Internal Ex-Post Evaluation for Grant Aid Project

Country Name	The Project for Flood Forecasting and Warning System in High Atlas Region				
The Kingdom of More	(Le Projet de Système de Prévision et d'Alerte aux Crues dans la région du Haut Atlas)				
I. Project Outline					
Background	In Morocco, the major rivers start from the precipitous High Atlas mountains and the flows induced river floods and mudslides and damaged in the river basin areas. The large-scale disasters, such as the mudslides in the Ourika Valley in 1995 (more than 200 dead) and the heavy rains in 2002 (more than 60 dead and the property damage of equivalent to more than 800 million JPY) occurred in the areas. Since 1995, the Government of Morocco made efforts to mitigate flood damages, including erosion control and construction of sediment control facilities, and requested the Government of Japan to establish flood forecasting and warning system in High Atlas Region.				
Objectives of the Project	To establish flood forecasting and warning system in High Atlas Region by procurement and installation of hydrological observation and data collection subsystem, data analysis, and flood information transmission subsystem and warning and transmission subsystem as well as capacity building of operation and maintenance of the systems, thereby contributing to the mitigation of flood damages.				
Contents of the Project	 Project Site: Ourika and Rheraya river basins of Tensift River (16 sites of telemeter observation stations including 5 existing sites, 1 site of flood forecasting and warning center, 13 sites of warning stations, 1 site of warning center, and 3 sites of data monitoring stations) Japanese side: Procurement of hydrological observation and data collection subsystem, data analysis and flood information transmission subsystem and warning and transmission subsystem. Technical Assistance (soft component of Grant Aid) for capacity building for operation and maintenance of the systems and evacuation drills. Moroccan side: Removal of any obstacles and secure the land use on the construction sites and the installation of the system. Provision of electricity, water supply and other necessary utilities for the Project. 				
Project Period	E/N DateMarch 23, 2011Completion DateDecember 5, 2013G/A DateMarch 23, 2011Completion DateDecember 5, 2013				
Project Cost	E/N Grant Limit / G/A Grant Limit: : 586 million yen, Actual Grant Amount: 463 million yen				
Executing Agency	Ministry of Energy, Mines, Water and Environment (the name of the ministry changed to the Secretary of State in charge of Water under the Ministry of Equipment, Transport, Logistics and Water, on April 5, 2017)				
Contracted Agencies	Main Contractor(s): Marubeni Corporation				

Main Consultant(s): CTI Engineering International Co., Ltd.

II. Result of the Evaluation

1 Relevance

<Consistency with the Development Policy of Morocco at the Time of Ex-Ante and Ex-Post Evaluation>

The project was consistent with Morocco's development policies highlighting importance of flood risk management to reduce vulnerability set in policy documents such as "The Action Plan of Integrated Water Resources (GIRE: Le Plan de Gestion Intégrée des Resources en Eau" (2009-2030) and "The National Plan of Protection against Flood (PNPI: Le Plan National de Protection contre les Inondations" (2012). The current new law of Water Act No.36-15 (2016) prioritize water-related risk management and expansion of flood forecasting and warning systems in flood-prone areas at the time of ex-post evaluation.

<Consistency with the Development Needs of Morocco at the Time of Ex-Ante and Ex-Post Evaluation >

The project was consistent with Morocco's development needs of mitigation of human casualties, significant economic damages in the country's large urban centers, disruption of economic activities, and damages to infrastructure at the time of ex-ante evaluation. There are still needs of reduction of the risk of flooding in order to avoid human losses.

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with Japan's ODA Policy for Morocco¹ supporting the 6 priority areas confirmed by both governments of Morocco and Japan in 1999, including support for the environment sector for ensuring sustainable development. <Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Effectiveness>

The project partially achieved its objective at the time of the target year of 2015 and mostly achieved it at the time of ex-post evaluation. The proportion of the flood warnings issued by the flood forecasting and warning system upon precipitation exceeding the predetermined level (Indictor 1) was 70% in 2014 and 2015, and it reached to 90% in 2016 and maintained the same level at the time of ex-post evaluation in 2017. In some cases where the water level exceeded the predetermined level, no flood warning or alert was issued. On the other hand, all of the telemeter observation stations, flood forecasting warning stations, warning center, and data monitoring stations had been functioning well, except for the observation station in Tizi-n-Likemt which was damaged by the snow storm in 2016 and has been shut down since then. Namely, the indicator 1 of less than 100% did not necessarily mean the unfunctional or malfunctional system.

¹ Source: Ministry of Foreign Affairs, "ODA Databook" (2009), p. 359

According to the Agency of Tensift Hydraulic Basin (ABH-T: Agence du Bassin Hydraulique de Tensift), since they use not only the flood forecasting system installed by the project but also by the conventional system of $ABH-T^2$, the decision making on issuing flood warning is based on comprehensive analysis on telemetry data transmitted through the system installed by the project as well as the direct visual observation by the operators.

The project also has contributed to increasing awareness of flood warning and evacuation among the local population and decreasing the number of casualties damaged by floods. ABH-T conducted awareness raising sessions and evacuation drills once a year in the targeted river basins from 2013 to 2016. Actual evacuations from flooding based on the flood forecasting and warning system had been conducted twice in each year between 2013 and 2017.

<Impact>

Some positive impacts and a minor negative impact were observed at the time of ex-post evaluation. Because of regular sensitization of population by ABH-T as mentioned above and better coordination among relevant organizations for flood events, the number of casualties by flood was limited to one each in 2013 and 2014 and none since 2015. In addition, the flooding risk reduction led to an increase in the number of tourists and promoted touristic activities among residents, especially women, in the targeted river basins. On the other hand, there were some cases that false flood warnings were issued, which disrupted the tourism in the target area. <Evaluation Result>

In light of the above, the effect of the project has been observed mostly as planned. Therefore, the effectiveness/impact of the project is high.

Quantitative Effects

Indicators	Baseline 2009 Baseline Year	Target 2015	Actual 2014	Actual 2015	Actual 2016	Actual 2017	
		3 Years after	2 Years after	3 Years after	4 Years after	Ex-post	
		Completion	Completion	Completion	Completion	Evaluation Year	
Indicator 1: Proportion of flood warnings upon precipitation excess over the predetermined level (%)	0	100	70	70	90	90	
Source : Data provided by ABH-T							

3 Efficiency

The output of the project was produced as planned. Although the project cost was within the plan (ratio against the plan: 79%), the project period exceeded the plan (ratio against the plan: 136%) in order to take measures against land acquisition and technical problems in the data transmission subsystem. Therefore, the efficiency of the project is fair.

4 Sustainability

<Institutional Aspect>

[AHB-T]

AHB-T has been obligated to set up flood forecasting and warning systems under the Water Act No. 36-15 of August 2016. To this end, ABHT has been annually increasing the number of staff in charge of the flood forecasting and warning system management (Systeme de Prevision et d'Alerte aux Crues: SPAC) which shifted from one managing officer to a team of 4 managers including 1 supervisor/electro-mechanic engineer for follow-up and exploitation of the system, 1 hydrological chief technician for flood forecasting, analysis and transmission, 1 technician for water resources management and data analysis and 1 technician for telemetry and communication. In addition, ABHT is implementing regular maintenance and monitoring procedures for the facilities and equipment installed by the project in order to fulfill the recommendations of JICA experts and ensure the sustainable operation of the system. Yet, the number of technical staff remains insufficient to conduct operation and maintenance (O&M) for the flood forecasting and warning system. Therefore, Preventive and curative maintenance is now systematic and done at an annual basis and controlled by the external agents who have been outsourced by ABH-T.

[Al Haouz Province]

Al Haouz Province has 1 manager for system management (flood risk management) and 1 transmission agent and 1 computer engineer for system development and regular maintenance. They have the insufficient number of staff members as well. <Technical Aspect>

The staff members of ABH-T and Al Haouz Province have a certain level of knowledge and skills for operation and maintenance (O&M) of the flood forecasting and warning systems without serious problems because of their experiences of O&M of their own flood warning system in addition to the technical assistance by the project although no technical trainings were conducted after the project.

The flood forecasting and warning system was developed in two phases, namely a pilot system under JICA development study (2001-2003) and a full-scale system under grant-aid project (2011-2013). Two suppliers were involved in the implementation of the project, one for the pilot phase and another for the full scale phase and each of suppliers provided different type of equipment. As a result, there were some difficulties in interconnection between the two systems to establish one integrated system at the beginning of the full scale phase. In addition, lack of translated key documents and manuals in French provided by suppliers and consultants, have constrained timely maintenance of the system because the AHB-T staffs have difficulty to understand the English documents.

[AHB-T]

The actual expenditure for the O&M, including cost for maintenance service and periodic inspection and repair, increased from 0.132 million Moroccan Dirham (MAD) in 2014 to around 2.9 million MAD in 2017. Sufficient budget has been allocated to operation and

 $^{^2}$ The conventional system uses visual checks by the operators of the observation stations, communication by fax or radio between the observation stations and ABH-T and communication between ABH-T and the provincial offices for flood warning and evaluation.

maintenance of the system from 2014 to 2017 with a remarkable increase every year which gives hope to the continuity of getting enough adequate budget in the future.

<Current Status of Operation and Maintenance>

As mentioned above, all of the major equipment installed by the project has been functioning well, except for equipment installed in the Tizi-n-Likemt observation station which had been damaged by strong snow storm. And Temporary restoration works have been made but it has been unfunctional since 2016. The maintenance of this station was judged to be very difficult due to heavy snow in winter season. As a matter of fact, at the time of ex-post evaluation, ABHT has been planning to relocate this station

In terms of periodic inspections, overhauls, and repairs in case of troubles for the equipment, ABH-T has entrusted an external local agency. The agency has conducted the annual periodic inspections for all the stations/centers, except for the warning center, and conducted the overhauls once a year for all the stations/centers. Also, the agency has repaired the telemeter observation stations 3 times and the data monitoring stations 1 time so far.

<Evaluation Result>

In light of the above, some challenges have been observed in terms of the institutional and technical aspects of the implementing agency. Therefore, the sustainability of the project effect is fair.

5 Summary of the Evaluation

The project has mostly achieved its objectives to establish flood forecasting and warning system in High Atlas Region. As for sustainability, the O&M staff of AHB-T and Al Haouz Province has a certain level of technical skills and knowledge for O&M of the flood forecasting and warning system installed by the project. However, the number of O&M staff for each organization has not been sufficient and the O&M works have been outsourced to the external agents by AHB-T. As for efficiency, the project period exceeded the plan. Considering all of the above points, this project is evaluated to be satisfactory.

III. Recommendations & Lessons Learned

Recommendations to Implementing Agency:

• The lack of data information recorded because some technical problems in the system installed by the project resulted in the damage of some equipment in many alert stations by major flood in 2014 and reparation of these equipment delayed. To secure sustainability of the project, the observation sites with equipment installed by the project should be regularly visited and checked or examined. In addition, when certain equipment are broken down, they must be repaired or replaced with correct ones as soon as possible. Furthermore, it is recommended that ABHT strengthen its organization and conduct drills to further operate the system as a whole, including the conventional system as well.

Lessons Learned for JICA:

- The project has been well planned to respond to the real needs of the Moroccan government and population. As a matter of fact, it has been duplicated to other flood risk river basins in the country. However, to further reinforce sustainability of project effects, it is recommended to conduct trainings for O&M staff by using key documents provided by the Japanese experts, consultants and suppliers in order to make not only the O&M staff but also managing staff understand legal and technical matters for O&M of the system precisely. In addition, technical documents, including O&M manuals and technical guides to be provided by suppliers and consultants, should be translated into understandable language for the O&M staff in order to ensure trainings effects and to avoid misunderstandings. Concerning insufficient staff at ABHT and Al Haouz province, it is very important for JICA if similar projects are implemented in the future to examine the executing agency's capacity to secure necessary staff for O&M of the project at early formulation stage as well as its capacity to manage outsourcing contracts when external personnel is hired.
- At the planning and implementation stage, it is essential to consider interconnection of telemetry system which is a key to transmit data for flood forecasting and warning. Also, it is better to consider single supplier to procure unified equipment for ensuring integrity of the system in order to avoid interference of system integration. At the same time, it is necessary to carefully consider adequate project period to cover required time for necessary project activities, such as land acquisition process and works for system integration and interconnection.



Imlil alarm station in Rheraya valley



Tinetine Radar station in Rheraya valley

Tazitounte alarm station in Ourika valley	Setti Fadma alarm station in Ourika valley