bridge (12-02-N2) was constructed, people had relied on a bamboo bridge which only they had crossed on foot, and traffic was cut off during the rainy season. However, bridge construction has made vehicle traffic possible and people can cross in a shorter time and year-round.

Neighboring residents using the bridge on bike and by car (Sirajganj District)

Table 3: Traveling time before and after bridge construction[5]

(unit: minute)

Targeted bridges (length)	Routes (Districts)	Transportation means	Traveling time before construction	Traveling time after construction
05-04-04 (70M)	Daulatpur Sub-district Manikganj District 9.25 km	Motorized Vehicle, CNG, Bike	120 – 180	30
		Other means except vehicles (rickshaw, etc.)	180 – 240	60 – 90
12-02-N2 (65M)	Kashiani Sub-district Gopalgonj District 0.7 km	Motorized Vehicle, CNG, Bike	N/A	1 – 2
		Other means except vehicles (rickshaw, etc.)	9 – 10	2 – 3
55-01-N1 (50M)	Sadar Sub-district Sirajgonj District	Motorized Vehicle, CNG, Bike	N/A	15

[5] As the sites of this project are located on rural and feeder roads, detailed statistical data such as traffic volumes are not systematically collected. Therefore, three sites were selected by consultation with LGED; LGED district offices were requested to conduct a survey on traffic volume. Manikganj was deliberately selected as this districts has the most number of bridges. However, it should be noted that these three sites do not necessarily represent the situation of the entire project.

	5.2 km	Other means except vehicles (rickshaw, etc.)	120	40

Source: LGED

According to a study conducted by LGED's district offices, traffic volume on each bridge has also increased 6 to 16 times (Table 4). As mentioned, at sites where only boats or bamboo bridges were available, the steel bridges now enable people to use rickshaws, vans, auto-rickshaws, motorbikes, buses and trucks. This change contributes to energizing the rural economy.

The beneficiary survey examined changes in the frequency of village departures by comparing before and after bridge construction at six sites. The average rate of increase is 1.74 times at Pangsha sub-district, compared to the pre-construction situation, which is the smallest increase among the six sites. In Savar sub-district, the rate of increase in frequency is 10.57 times, which is the largest increase. In general, the change is greater in sub-districts close to Dhaka city.

According to survey by LGED, especially at villages around the bridges, the number of three-wheel compressed natural gas cars (CNGs) has grown. This shows that CNGs have become a major transportation means of the residents of these areas.[6]

Table 4: Traffic volume per day at portable bridges

(unit: the number of cars)

Targeted bridges	Vehicle types	Before construction	After construction
05-04-04 Manikganj District	Vehicle, CNG, Bike	10	165
	Rickshaw and others	45	70
12-02-N2 Gopalgonj District	Vehicle, CNG, Bike	N/A	30 – 40
	Rickshaw and others	8 – 9	85 – 95
55-01-N1 Sirajgonj District	Vehicle, CNG, Bike	N/A	250
	Rickshaw and others	30	225
05-04-07 Manikganj District	Vehicle, CNG, Bike	8	150
	Rickshaw and others	42	250

Source: studied by LGED[7]

3.2.2 Qualitative Effects

The results of the beneficiary survey show that convenience for people who live around the bridges has been improved as well. For example, time needed to go to market is reduced on average from 20.9 minutes to 5.2 minutes. As a result, people who used to visit the market on average 2.8 times per week before bridge construction now visit 8.2 times. The frequency of hospital visits has increased on average from 8.1 times to 19.1 times per year, and, visiting relatives and friends from 12.4 times to 24 times.

Table 5 Purposes of bridge use and visiting frequency

Purposes of use	Before bridge construction		After bridge construction	
	Average visiting frequency (time)	Average transit time (minute)	Average visiting frequency (time)	Average transit time (minute)
Market (per week)	2.8	20.9	8.2	5.2

[6] From results of the beneficiary survey.

[7] Traffic data before bridge construction were roughly estimated by LGED's sub-district offices for this evaluation study, as such data did not exist. Data after bridge construction was collected in January 2012.

Hospital (per year)	8.1	28.8	19.1	11.6
Houses of relatives and friends (per year)	12.4	26.7	24.0	9.8
School (days)	0.92	19.3	0.95	5.5

Source: beneficiary survey

3.3 Impacts

3.3.1 Intended Impacts

(1) Generation of Employment Opportunities

The results of the beneficiary survey[8] also show that 82.3% of respondents feel that employment opportunities have either "increased" or "slightly increased" after the bridge construction (Table 6).

In particular, the generation of employment opportunities in Savar Sub-district and Dhamrai Sub-district in Dhaka District is notable. Regarding the case of Dhamrai Sub-district, one of the main factors for this increase is attributed to the fact that the constructed bridge enables people to commute to a sewing factory located 30 km away from the village.

Table 6 Employment opportunities before and after the bridge construction

	Begomanj	Shathia	Shirajdikhan	Savar	Dhamai	Pangsha	Total
Increased	11.43	22.86	45.71	100	57.14	65.71	50.48
Slightly increased	54.29	48.57	22.86	0	37.14	28.57	31.90
Same	34.29	28.57	31.43	0	5.71	5.71	17.62
Slightly decreased	0	0	0	0	0	0	0
decreased	0	0	0	0	0	0	0

Source: Beneficiary Survey

Concerning earnings, 57% of respondents recognized an increase in earnings after bridge construction. The remaining 43% feel their earning level is the same. In particular, farmers receive the most benefit from the construction as they can more easily obtain agricultural chemicals, fertilizers and seeds. With regard to the sales volume of crops, precise data do not exist. However, people who participated in group discussions[9] organized during this evaluation study mentioned that the bridge construction contributed to their income increase as they are now able to deliver harvested corps by car or truck. Wholesalers also can come to their villages to buy directly from them.

(2) Vitalization of Social and Economic Activities

The evaluation study reveals that bridge construction also contributes to stimulating economic activities in rural areas. The beneficiary survey reports that, in total, 18 kinds of new shops and businesses, such as grocery stores, tea-houses, real estate offices, agricultural products stores, pharmacies, dairy products sellers and poultry farms, were initiated. For example, around villages in Savar Sub-district of Dhaka District, the economy has grown remarkably in recent years and land prices have greatly risen like other suburbs of Dhaka. In addition, influenced by oil refineries, mineral

[8] Total 210 people were surveyed: 35 community members were randomly selected as respondents from each community in five districts including Dhaka, Munishganj, Noakhali, Rajburi, and Pabna.

[9] Targeting two communities adjacent to each of the six bridge sites selected for the beneficiary survey, 12 discussion sessions, in total, were organized. For each session, eight to ten people including business people, farmers and women, got together.

water factories and glass factories constructed in these areas, the number of shops has increased to 200 from only 10 prior to bridge construction. These data explicitly indicate the economic benefits of the project. It is also noted that, at almost all of the sampled sites selected for the beneficiary survey, land prices around the constructed bridges have increased.

Regarding the impact on women, the3 group discussions revealed that, generally speaking, women tend to hesitate to use bicycles or water taxis which cost them, and as a result, the range of their activities had been limited compared to men. However, after bridge construction, women could more easily move around on foot and by car, CNGs and rickshaws, which resulted in expanding the range of their activities. Female respondents stated that they could now cross a bridge to visit their acquaintances (83%) and go to hospitals (73%) (multiple answerers). Changes to women's behaviors were also observed as, for example, now being able to participate in group meetings on microfinance (2%).

It is also reported in the group discussion that, in Pabna District, the ratio of pregnant women who go to hospitals has increased from 10% to 70%. It was also discussed in the discussion in Pangsha and Pabna District, that there have been agriculture schools on the city side of the bridges, but female students sometime fell from boats into the rivers. This resulted in a high drop-out of female students, leading some schools to limit the acceptance of females. However, after securing safe passage by use of bridges, this problem was resolved.

3.3.2 Other Impacts

(1) Impacts on the natural environment

Neither the implementing agency nor respondents of the beneficiary survey have reported any negative impacts to the environment, including water pollution and water decrease caused by blockages of rivers during the bridge construction. Problems related to exhaust gas and noise have also not been pointed out.

(2) Impacts of Resettlements and Land Acquisition

The basic design of this project required land acquisition at seven sites. However, there were cases that land acquisition was not realized because some landowners were not willing to sell. In addition, since several construction sites were also changed due to problems such as soil erosion, the number of land acquisition sites was eventually reduced to four. It was confirmed that land acquisition at these sites had been conducted by following procedures set up by the GoB and by paying appropriate compensation to landowners. Regarding residents' resettlements there were no such cases.

The observations above indicate that this project has largely achieved its objectives; therefore, its effectiveness is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

When the basic design of the project was planned, the number of bridges (outputs) to be constructed was 92. However, the number was increased to 96, and construction sites were also changed accordingly. These changes were due to the fact that 22 out of the 92 bridges initially planned were constructed through other projects or other schemes. In some cases, construction work on these bridges was completely canceled. Instead, 26 bridges were planned for construction and materials that would have been used for the canceled bridges were utilized for construction of the newly planned bridges. Reasons for the changes or cancellations varied site by site, include soil erosion, topographical changes, land acquisition problems, relocation problems of religious institutions, changes of residents' needs, etc. It can be said that those reasons are accepted.

The basic design study report states, "if site configuration is changed by the shifting and/or meandering of the riverbed, the location, lengths, span, etc., may be changed or revised." The English

version of the basic design study report also states, "if it is difficult to allocate the budget to the Project due to the unforeseeable conditions such as economic crisis in Bangladesh, the project shall be re-planned accordingly." In response to this, LGED selected new sites with high priority in the original 17 districts.

The number of outputs finally planned by the GoB at the implementation stage turned out to be a total of 96 bridges (Table 7). Total length of all constructed bridges was 4,885 meters, which is not changed from the initial plan.

Table 7 The number of outputs finally planned by the GoB at the implementation stage

The number of bridges planned under the basic design (2005)	**92 bridges**
Bridges constructed under other schemes or cancelled	22 bridges
Bridges newly planned	26 bridges
The number of bridges decided to be constructed at the implementation stage (2011)	**96 bridges**
Under construction (as of 2012)	3 bridges
Not launched	1 bridge
Completed bridges (as of 2012)	92 bridges
The number of bridges expected to be constructed at the end of the project (the end of 2012)	95 bridges

Source: prepared based on documents provided by LGED

At the point of this evaluation study, construction works for 92 bridges was completed, while those for the four bridges remained unfinished. Among the four bridges, three have been under construction. Delay of those construction works are caused by project sites being submerged or technical problem of constructor. For the last bridge, the construction work has not been initiated yet and the decision to cancel its construction was already made. This is because materials provided by Japan were incomplete and the bridge cannot be assembled in its current condition.[10] Therefore, the number of expected outputs is 95 and the total length of all bridges is 4,860 meters.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project plan indicated that Japan would bear 1.99 billion yen of the entire project cost. However, since Japan conducted competitive bidding for the bridges' superstructure materials, the actual project costs came to 1.478 billion yen, which accounts for 74% of the planned costs.

3.4.2.2 Project Period

This project was implemented in three phases. A planned work period for each phase covered development of a detail design for about seven months and procurement of necessary materials for about eight months. The total project period was planned as 38 months by summing up the work periods of the three phases. While Japan side finished developing the basic design and procuring superstructure materials within each planned period of the three phases, Bangladesh smoothly finished processing tax exemptions and customs clearances. The project was then completed in March 2009. As shown in Table 8, the actual project period was 37 months and the project was implemented within the planned period (97% in comparison to the planned period).

[10] The reasons for the material shortage is unclear, with different explanations provided by Japanese consultant, as well as suppliers. It is difficult to clarify the reason at this point.

Table 8 Plan and Actual Project Period

	Plan	Actual
Japan	38 months including detailed design and bidding period	phase 1: March 2006 – Jan 2007 phase 2: March 2007 – Dec 2007 phase 3: March 2008 – March 2009 (37 months, including 3 phases)
Bangladesh	phase 1: Completion in Jan 2009 phase 2: Completion in Dec 2009 phase 3: Completion in March 2011 (Completion of construction 2 years after receipt of materials)	Phase 1 and 2 are expected to be completed in Dec 2012. Phase 3 was completed in Oct 2010.

Source: JICA

Although GoB planned to construct all bridges within two years after the receipt of the materials, only 88 bridges were constructed as of March 2011, which was the planned date of the project completion. The delay was caused because the plan itself had been modified, as mentioned above, and some construction sites were submerged during the rainy season. However, the fact that LGED was able to complete 88 bridges despite changes in the plan demonstrates LGED's organizational capacity. A project officer of the implementation agency foresaw that construction work on all bridges would be completed in December 2012 at the earliest.

In summary, although project cost was as planned, project period exceeded the plan, therefore efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

LGED's maintenance unit at headquarters, Maintenance and Asset Management, possesses the Road Asset Management System, a database of existing roads, over which the LGED has jurisdiction. Based on information in the database, the unit determines the condition of roads and bridges as well as the necessity of their maintenance. It then decides the general maintenance policy and priority of road and bridge maintenance. Following the policy, LGED's sub-district offices conduct actual maintenance work. At present, LGED has 10,764 technicians, of which 85% or 9,177 technicians are placed in sub-district offices. As eight to 19 technicians are sent to each sub-district office, it is observed that the system for maintenance is well established and does not have any particular concerns. LGED is now in the process of formulating maintenance policy on roads and bridges and it seems that awareness of the maintenance has increased in LGED.

The bridges of this project have not been integrated into the Road Asset Management System because four bridges are still under construction at this moment. However, after completion of these bridges and the project itself, all bridges will be integrated into the system and controlled together with the other existing bridges.

Following an interview conducted with a responsible officer of the implementing agency, Table 9 shows the frequency of its maintenance activities. LGED plans to conduct periodic inspections every three years. Since all of the bridges planned under this project have not been fully constructed, the project has not entered into the maintenance phase. Therefore, a schedule of inspections for these bridges has not been decided yet. Interviews with officers of LGED's district offices and sub-district offices indicate that LGED's technicians have conducted routine checks on a daily basis.

Table 9: Planned Maintenance Activities for Portable Bridges

Type of maintenance	Timing	Contents of maintenance
Routine maintenance	Daily	Cleaning and checking

Emergency maintenance	As necessary	Repair as necessary
Periodic inspection	Every three years	Repair as necessary

Source: LGED

With regard to access roads and approaches to bridges, groups of poor village women organized and hired by LGED conduct daily checks, clean and do simple repairs. These groups are organized on a nationwide scale as a part of a project that works on poverty. The groups undertake simple repair and checks not only for the bridges under this project, but for all roads and bridges that LGED controls. In cases where these groups find larger problems with the bridges, they report to LGED's sub-district offices. This system is highly appreciated as it contributes to effective road maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

As the steel materials are coated with zinc anode, it is considered no maintenance is required for 50 years in theory. If they begin to rust, a simple repair with spray paint is all that is necessary. Therefore, it is possible to conduct bridge maintenance with ordinary maintenance techniques, if there are no unexpected incidents.

An interview survey at LGED's headquarters revealed that technical training in maintenance to technicians of district offices and sub-district offices is offered periodically. The level of maintenance techniques is therefore very high. As LGED constructed the foundation and substructure parts of the bridges by itself, it seems that LGED does not have any problems concerning maintenance techniques on these parts or on connecting parts. However, maintenance training specializing on steel bridges has not been offered to them. It is not therefore clear whether LGED has a capacity for repairing these bridges by itself in the case that the bridges themselves are greatly damaged by unexpected incidents such as accidents with large trucks, or drastic topographic changes.[11]

3.5.3 Financial Aspects of Operation and Maintenance

Every year, LGED's sub-district offices review the conditions of roads and bridges and develop their maintenance plans. Following the plans, they then request that the headquarters provide a necessary budget. LGED's headquarters provide their approval based on the order of priority, and such maintenance costs are approved as a whole. The headquarters does not always accord the entire amount of the requested budget. They make their final decision based on priority, while making their efforts to allocate the entire budget in a well-balanced manner. Table 10 below illustrates the budget that LGED allocates to maintenance from 2008 to 2012. The maintenance budget shows a tendency of slightly increasing at the national level.

Table 10: Transition of LGED's Maintenance Budget (entire amount at the national level)

(unit: million Taka)

	2008 – 2009	2009 - 2010	2010 - 2011	2011 – 2012
Maintenance for roads and culvert bridges	4900	5085	6000	6250
Maintenance for foundation parts of bridges	662.50	433.40	530	-

Source: LGED

LGED's sub-districts offices stated that a specific maintenance budget was not allocated for the bridges of this project as these bridges were designed in a manner such that no maintenance would be required for 50 years, and they are still relatively new. Considering the fact that there is no necessity for large-scale repair at this point, the current budget allocation system seems reasonable.

3.5.4 Current Status of Operation and Maintenance

[11] In Dhaka district, there are some sites with a large volume of large truck traffic, and some LGED officers expressed concern about future damage.

(1) Current Situation

Concerning the bridges selected as samples for the on-site survey and beneficiary survey, the condition of their approaches, access roads, connecting roads and bridges themselves are generally good. However, the on-site survey found that an access road at one site had not been finished (Sirajgonj District).[12] In addition, the beneficiary survey found that a foundation part of another bridge was slightly damaged in Rajbari District.[13]

From February to June 2012, during this ex-post evaluation, the Implementation, Monitoring Evaluation Division (IMED) of the Planning Commission in the GoB conducted an evaluation study. The study inspected the condition of 83 bridges and conducted research on the social impact.[14] On that occasion, IMED pointed out several problems, such as loss of nuts and bolts at several bridges. However, according to a responsible officer of LGED, these problems have already been addressed and repaired.

It is assumed that maintenance will be carried out by spraying to stop rust and by changing parts such as bolts and nuts. Painting sprays provided under this project have already been used up, and similar sprays are available in Bangladesh and will be used in the future. LGED explained that like the paint sprays, products such as bolts and nuts made in Bangladesh will be used, although they are neither exactly the same nor as strong as those provided by Japan. Currently, no supplier in Bangladesh is able to produce nuts and bolts to the same quality as Japan.[15]

According to an interview with LGED officers at the district level, the traffic over some bridges has been increasing more rapidly than expected. At sites where many large trucks pass, parts will wear out at an accelerated rate due to vibration; thus, 50 years of no maintenance may not be the case. Further, concrete suppliers of bolts and sprays have not yet been decided, and guidelines on inspection and repair do not exist. Thus, it appears that current repairs have been conducted more or less on an ad-hoc basis. In the past two steel bridge projects, similar maintenance has been conducted and so far there are no major issues which have been reported. However, in the long run, it would be better for the LGED to identify bridges that require close attention, in light of the above-mentioned points. In addition, preparation of specific maintenance policies and maintenance guidelines is desirable.

(2) Long-term Sustainability

From a long-term view, the possibilities for minor collisions, or accidents occurring between heavy vehicles and pedestrians were pointed out, especially at heavy traffic areas such as Dhaka District.[16] As the portable steel bridges were constructed with a design of only one traffic line, where cars coming from opposite directions cannot pass over the bridges at the same time, traffic jams have occurred at the sites where initial traffic forecasts made during project planning were understated. Taking into consideration a scenario where traffic greatly increases in the future, LGED is exploring the possibilities of shifting the current bridges to wider bridges made with concrete. In this case, the current portable steel bridges would be relocated to another site and used there.

[12] It is not yet completed but it is passable on foot and by bicycle.

[13] These problems were discovered during the on-site inspection conducted as a part of the beneficiary survey.

[14] IMED of the Planning Commission selects one project among the projects implemented by each Ministry and conducts a large-scale evaluation study. In 2012, the project in question was selected for the evaluation.

[15] Interview with a LGED office in charge of this project.

[16] As a measure for protecting pedestrians, turnouts are set on bridges whose lengths exceed 50 m in the case of the Upazila (sub-district) roads or 80 m in the case of union and village roads. There are possibilities of minor collisions or accidents on bridges shorter than 50m.

Left: children going to school, while stepping aside from a large truck (Dhaka District)
Right: Trucks and bicycles waiting an oncoming vehicle to pass the bridge. Since the bridge is designed with only one traffic line, it is difficult to cope with the traffic increase (Dhaka District)

As mentioned above, slight problems are observed in technical aspect and current status of operation and maintenance. Therefore, sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

In Bangladesh, where a large percentage of the population live in rural areas, expansion of road networks and bridge development in these areas is vital for economic development and poverty reduction. Bangladesh has continuously engaged in road development projects in rural areas in its development strategy. Hence, this project is consistent with Bangladesh's development strategies and development needs. The direction of this project is also in line with Japan's ODA policies. It is therefore concluded that relevance of this project is high. To date, 92 bridges, already constructed, have enabled people to cross rivers throughout the year. This has resulted in greatly reduced travel time and has contributed to local transportation and economic development in these areas. After bridge construction, people in the surrounding areas have expanded movement and activities, as well as an increase in their range of economic activity. Generation of employment opportunities has also been observed. Given these results, this project has largely achieved its objectives, therefore its effectiveness is high. Nevertheless, efficiency of this project is fair. This rating is attributed to the fact that bridge construction work conducted by the GoB was delayed at certain sites, while both the project cost and period of Japanese side were within the plan. With regards to the sustainability of this project, notable concerns on the structure and budget of the implementation agency are not identified. In addition, bridge sites requiring large-scale repairs have not been found at this point. However, it is observed that the implementation agency has not identified suppliers of high quality spare parts for future maintenance, and guidelines for maintenance have also not been provided. Therefore, sustainability of the project effect is fair.

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

4.2. Recommendations

4.2.1 Recommendations to the Implementation Agency

As discussed, four bridges remain unfinished (cancellation of one site has been already decided while the other three are under construction) at this moment . The construction work on these three bridges should be rapidly completed and this project should then be completed. By doing so, the bridges constructed under this project should receive necessary maintenance under the ordinary maintenance

system.

Maintenance activities such as rust-proofing by spraying, and exchange of bolts and nuts, will be needed in the future. Under the situation that the LGED can obtain neither painting sprays from Japan nor steel parts bearing the same strength as those used under this project, it is observed that the LGED has procured necessary parts and repaired bridges on an ad-hoc basis. Maintenance methods and guidelines for portable steel bridges have not been developed either. These observations reveal that systematic monitoring needs to be conducted for all bridges. It is also required that maintenance activities and repairs be conducted with effective procurement and appropriate maintenance guidelines.

4.2.2. Recommendation to JICA

It is important for JICA to urge LGED to appropriately and systematically conduct maintenance activities for the bridges including those constructed by the previous Japanese Grant Aid Projects.

4.3 Lessons Learned

In this project, Bangladesh was responsible for constructing bridges after the provision of materials by Japan. From the planning period of basic design to the commencement of construction, the soils of certain project sites degraded, or the demands of residents changed. These situations forced the implementation agency to change construction sites. When small-scale bridge construction works are carried out at the local level like this project did, implementation agencies might need to cancel construction work or modify initial plans after launching the work. Considering Bangladesh's situation, that river flood occurs every year, which causes soil erosion and topographical changes as well as local and social needs tending to change drastically, it is recommended that project bodies carefully examine the period necessary for bridge construction, in similar types of projects. In addition, if planned projects require great contributions from the beneficiary countries, and if their contribution would greatly influence the success of the projects, Japan should keep providing enhanced supervision and follow-up even after completing the activities that Japan needed to undertake.