

Country Name	Project on Development of Human Capacity on Operation of Weather Analysis and Forecasting
People's Republic of Bangladesh	

I. Project Outline

Background	<p>Bangladesh is a vulnerable country against natural disaster including floods, tropical cyclones and storm surges, in particular, in the coastal area. Also, the northeaster area of the country surrounded by mountains has been frequently damaged by flash floods. Therefore, the government of Japan supported construction of weather radar observation stations by grant aid (in Rangpur (2000), Dhaka (2000), Cox's Bazar (2007), Khepupara (2008) and Moulvibazar" (2009) in order to cover the whole territory of Bangladesh. The Bangladesh Meteorological Department (BMD) conducted weather observation based on the data from the weather radar stations in addition to surface observation, balloon observation and observation at the Radiosonde Observation Station. However, the data collected by the weather radars were not sufficiently utilized because they were not appropriately calibrated. In addition, weather forecasts were differed by the weather forecast officers.</p> <p>Under those situations, the Government of Bangladesh requested to the Government of Japan for a technical cooperation to development human resources for conducting rainfall volume analysis using the weather radar data as well as to enhance capacity to transmit more useful weather forecast as disaster information.</p>				
Objectives of the Project	<p>Through the improvement of capacity of BMD for weather observation, analysis and forecast, the project aimed at the timely issue of accurate weather information to stakeholders involved in natural disaster management, thereby contributing to the reduction of natural disaster losses in Bangladesh.</p> <ol style="list-style-type: none"> Overall Goal: Natural disaster losses are reduced by the utilization of highly precise weather information. Project Purpose: More accurate weather information is timely issued to the stakeholders of the natural disaster management*. <p>* The stakeholders for the natural disaster management include Department of Disaster Management, Flood Forecasting and Warning Centre (FFWC), Local Government Engineering Department, Dhaka Medical College, mass media.</p>				
Activities of the Project	<ol style="list-style-type: none"> Project Site: Operation areas of BMD (39 sites including Dhaka, Chittagong, Khulna, Rangpur, Moulvibazar) Main Activities: 1) Trainings for observation staff on weather observation and for inspectors on calibration of observation equipment, 2) Conducting calibration analysis for actual rainfall volumes and simulated rainfall volume, 3) development and improvement of data quality management, 4) Trainings for BMD staffs on the Numerical Weather Prediction (NWP), 5) Organizing seminars workshops for disaster management and preparation of leaflets on disaster management, 6) Trainings for maintenance staff of BMD on operation and maintenance of weather radar facilities Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> <p>Japanese Side</p> <ol style="list-style-type: none"> Experts: 16 persons Trainees Received: 6 persons Equipment: PCs, visual presenters, rain gauge and data logger, automatic weather system, etc. Local cost: traveling cost of experts </td> <td style="width: 50%;"> <p>Bangladesh Side</p> <ol style="list-style-type: none"> Staff Allocated: 30 persons Land and facilities: Office space in BMD Local cost: logistical support, supplementary budget for seminars and open-classes </td> </tr> </table> 			<p>Japanese Side</p> <ol style="list-style-type: none"> Experts: 16 persons Trainees Received: 6 persons Equipment: PCs, visual presenters, rain gauge and data logger, automatic weather system, etc. Local cost: traveling cost of experts 	<p>Bangladesh Side</p> <ol style="list-style-type: none"> Staff Allocated: 30 persons Land and facilities: Office space in BMD Local cost: logistical support, supplementary budget for seminars and open-classes
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Project Period	September 2009 – December 2013	Project Cost	(ex-ante) 260 million yen, (actual) 454 million yen		
Implementing Agency	Bangladesh Meteorological Department (BMD)				
Cooperation Agency in Japan	Japan Meteorological Agency (JMA), Ministry of Land, Infrastructure, Transport and Tourism				

II. Result of the Evaluation

1 Relevance
<p><Consistency with the Development Policy of Bangladesh at the Time of Ex-Ante Evaluation and Project Completion></p> <p>The project was consistent with Bangladesh's development policies of "Poverty Reduction Strategy Paper (2005-2008)" with high priority to establishment and improvement of disaster prevention system including early warning and forecast system and "National Development Plan of Disaster Management (2010-2015)" prioritizing the technical and technological capacity building of BMD. The policy priorities were confirmed at the time of ex-ante evaluation and the time of project completion.</p> <p><Consistency with the Development Needs of Bangladesh at the Time of Ex-Ante Evaluation and Project Completion ></p> <p>The project was consistent with Bangladesh development needs of capacity development for BMD staffs to provide meteorological services, such as weather observation and forecast, by utilizing the data from the meteorological radar system. The development needs were confirmed at the time of ex-ante evaluation and the time of project completion.</p> <p><Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation></p> <p>The project was consistent with a Japan's ODA policy for Bangladesh, prioritizing support for 4 priority areas including social development and human security with a component of disaster management in "the Country Assistance Program for Bangladesh" (2006).</p> <p><Evaluation Result></p> <p>In light of the above, the relevance of the project is high.</p>

2 Effectiveness/Impact

<Status of Achievement for the Project Purpose at the time of Project Completion>

The Project Purpose was achieved by the project completion. The optimized radar data of rainfall was provided to FFWC by BMD during the project (Indicator 1). The program of preparing “Visualized BMD Special Weather Bulletin” for cyclone tracking, storm surge and strong wind warning was developed by the project, and, the “Visualized BMD Special Weather Bulletin” was timely issued through television and the BMD’s website when the Cyclone Mahansen hit Bangladesh in May of 2013 (Indicator 2).

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have been continued since the project completion. The optimized radar data of rainfall has been continuously provided to FFWC by BMD via the automatic data sharing link using email and website.

The rain gauges and the automatic weather systems installed by the project at the observation stations been functional and continuously collected the real-time meteorological data including rainfall. This enables BMD to generate the timely weather information in high resolution by corroborating such data with the rainfall data from the existing meteorological radar systems. The summary of the trend analysis of climate change based on the meteorological data is available on the BMD’s website by a charge for general users and by free for government institutions, and the 30-year average climate data is open to the public for free.

<Status of Achievement for Overall Goal at the time of Ex-post Evaluation>

The Overall Goal has been achieved at the time of ex-post evaluation. According to the BMD staffs interviewed by the ex-post evaluation survey, the stakeholders of the natural disaster management have relied on and utilized the weather information released by BDM for emergency preparedness. In terms of a reduction in the natural disaster losses, according to an article published by the International Institute for Environment and Development¹, while more than 3,400 people and 339 people were killed by “Cyclone Sidr” in 2007 and “Aila” in 2009, respectively, the number of the fatalities for the Cyclone “Roanu” in 2016 was limited to less than 30 in Bangladesh though more than 200 people were died in Sri Lanka. Considering the danger level of cyclonical storms, the Cyclone Sidr (the peak 1minute sustained winds of 260km/h (160 mph) and the lowest pressure of 944 hPa) was the level of sever danger which damages individual buildings and the Cyclone Aila and the Cyclone Roanu were the level of significant danger which damages individual roofs. Therefore, it can be reasonably estimated that the project is able to mitigate the expected fatalities caused by the significant danger level of cyclonical storms.

<Other Impacts at the time of Ex-post Evaluation>

Some positive impacts were observed at the time of ex-post evaluation. BMD makes the weather information open to the public via the BMD’s website and mobile application, and not only public and private organizations but also the general citizens can access to the information. According to the UNDP’s “Terminal Evaluation Report for the Comprehensive Disaster Management Report”, the BMD’s weather forecast helps the vulnerable groups, especially women and children, to prepare for natural disasters. According to the study², the cyclone in 1991, which is the deadliest cyclone in Bangladesh with the estimated fatalities between 68,000 to 138,000, killed vulnerable groups of people such as women, elder people and children at higher rate than the other groups. However, in these days, there has been a significant reduction of fatalities in vulnerable groups. In addition, the BDM weather forecasts and climatic information has been currently used by the public service agencies, such as the Department of Agriculture Extension and civil society organizations (CSOs) and non-governmental organizations (NGOs). According to a study³ by Deltares, an independent institute for applied research in the field of water and subsurface based in Netherland, overall the community people managed to save a large amount of damages by taking protective actions after receiving early warning and the estimated average savings per household were 768 USD for fisheries, 640 USD for agriculture and 678 USD for livestock. The Practical Action Bangladesh, an international NGO based in the United Kingdom translated the weather forecasts into understandable manner for the communities in order to use them for activities of agriculture, fisheries and livestock production.

<Evaluation Result>

In light of the above, through the project, the Project Purpose was achieved, the project effects have been continued and the Overall Goal has been achieved by the time of ex-post evaluation. Therefore, the effectiveness/impact of the project is high.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results
(Project Purpose) More accurate weather information is timely issued to the stakeholders of the natural disaster management.	(Indicator 1) Rainfall data of the optimized radar Z-R relation parameter for rainfall calculation being provided to FFWC.	Status of the Achievement: Achieved (Continued) (Project Completion) • The rainfall data of the optimized radar ZR relation parameter for rainfall calculation was provided to FFWC by BMD. (Ex-post Evaluation) • The rainfall data has been continuously provided to FFWC by BMC via the automatic data sharing system using email and website.
	(Indicator 2) Accurate and easily-understanding forecast and warning including tropical cyclone are timely issued to the organizations related to natural disaster management and mass media.	Status of the Achievement: Achieved (Continued) (Project Completion) • When the cyclone “Mahasen” hit Bangladesh in May of 2013, the “Visualized BMD Special Weather Bulletin” was timely issued through television and the BMD’s website. (Ex-post Evaluation) • According to the stakeholders for the natural disaster management

¹ International Institute for Environment and Development (2016) “Cyclone Roanu hits Bangladesh: a story of loss and damage avoided” (<https://www.iied.org/cyclone-roanu-hits-bangladesh-story-loss-damage-avoided>), as of April, 2018)

² Keiko IKEDA, “Gender Differences in Human Loss and Vulnerability in Natural Disaster: A Case Study from Bangladesh” (Indian Journal of Gender Studies, 1995)

³ Deltares, “Mobile Services for Early Warning in Bangladesh: Final Report”, (2015),

https://www.deltares.nl/app/uploads/2015/11/Deltares-Mobile-Services-for-Early-Warning-in-Bangladesh-Final-Report_web.pdf, p36

		surveyed for the ex-post evaluation, BMD nowadays updates the weather information 6 times a day, and they regularly receive the accurate and timely weather information through television, radio and the BMD's website.
(Overall Goal) Natural disaster losses are reduced by the utilization of highly precise weather information.	(Indicator 1) Cases which prove that the utilization of BMD's weather information by organizations related to natural disaster management contributed to reduction of the natural disaster losses.	(Ex-post Evaluation) Achieved <ul style="list-style-type: none"> The stakeholders of the natural disaster management have relied on and utilized the weather information released by BDM for emergency preparedness. According to International Institute for Environment and Development, the number of the fatalities for the cyclone "Roanu" in 2016 was limited to 30 compared to the number of fatalities by the cyclone "Sidr" in 2007 and "Aila" in 2009.

Source : Interview and questionnaire with BMD and the stakeholders of the natural disaster management, the Project Completion Report (2014)

3 Efficiency

Although there was no change in the outputs of the project, the project cost and period exceed the plan (ratio against the plan: 175% and 144%) since the Project Purpose had not been achieved within the original project period due to the one-year delay of the procurement of the rain gauges and the automatic weather observation systems and the delay of the project activities. The delays increased the project cost because of the raised price of the equipment and the increased cost of trainings as well as the additional dispatch of the Japanese experts for the extended project period.

Therefore, the efficiency of the project is low.

4 Sustainability

<Policy Aspect>

Although "the National Plan for Disaster Management (NPDM, 2016-2021)" has not been approved yet, the draft plan was prepared following the Sendai Framework for Disaster Reduction and the Sustainable Development Goal for resilience targets in order to address issues on resilience against disaster including strengthening of disaster risk governance to manage disaster risks and investment in disaster risk reduction for resilience. Also, the Disaster Management Policy 2015 following the Disaster Management Act 2012 enhances disaster management at national level.

<Institutional Aspect>

BMD has taken responsibilities for the activities related to the weather forecast and warning for natural disasters, including operation and maintenance of the meteorological radar systems, collection and analysis of the meteorological information, and release of the weather information. The number of staffs of BMD, including directors, increased from 767 in 2008 before starting the project to 942 in 2016 at the time of ex-post evaluation. In particular, the number of technical staffs who conduct weather analysis and forecasting increased from 630 to 706 during the same period and it is sufficient to conduct the activities related to weather analysis and forecasting.

The information and forecast sharing protocol between BMD and all other relevant organizations remains the same since the project completion as mentioned above.

<Technical Aspect>

The 6 staffs of BMD trained by the project have retained in their respective sections and continued providing the services. They have sustained the necessary skills and knowledge to perform the activities related to the weather forecast and warning for natural disasters. The technologies and manuals produced by the project for weather analysis and forecasting, such as the instruction manual on radar calibration, and the PC Cluster operation manual, have been utilized by BMD. Also, the final version of the weather observation guidelines and the data input manual including software prepared by the project were handed over to BMD until the end of the project.

The Training Division of BMD continues to provide all the modules prepared by the project. The contents of those trainings, such as the Weather Forecaster Course, the Technical Staff Course, the Engineer Course, the Measuring Instruments Official Verification Course, the Weather Observer Course, and the Balloon Operator Course, were updated in 2016.

<Financial Aspect>

The budget of BMD has continuously increased from 303 million Taka in 2013/14 to 747 million Taka in 2016/17. The further increase is expected in the next three years from 2017/18 to 2019/20. It is because of the budget allocation in 2017/18 from the two development projects, such as "the Improvement of Meteorological Rader System in Dhaka and Rangpur" supported by JICA (375 million Taka) and "Strengthening of meteorological observatories located at 13 River Port Areas of Bangladesh" (294 million Taka) funded by the government budget. On the other hand, the allocation for operations and maintenance of the weather observation systems needs improvement. For example, the data capturing for 6 meteorological observatories require to operate the oil-fired power generator 6 times a day because the quality of the electricity supply is not suitable for the functioning of the equipment. Due to inadequate O&M budget allocation, the frequency of the data collection was not maintained as planned

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the technical and financial aspects of the implementing agency. Therefore, the sustainability of the effectiveness through the project is fair.

5 Summary of the Evaluation

The project achieved the Project Purpose and the Overall Goal through timely issuing more accurate weather information to the stakeholders involved in the natural disaster management. As for sustainability, the frequency of the data collection has not been maintained as planned due to insufficient operation budget. As for efficiency, the project cost and period exceed the plan because of the one-year delay of the procurement of the rain gauges and the automatic weather observation systems.

Considering all of the above points, this project is evaluated to be partially satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

[For BMD]

Automation of observation, monitoring, communication and data acquisition will significantly improve the precision of the forecast by the agency. In addition to the national level forecast, localized weather forecasts will be helpful to the occupational groups (e.g. farmers,

fishers, small businesses) where weather observation facilities are currently available (42 surface observatories, 10 pilot balloon observatories, 3 radiosonde observatories, 12 agromet observatories, 49 rainfall measuring stations, and 5 radar stations).



BMD Analysts preparing forecasts



Moulovibazaar Radar Station