People's Republic of Bangladesh

Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for Improvement of Meteorological Radar System at Cox's Bazar and Khepupara"

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0. Summary

This project is well aligned with the Government of Bangladesh policies that give high priority to disaster management as well as the development needs of a country that has suffered tremendously from cyclones. The project was efficiently implemented with inputs executed and outputs produced almost as planned.

One of the project's targets for a 300km radius radar detection range for a precipitation intensity of 1mm/h, or more, has been met. Although the annual operation target hours of the meteorological radars fell well below the target for FY 2009/10, the prospects for the extension of operation hours are good. Findings of the evaluation study suggest that it has largely generated intended impacts including improved cyclone information and warnings and better quality forecasts for the Cox's Bazar District in addition to contributing to the reduction in damage caused by cyclones. The implementing agency that has operated and maintained all of Bangladesh's meteorological radars over the past two decades is competent enough to continue to generate these project effects and therefore the sustainability of the project is high.

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

1. Project Description

Project Locations

Cox's Bazar Radar Station

Khepupara Radar Station

1.1 Background

Bangladesh is prone to various types of natural disasters and in particular has been devastated a number of times by tropical cyclones. According to official records, over the four decades up to 2004, Bangladesh has been struck by 52 major cyclones which left more than 700,000 dead or missing: this accounts for nearly 70% of the total number of dead and missing due to natural disasters.

The previous meteorological radar systems (with two S-band weather radars mainly for storm monitoring purposes) were installed in Cox's Bazar and Khepupara in 1988 with Japan's grant

assistance. The radar systems failed irreparably in 2004 after 16 years of use: 16 years exceeds the 10 to 12 year recommended period of use. Since the radar observations stopped, the Bangladesh Meteorological Department (BMD), the sole national meteorological service provider, was unable to obtain timely cyclone information (such as intensity, location of the centre, and direction of movement), and consequently the quality and accuracy of cyclone warnings and advisories issued by the BMD deteriorated.

The Government of Bangladesh (GoB) recognized the critical importance of cyclone monitoring and warning in disaster management and the urgent need to replace and improve its radar systems. Due to their financial constraints, the GoB requested assistance from Japan.

1.2 Project Outline

The objective of this project is to enhance the cyclone monitoring capability of the BMD by: replacing the existing Cox's Bazar and Khepupara Meteorological Radar Systems; establishing data communication systems; and introducing a meteorological satellite data receiving system.

Grant Limit / Actual Grant Amount	Phase 1: 866 million yen / 865 million yen Phase 2: 803 million yen / 791 million yen
Exchange of Notes Date	Phase 1: July 2005 Phase 2: June 2006
Implementing Agency	Bangladesh Meteorological Department
Project Completion Date	February 2008
Main Contractors	Mitsubishi Corporation Shimizu Corporation
Main Consultant	Japan Weather Association (JWA)
Basic Design	"Basic design study on the project for improvement of the meteorological radar systems at Cox's Bazar and Khepupara in the People's Republic", JICA and Japan Weather Association, October 2004 - March 2005 and April 2005 - May 2005.
Detailed Design	Phase 1: August 2005 - October 2005 Phase 2: August 2006 – October 2006
Related Projects (if any)	[Technical Cooperation] "The Project on Human Capacity on Operation of Weather Analysis and Forecasting " (2009-12) [Grant Aid] "The Project for Replacement of Weather Surveillance Radars" (1986-88) "The Project for Microwave Link for Meteorology" (1992-94) "The Project for Improvement of Weather Warning Services related to Natural Disasters" (1997-99) "Follow-up Cooperation for the Project of Weather Warning Services Related to Natural Disasters" (2005) "The Project for the Establishment of the Meteorological Radar System at Moulvibazar" (2007-2009)

2. Outline of the Evaluation Study

2.1 External Evaluator

Rie Fusamae, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

Duration of the Study: October 2010 - October 2011
Duration of the Field Study: February 6, 2011 - February 21, 2011
June 10, 2011 - June 16, 2011

3. Results of the Evaluation (Overall Rating: A[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, the project plan was included in the Three Years Rolling Investment Programme 2004-2006 of the GoB as a project requiring urgent implementation.

The project remains in line with the GoB's development policy. The current GoB policy is manifested in the Poverty Reduction Strategy Paper (PRSP), "Steps towards Change: National Strategy for Accelerated Poverty Reduction II (Revised), FY 2009-11," in which priority is given to disaster management particularly in terms of social protection for the vulnerable and also in order to tackle climate change. The PRSP identifies enhancement of disaster management and risk reduction capacity and knowledge management on disaster risk reduction as the major strategic goals. The policy agenda set towards that end include capacity development in disaster warning and forecasting with a focus on the BMD, and the project aims to contribute to the BMD.

3.1.2 Relevance with the Development Needs of Bangladesh

The restoration and improvement of BMD's cyclone monitoring capacity was of pressing importance for the country, which has been heavily affected by cyclones. The Disaster Management Bureau (DMB)[3] of the Ministry of Food and Disaster Management and the Cyclone Preparedness Programme (CPP)[4], which takes a leading role in the cyclone warning and evacuation system, as well as the media depends on information and warnings provided by the BMD based on radar data from Cox's Bazar and Khepupara, the only two meteorological radars in the country located in coastal areas. The two radar systems ceased to function in 2004 and the BMD was unable to deliver accurate information on cyclone: intensity, direction and the location of its centre.

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

[2] ③: High, ②:Fair, ①:Low

[3] DMB is responsible for disaster risk reduction and disaster management from the warning stage to the recovery stage. Its responsibilities include proposing disaster-related legislation, awareness-raising for disaster risk reduction, coordination of concerned organizations in disaster management, monitoring of delivery of warnings, and evacuation and relief activities. (Ministry of Food and Disaster Management, "Standing Orders on Disaster," April 2010.)

[4] The CPP was launched, following the cyclone of 1970, by the International Federation of Red Cross and Red Crescent Societies (IFRC) and the Bangladesh Red Crescent Society (BDRCS) in order to establish a warning delivery system. Since 1973, it has been a joint programme between the BDRCS and the GoB. The CPP has engaged mainly in the dissemination of cyclone warnings, evacuation assistance, assistance in relief and rehabilitation operations, covering 37 Upazilas in coastal areas of 11 Districts. (Interview with CPP)

Since the planning stage of the project, seven major cyclones have made landfall on Bangladeshi soil or its coastline including one of the most powerful cyclones in Bangladeshi history, (Cyclone Sidr of November 2007) which left 3,363 people dead and 871 missing[5]. Though the early warning system is improving, cyclones have continued to have serious impact on the country's economy and society, and the need for accurate information and early warning remains great.

3.1.3 Relevance with Japan's ODA Policy

The project aims to reduce damage from cyclones by improving cyclone monitoring functions. It is fully consistent with Japan's ODA Charter, which gives priority to addressing global issues including natural disasters. Disaster management was also one of the four priority areas identified in the Country Assistance Plan for Bangladesh at the project planning stage.

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

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

Planned outputs of the project were produced as planned. Details are shown in the table below.

Table 1 Planned and Actual Outputs

Planned			Actual
System / Facilities	Site	Main Equipment	
Meteorological Radar System	1) Cox's Bazar Radar Station 2) Khepupara Radar Station	Radome, Antenna, Antenna controller, Transmitter, Amplifier Tube Unit (ATU), Digital Receiver and Signal Processor (DRSP), Dehydrator, Wave-Guide Configuration, Radar Task Controller, Data & Protocol Converter, Isolation Transformer, Radar AVR, Flywheel Power Backup Unit, Test instruments & materials	As planned
Meteorological Radar Data Display System	1) Cox's Bazar Radar Station 2) Khepupara Radar Station	Severe Storm & Doppler Velocity Indicator, Severe Storm & Doppler Velocity Indicator, Data Analyzing Unit	As planned
	Storm Warning Centre (SWC)	CCU, Southern Composite Processor, Accumulated Rainfall Processor, Cyclone Tracking Monitor, Product Retrieval Unit, Radar Web Server, Doppler Velocity Indicator, Meteorological Data Archiving Unit	As planned
	Cox's Bazar Meteorological Office	Radar Image Access Unit	As planned
Meteorological Data Communication System	1) Cox's Bazar Radar Station 2) Khepupara Radar Station	VoIP Gateway, Spread Spectrum Transceiver with ODU, Antenna, VoIP Gateway, VoIP Exchanger	As planned
	Cox's Bazar Meteorological Office	VoIP Gateway, Spread Spectrum Transceiver with ODU, Antenna	As planned
	SWC	VoIP Gateway, VoIP Exchanger	As planned

[5] BMD

Meteorological Data Satellite Communication System	1) Cox's Bazar Radar Station 2) Khepupara Radar Station	VSAT Out-door Unit (ODU/Transmitter), VSAT Out-door Unit (ODU/LNB), VSAT Antenna, VSAT In-door Unit (IDU), Test instruments & materials	As planned
	SWC	HUB Out-door Unit (ODU/Transmitter), HUB Out-door Unit (ODU/LNB), HUB Antenna, HUB In-door Unit (IDU), Test instruments & materials	As planned
Meteorological Satellite Data Receiving System	SWC	MTSAT Receiver, MTSAT Acquisition Workstation, Satellite Data Processor	As planned
Meteorological Radar Tower Building	1) Cox's Bazar Radar Station 2) Khepupara Radar Station		As planned

Source: Basic Design Study Report (2005), Project Completion Reports (2007, 2008)

It was assumed at the project planning stage that the BMD would conduct technical training for its meteorologists and engineers. Although not provisioned as part of the project, internal training was provided in the form of on-the-job training as needed and also by internally sharing knowledge within the BMD that was gained by some staff members who participated in overseas training including the counterpart training held in Japan.

The Bangladeshi side undertook all its required work as specified in the Minutes of Discussion of the Basic Design Study, including: securing land and legal rights for the construction of the radar towers, clearing land, providing facilities for electricity distribution, water supply and communications, obtaining frequency allocation, and providing space segments for a satellite communications system.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual cost of the project was mostly as planned: amounting to 1,664 million yen, equivalent to 99% of the estimated cost of 1,676 million yen. Of the total capital cost, 1,657 million yen was borne by the Japanese side and 7 million yen by the Bangladeshi side (planned amounts were 1,669 million yen (Japanese grant ceiling) and 7 million yen for the Bangladeshi side)[6].

3.2.2.2 Project Period

The project period (from the detailed design up to the project's completion) was 31 months: shorter than the planned 32 months.

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

[6] Converted at the exchange rates used in the basic design study (1BDT=1.822yen) and at the time of the project completion (1BDT=1.55yen), respectively.

3.3 Effectiveness (Rating: ②)

3.3.1 Quantitative Effects

3.3.3.1 Improvement of Cyclone Monitoring Capacity

The radar system's reliable detection range for a precipitation intensity of 1mm/h or more is 300km radius as targeted. This is broader than the 200km radius of Cox's Bazar's and Khepupara's old systems before their failure in 2004. The maximum detection range covers a 440km radius.

3.3.3.2 Operation Hours of Meteorological Radars

Annual operation hours of both radars fall below the 4,000 hour target set at the time of the project planning. While operation hours of the Cox's Bazar radar reached 88% of its target, the Khepupara radar operated at only 589 hours (or 15% of its target) in the expected achievement year of 2009/10 (See Table 2).

Table 2 Planned and Actual Operation Hours of the Meteorological Radars

	Baseline	Target	Actual (2009/10)
Cox's Bazar Radar Station	Non-operational (Approx. 2,000 hours before the failure of the system)	Approx. 4,000 hours/year	3,529 hours/year
Khepupara Radar Station	Non-operational (Approx. 2,000 hours before the failure of the system)	Approx. 4,000 hours/year	589 hours/year

Source: BMD

The main reasons for the low operation rate of the Khepupara radar were that it was affected by frequent power outages and insufficient fuel supplies for the generator. In response to the situation, the BMD secured a budget for fuel for Fiscal Year (FY) 2010/11[7]. Indeed, the Khepupara radar operated 589 hours in the pre-monsoon season (March – May) in the year, more than triple the previous year's 142 hours. In May alone, the month that precipitation sharply increases, the operation hours increased 78 hours from the previous year to 319 hours. The BMD intends to keep the same operation level in Khepupara until November when the post-monsoon season ends and also plans to operate it for more than 3,000 hours annually in the coming years.

Although the Cox's Bazar radar did not reach its operation hour target of 4,000 hours, some questions exist as to whether this target was reasonable. The BMD considers 4,000 hours to be the maximum operation hours and recognizes that actual operation time depends on meteorological conditions and therefore varies from year to year. Since reducing operation time when there are no precipitation phenomena does not pose serious problems itself, it is not appropriate to jump to the conclusion that the operation time of the Cox's Bazar radar was not sufficient[8].

It is also debatable whether using operation hours as an indicator was appropriate to assess the effectiveness of radar operation. Operation hours do not include the time spent on inspections as well as the time that radar operations are deliberately stopped while there are no precipitation phenomena. Therefore, it may have been more appropriate to use an indicator such as: 1) the total time of operation hours and planned/deliberate outage hours, or 2) unplanned outage hours

[7] It is covered by the budget of the Head Office.
[8] Comments from a meteorological expert in Japan

due to power outages and mechanical/system failures[9]. A target could then be set based on past operational records.

It should be noted that understaffing in the two radar stations has to some extent affected operation rates of both radars in the monsoon seasons. The BMD is trying to improve the situation and has proposed a new organizational structure to the Ministry of Establishment which includes an increase in the number of staff. It is currently under consideration in the Ministry.

Based on the above findings, it can be said that the project enhanced the cyclone monitoring capacity of the BMD. On the other hand, the full benefit of the project has not been realised due to the low operation rates of the radars, though it should be kept in mind that the target may not have been appropriate.

3.3.2 Qualitative Effects

3.3.2.1 Development of Monitoring Capacity on Cyclonic Wind Velocity

The new meteorological radar systems are equipped with a Doppler function to monitor wind, which enabled the BMD to obtain data on precipitation intensity in a broader range also in addition to information on cyclonic wind velocity distribution. The old radar systems installed in 1988 did not have such a function even though storm surges caused by cyclonic wind have often resulted in tremendous damage.

3.3.2.2 Early Monitoring of Cyclones

As part of the project, a meteorological satellite data receiving system was set up in the Storm Warning Centre (SWC) of the BMD. Though the BMD had had a satellite data receiving system compliant to the Japanese Geostationary Meteorological Satellite (GMS-5), it had been unable to receive satellite data since the GMS-5 was taken over by the Geostationary Operational Environmental Satellite-9 (GOES-9) of the United States in May 2003. A new satellite data receiving system installed under the project made available to the BMD satellite imagery provided by the Japanese Multi-functional Transport Satellite (MTSAT), which succeeded GOES-9. By analyzing MTSAT data along with radar data, the BMD is able to monitor cyclones in the Bay of Bengal and the Indian Ocean at an early stage. (Note: The system crashed early this year and is expected to be restored soon (See 3.5.4 Current Status of Operation and Maintenance)).

3.3.2.3 Quick Dissemination of Cyclone Information and Warnings

The BMD had been unable to provide cyclone information based on the latest radar observation data since the failure of the radar systems in Cox's Bazar and Khepupara in 2004. With the replacement of the systems, the SWC currently receives radar data every 30 to 60 minutes when a cyclone develops. In addition, a satellite data communication system was newly installed in the SWC and the two radar stations for stable and swift transmission of radar data to the SWC, and now receives data in an average transmission time of 15 minutes and promptly prepares special weather bulletins that can be distributed to disaster management agencies and the media through such means as a microwave link.

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

[9] Comments from a meteorological expert in Japan. By not including planned and deliberate outage hours into "non-operating hours", effectiveness of operation can be assessed independently of meteorological conditions.

3.4 Impact

3.4.1 Intended Impacts

3.4.1.1 Improvement of Cyclone Information and Warnings

(1) Accuracy

According to the results of the beneficiary surveys conducted by the ex-post evaluation team, the majority of the respondents recognized improvement in the accuracy of cyclone information and warnings. The CPP and the Disaster Management Committee (DCC) formed under each Union Parishad (Committee), which is the lowest administrative body in the county, play a central role in dissemination of warnings to communities and evacuation support[10], while citizens receive cyclone information and warnings mainly through the media such as radio and television[11]. The beneficiary survey mainly targeted DCC members that include Union Parishad members. A total of 155 respondents[12] from 10 Union Parishads[13] indicated that the accuracy of cyclone information has improved (Figure 1).

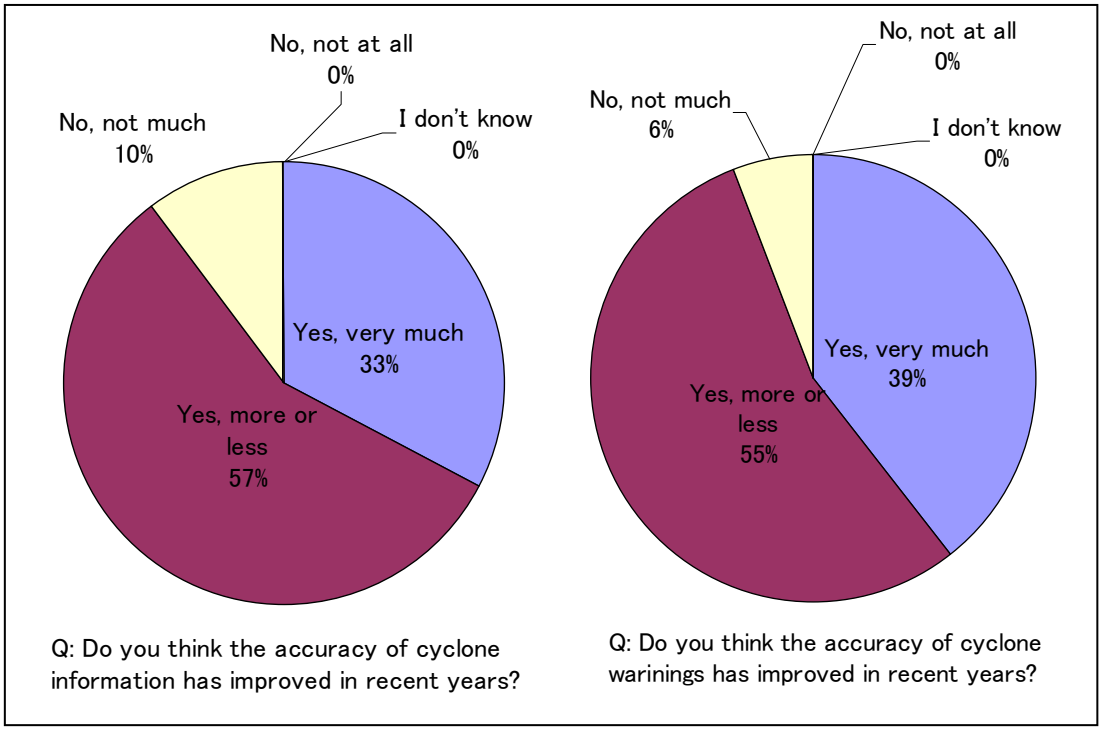

Figure 1 Results of Beneficiary Surveys on Accuracy of Cyclone Information and Warnings

The DMB and the CPP also recognize the improvement of accuracy of cyclone information and warnings issued by the BMD. The level of satisfaction of the CPP is particularly high[14].

[10] Tools such as megaphones and warning signal flags have proven to be effective. (Interview with DMB)

[11] Cyclone information that citizens receive include: centre position, direction of movement, maximum wind speed, height of tidal surge, areas likely to be affected and warning signal level numbers.

[12] Of 155 respondents, 115 are Union DCC members including Union Parishad members and 40 are those involved in administration of Union Parishads. 22 out of the 155 are women.

[13] The administrative structure of rural Bangladesh consists of Divisions, Districts, Upazilas and Unions. For the survey, 10 Upazilas heavily affected by any cyclone hit after the completion of the Cox's Bazar Radar Station (February 2007) were selected from 4 districts (Barguna, Patuakhali, Khulna, Cox's Bazar). One Union is chosen from each of the 10 selected Upazila making the total number of surveyed Unions 10.

[14] Interview with DMB and CPP. CPP commented that 95% of warnings issued in the last few years were

(2) Timing of warning issuance

Though the Standing Orders on Disaster of the GoB stipulates that the BMD should issue danger signals at least 10 hours before an expected landfall[15], in case of super cyclones, the BMD is supposed to issue danger signals 24 hours in advance. The table below shows the lead times for evacuation, which indicates a period of time from the first issuance of a danger signal until landfall, by super cyclone (more than 200km/h in intensity) that hit Bangladesh after the first replacement of meteorological radar systems in Cox's Bazar and Khepupara in March 1988.

Table 3 Lead Time for Evacuation

Year	1991	1994	1997	2007
Lead Time	32 hours*	21 hours	25 hours	27 hours

*It took a long time due to slow pace of the cyclone
Source: BMD

Cyclone Sidr of 2007 is the only super cyclone that hit the country since the completion of one of the two radar systems under the project. The BMD issued danger signals earlier than usual based on conclusions drawn from radar data and other information that left no doubt about the intensity of the cyclone.

Results of the beneficiary surveys also indicate an improvement in the timing of warning issuance. 139 people (90%) of those surveyed answered that they receive warnings earlier than before.

3.4.1.2 Improvement of Quality of Weather Forecasts for Cox's Bazar District

As part of the project, a meteorological data display system and a meteorological data communication system were installed in the Cox's Bazar Meteorological Office, which prepares forecasts for the Cox's Bazar District. Through the system, the Meteorological Office receives radar data from the Cox's Bazar radar including data on the movement of clouds and storms. This data had not been available before the project and they now use such detailed data to prepare forecasts[16].

3.4.1.3 Reduction of Cyclone Damage

Historically cyclones have caused extensive damage to the coastal areas of Bangladesh. Table 4 shows the scale of and number of victims of major cyclones that struck Bangladesh after March 1988.

Table 4 Scale and Number of Victims of Major Cyclones

Year	Landfall Area (Name of Cyclone)	Max. Wind Speed (km/h)	Tidal Surge (ft)	No. of Dead & Missing	No. of Affected Districts	No. of Affected People
1988	Khulna	160	2-14.5	12,133*	―	―
1991	Chittagong	225	12-22	138,882	19	10,798,275
1994	Cox's Bazar - Teknaf Coast	278	5-6	188	―	416,000
1997	Sitakundu	232	15	155	10	2,835,472
1997	Sitakundu	150	10-15	300	―	2,015,669
1998	Chittagong Coast	173	3	114	―	―

accurate.

[15] Ministry of Food and Disaster Management, "Standing Orders on Disaster," April 2010.

[16] Interview with the Cox's Bazar Meteorological Office

2000	Sundarban Coast	50-60	2-4	253	—	—
2002	Sundarban Coast	65-85	5-7	182	—	—
2004	Cox's Bazar - Akyab (Myanmar) Coast	65-90	2-4	30	—	—
2007	Khulna - Barishal Coast (Sidr)	223	15	4,234	30	8,923,259
2008	Khulna – Barishal Coast (Rashmi)	83	5-7	11	17	321,831
2009	Chittagong – Cox's Bazar Coast (Bijli)	60-80	—	5	15	92,558
2009	Khulna Coast (Aila)	92	6-8	1,278	11	4,826,630

* Including deaths in India
Source: BMD and DMB website

Since a number of factors determine the amount of damage caused by a cyclone, it is difficult to verify whether the damage relative to the scale of the cyclone has been reduced. However, when the two biggest cyclones in terms of maximum wind speed, height of tidal surge and number of affected people, namely the 1991 cyclone and Sidr of 2007[17], are compared, it can be said that the number of dead and missing from the latter is substantially lower.

The GoB acknowledges that the number of deaths from cyclones has been lower than in the past and identifies the improved early warning system as a primary factor[18]. An improvement in the quality of cyclone warnings issued by the BMD has also been acknowledged by: DMB officials, a leading government agency for disaster prevention and response, and the staff of the CPP that delivers cyclone warnings to residents in high-risk areas[19]. The CPP appreciates the early issuance of warnings by the BMD for all recent cyclones that have allowed communities sufficient time for evacuation after receiving warnings from the CPP[20]. Although the death toll from Cyclone Sidr is high (exceeding 3,000), the number of those killed on land was about 1,000 and the CPP estimates that most of the victims were fishermen that ignored warnings.

In the above-mentioned beneficiary survey, 92% of the 155 respondents answered that residents in their unions are better prepared for cyclones than before. As the main reasons for the better-preparedness, 41% answered that people have sufficient time for evacuation as a result of early receipt of warnings, and 35% noted an increased awareness from past experience about the disastrous effects of cyclones. To the question about assumed reasons why some people lost their lives due to recent cyclones, the top answer (51%) was that they did not evacuate despite warnings.

3.4.2 Other Impacts

No negative impact such as environmental impact has been observed. Resettlement and land acquisition were not required for the project.

As seen above, the project has generated positive impacts. Findings suggest that it has contributed to the improvement of cyclone information and warnings, increasing the quality of forecasts for Cox's Bazar District, and reducing damage from cyclones.

[17] Sidr hit the country after the completion of Cox's Bazar radar replacement.
[18] Government of Bangladesh, "Steps towards Change: National Strategy for Accelerated Poverty Reduction II (Revised) FY 2009-11," December 2009.
[19] The CPP transfers warnings provided by the BMD from the CPP Headquarters to communities through CPP regional offices, Upazila offices, CPP Union teams, and CPP Unit teams and CPP volunteers.
[20] Interview with CPP.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

Since the time of the project planning, the observation setup and the total number of staff involved in observation in both radar stations have not been changed[21]. Normally, a team consisting of an electronic assistant and a mechanic work in two shifts for a total of 12 hours. When a cyclone approaches, however, the radars operate around the clock on three shifts for special observation. In addition to the team members, an (assistant) electronic engineer(s), electronic assistants, a foreman/mechanics and an assistant meteorologist supervise observations.

Both stations receive backup from the BMD Head Office during the development of a cyclone. However, the number of electronic assistants has decreased by 1 in both stations despite the recommendation by the basic design study team for more staff allocation to certain posts including electronic assistant to extend observation time in the monsoon seasons (See Table 5). This has resulted from a change in GoB recruitment rules that do not fit with BMD's organizational setup. Due to the change, it has become difficult for the BMD to recruit electronic assistants and consequently the BMD cannot even fill positions left vacant by retirements. In order to increase manpower and enhance observations, the BMD has proposed a new organogram along with its proposed staff numbers for each post to the Ministry of Establishment.

Table 5 Number of Personnel in Cox's Bazar and Khepupara Radar Stations

Posts	Cox's Bazar			Khepupara		
	2005		2011	2005		2011
	Actual	Proposed increase	Actual	Actual	Proposed increase	Actual
Electronic Engineer / Assistant Electronic Engineer	1	1	2	1	1	1
Electronic Assistant	4	1	3	4	1	3
Assistant Meteorologist	1	―	1	1	―	1
Foreman / Mechanic	5	―	5	4	1	5
Radio Mechanic	0	―	1	0	―	0
Balloon Maker	0	―	0	0	―	3
Other	5	2	3	3	2	5
Total	16	―	15	13	―	18

Source: BMD

With regard to the maintenance of equipment procured under the project, through decades of experience, the BMD has developed a well-established system in both radar stations for routine maintenance under the supervision of an assistant electronic engineer.

3.5.2 Technical Aspects of Operation and Maintenance

There is little concern about BMD's technical capacity since many of BMD's technical personnel have long engaged in operation and maintenance of meteorological radars and

[21] The two radar stations have almost the same number of observation staff despite the fact that the operation rate of the Khepupara radar is far lower than that of the Cox's Bazar radar. This is due to a gap in the technical capacity of the two radar stations.

received training when new equipment was installed under the project. Newly recruited or transferred staff acquired sufficient skills to manage routine operation and maintenance through on-the-job training under the guidance of experienced personnel. In addition, under JICA's technical cooperation project on Human Capacity on Operation of Weather Analysis and Forecasting, they have received further training on operation and maintenance of the radar systems[22] in order to use the equipment procured under the project more effectively and longer. JICA experts from the technical cooperation project[23] as well as BMD officials did not identify any problems with the routine operation and maintenance of the equipment. Though the BMD does not provide regular training for technical personnel, internal training is conducted in which personnel who have participated in overseas training share their knowledge as appropriate.

Technical personnel themselves in the Cox's Bazar and Khepupara radar stations also find little difficulty in operation and maintenance of the radars. However, since the software based system was introduced to the BMD for the first time, they feel the need to learn more about the Linux operating system and circuit analysis so as to deal with troubles properly when they arise.

3.5.3 Financial Aspects of Operation and Maintenance

Budgets for the BMD Head Office, the two radar stations and the SWC have increased steadily securing sufficient funds for usual operation and maintenance (See Table 6). Satellite communication fees, which were not required before the introduction of the satellite data communication system under the project, are covered by Head Office budget.

Table 6 Annual Budget of BMD Head Office and Radar Stations

(BDT1,000)

Item	2008/09	2009/10	2010/11	2011/12 (Prospect)
BMD Head Office				
Personnel Expenses	42,500	45,000	46,000	50,000
Consumable Cost	3,000	3,500	4,000	5,500
Electricity & Water Utilization Cost	3,800	4,000	4,100	4,500
Cost of Spare Parts	35,090	37,000	41,000	65,000
Telecommunication Cost	8,500	9,000	9,500	10,000
Space Segment	1,200	1,500	1,700	2,500
Total	94,090	100,000	106,300	137,500
Cox's Bazar Radar Station				
Personnel Expenses	3,500	3600	3,700	3,900
Consumable Cost	820	920	1,120	1,320
Electricity & Water Utilization Cost	700	800	910	1,110
Radar Maintenance Cost	810	910	1,110	1,310
Total	5,830	6,230	6,840	7,640
Khepupara Radar Station				
Personnel Expenses	3,580	3,680	3,780	3,860
Consumable Cost	400	500	600	710

[22] Under the technical cooperation project, the BMD is working on estimating rainfall through calibration analysis of radar data from the Cox's Bazar and Khepupara radars in order to increase the impact of a series of Japan's grant aid projects to develop meteorological radar systems including the Cox's Bazar and Khepupara project.

[23] Those experts include consultants from the Japan Weather Association (JWA): the main consultant for this project.

Electricity & Water Utilization Cost	500	600	750	910
Radar Maintenance Cost	1,000	1,100	1,200	1,330
Total	5,480	5,880	6,330	6,810

Source: BMD

Though the operation of the radar systems, particularly in Khepupara, has been affected by frequent power outages especially during the period from 2007 to 2009 and subsequent lack of funds for generator fuel, the BMD claims that it has managed to secure sufficient budget for fuel since FY 2010/11. Although the electricity and water budget of the Head Office for 2010/11 that covers the fuel cost does not indicate a significant increase (See Table 6), recent operation records in Khepupara show a substantial extension of radar operation hours (See 3.3.1 Quantitative Effects). It is therefore unlikely that financial issues will significantly affect the sustainability of the project's effects.

3.5.4 Current Status of Operation and Maintenance

The equipment in the two radar stations have managed to be maintained very well: all equipment is currently functioning properly and even looking as good as new. Both stations have kept complete maintenance records using daily, weekly, monthly and semi-annual check sheets. Uses of spare parts and the replacement of parts and components have also been recorded in detail. Mechanical troubles have been dealt with properly; however, it sometimes took a few months to change parts or components because these systems were the first digital radar systems introduced in Bangladesh.

The condition of the radar tower building is also good. The interior of the building has been thoroughly cleaned. The BMD arranges for maintenance and repair work on any radar tower buildings when problems are identified and therefore the inspection and maintenance of the Cox's Bazar and Khapupara radar tower buildings (walls, roof, doors, etc.) have been done only once when the warrantee period was ending a year after the completion of the construction. The BMD has encountered no serious problems with regard to maintenance of the radar tower buildings.

The project equipped the SWC with a meteorological radar data display system, a meteorological data communication system, a meteorological data satellite communication system and a meteorological satellite data receiving system. Of the four systems, the satellite data receiving system has been non-operational for more than 10 months. The prolonged response is partly due to the fact that a hard disk change did not work and partly because it is not required for observation activities. The problem is expected to be solved very soon now that the JWA, the main consultant of the project, diagnosed the problem, and the procurement of necessary parts is underway. The Japan Meteorological Agency is providing the BMD with access to meteorological satellite data on the Internet until the restoration of the data receiving system.

Based on the above findings, it is concluded that, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is well aligned with the policy of the GoB that gives priority to disaster management as well as the development needs of a country that has suffered tremendously from cyclones. The project was efficiently implemented with inputs executed and outputs produced

almost as planned.

One of the targets set for the project, the radars' detection range of 300km radius for precipitation intensity of 1mm/h or more, has been met. On the other hand, though annual operation hours of the meteorological radars fell well below the target in FY 2009/10, prospects for extension of operation hours are good. Findings of the evaluation study suggest that it has largely generated intended impacts such as improved cyclone information and warnings, better quality of forecasts for Cox's Bazar District and contribution to the reduction of damage from cyclones. The implementing agency that has operated and maintained all meteorological radars in Bangladesh for over two decades is competent enough to continue to generate such project effects and therefore the sustainability of the project is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Although operation and maintenance of the radar systems have been properly undertaken owing to skilled technical personnel, in order to maximize the project effects as well as to benefit more from the project, it is necessary to extend observation hours (particularly in the monsoon seasons). In this regard, the current observation setup of the two radar stations in the monsoon seasons in particular should be enhanced. It is recommended that the BMD make further efforts to obtain government approval of the proposed new organizational structure and increase personnel for observations.

As far as the meteorological satellite data receiving system set up in the SWC, the BMD should restore it as soon as possible, giving serious consideration to the fact that it remained non-functional during this year's entire monsoon season. In addition, developing an effective reporting and coping system that works without relying on the JWA (the main consultant of the project) is recommended.

4.2.2 Recommendations to JICA

There is no particular recommendation to JICA.

4.3 Lessons Learned

Indicators that measure the direct effects of a project, "project effect indicators", are important and therefore need to be set based on sufficient discussion among concerned parties. In setting such targets, the past performance records of the executing agency need to be taken into consideration.