

Country Name	Meteorological and Hydrological Services Improvement Project
The Lao People's Democratic Republic	

**I. Project Outline**

Background	<p>In Lao People's Democratic Republic (PDR), floods and landslides caused by southwest monsoons, typhoons and tropical storms occur annually across the country. They are particularly affecting the development of agriculture and air transportation. Department of Meteorology and Hydrology (DMH) is a sole government organization to provide national meteorological and hydrological service. However, its capacity to collect and analyze meteorological and hydrological data was insufficient and the meteorological observation system (e.g. weather radar) procured by the Japanese Grant Aid project (note) was not fully utilized. Consequently, DMH had difficulties in providing accurate information, which was necessary for the Mekong River development, water resources utilization, agricultural development and improvement of transportation, to concerned ministries, international organizations, etc.</p> <p>(note) The "Project for Establishment of Disastrous Weather Monitoring System" (EN signed in August 2004)</p>												
Objectives of the Project	<ol style="list-style-type: none"> <li>Overall Goal: Accurate meteorological and hydrological information will contribute to natural disaster management, agricultural development and transportation.</li> <li>Project Purpose: Meteorological and hydrological information is collected, analyzed and provided by DMH in proper and timely manner.</li> </ol>												
Activities of the project	<ol style="list-style-type: none"> <li>Project site: DMH headquarters (Vientiane City), Vientiane Province, Luang Prabang Province, Borikhamxay Province, Xayaboury Province, Khammouane Province.</li> <li>Main activities: Development of manuals and guidelines of the operation and maintenance of the equipment and data collection and analysis; training for DMH and provincial staff; rehabilitation or construction of provincial hydrological observation stations; renewal of equipment for observation, data archiving, inspection of data collection and processing at provincial stations; development of a forecasting system, agro-meteorological analysis; seminars/workshops for DMH and provincial staff, related ministries and the mass media; development of a web page, etc.</li> <li>Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Laotian Side</td> </tr> <tr> <td>1) Experts: 15 persons</td> <td>1) Staff allocated: 29 persons</td> </tr> <tr> <td>2) Trainees received: 4 person</td> <td>2) Land and facilities: Project office</td> </tr> <tr> <td>3) Equipment: Books, meteorological observation equipment, data processing/analysis equipment, communications equipment, office equipment, vehicles, motorcycles, etc.</td> <td>3) Local cost: Direct operational cost for project activities (total JPY 1 million yen).</td> </tr> </table> </li> </ol>					Japanese Side	Laotian Side	1) Experts: 15 persons	1) Staff allocated: 29 persons	2) Trainees received: 4 person	2) Land and facilities: Project office	3) Equipment: Books, meteorological observation equipment, data processing/analysis equipment, communications equipment, office equipment, vehicles, motorcycles, etc.	3) Local cost: Direct operational cost for project activities (total JPY 1 million yen).
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Ex-Ante Evaluation	2005	Project Period	July 2006 to January 2011 (Original period: July 2006 to January 2010; Extension period: January 2010 to January 2011)	Project Cost	381 million yen								
Implementing Agency	Department of Meteorology and Hydrology (DMH) under Water Resources and Environment Administration (WREA) (Note) DMH was under Ministry of Agriculture and Forestry (MAF) till 2007. After that DMH was supervised by WREA in the Prime Minister Office (PMO) and WREA was merged to a newly-created Ministry of Natural Resources and Environment (MONRE) in 2011.												
Cooperation Agency in Japan	Ministry of Agriculture, Forestry and Fisheries (Implementation of the project was commissioned to Japan Weather Association and CTI Engineering Co., Ltd.)												

**II. Result of the Evaluation****1 Relevance**

This project was highly relevant with Lao PDR's development policy such as (i) "collection and dissemination of meteorological and hydrological data" as stated in the National Socio-Economic Development Plan (NSED) (2001-2005), (ii) "capacity development of DMH for agriculture development and mitigation of damages from natural disasters" as positioned in the Agricultural Master Plan and Five-year Action Plan for Agriculture and Forestry Sector Development (2001-2005), and (iii) "harnessing modern methods of science and technology to predict the weather and other natural phenomena; dissemination of the information widely to the public to reduce damages from natural disasters" as stated in the NSED (2006-2010), at the times of both ex-ante evaluation and project completion. Also, the project was highly relevant with Lao PDR's development needs for DMH to provide accurate information for water resources utilization, agricultural development and transportation, at the times of ex-ante evaluation and project completion. Further, it is consistent with Japan's ODA policy at the time of ex-ante evaluation in a sense that it aimed at human resource development to contribute to agriculture development and infrastructure development, which were among the priority areas of assistance. Therefore, relevance of this project is high.

**2 Effectiveness/Impact**

The project aimed to improve the capacity of DMH to collect, process and analyze meteorological and hydrological data and to provide information such as weather forecast and early warning (project purpose) by training and rehabilitation of observation

facilities and equipment. Consequently, it was expected that such information be used in disaster management, agricultural development and aviation (overall goal).

The project purpose was achieved by the time of project completion. Although the procurement of equipment for observation stations were delayed, among the ten stations supported by this project, the six meteorological stations began recording data in digital format by October 2009, during original project period, and the four hydrological stations began recording data in digital format during the extension period of this project. Those data were collected on hourly basis, processed, analyzed, and provided to the public and concerned agencies as planned.

After project completion, data on all parameters have continued to be automatically recorded at the weather radar system and the six meteorological stations, and are sent to the Headquarters regularly and timely (i.e. in a way that was designed). However, analysis of radar data becomes impossible for some days when a problem of interference signals occurs<sup>1</sup>. Data from the four hydrological stations have been recorded and sent manually on daily basis due to a problem of data logger's battery since March 2011. Spare parts necessary to fix this problem are not available in the local market. Nevertheless, when necessary (e.g., in case of high water level), hydrological data can be manually recorded and sent to the Headquarters on hourly basis, which had been even impossible with the facilities before the rehabilitation by the project. The data input format and forecasting models/techniques (e.g. long range forecasting and satellite image analysis) introduced by this project are still used, while the methods of agro-meteorological and hydrological analyses (e.g. inundation analysis and water balance analysis) introduced by the project are no longer used as newer models are available and used. Provision of information on the web is continuing and regularly updated as well.

As for the overall goal, according to DMH, meteorological and hydrological information they provide is utilized for disaster management, agricultural development and aviation. For example, the National Agriculture and Forestry Research Institute (NAFRI) uses weekly and monthly data of rainfall and other parameters for crop calendars and advisory to farmers, and hourly meteorological data are used for flight services. Besides, the public, officials and business sectors are more aware of DMH's work. Media (TV, radio and newspapers) provides meteorological information more often than before. Telephone calls to DMH increased<sup>2</sup>.

In this way, this project has achieved the project purpose and the overall goal. Therefore, effectiveness and impact are high.

#### Achievement of project purpose and overall goal

Aim	Indicators	Results
(Project Purpose) Meteorological and hydrological information is collected, analyzed and provided by Department of Meteorology and Hydrology (DMH) in proper and timely manner.	Meteorological and hydrological data (of weather radar and observation stations) in books or digital archive.	(Project Completion) (i) Weather radar data and (ii) meteorological data from all 6 observation stations and (iii) hydrological data from 4 hydrological stations (3 rehabilitated and 1 constructed by the project) were recorded in digital archive. (Ex-post Evaluation) (i) and (ii) above are recorded in the digital archive and sent to DMH Headquarters properly and timely. Regarding (i), data analysis is difficult for some days when there are interference signals because the signals can damage data. Regarding (iii), hydrological stations had a problem in battery for automatic data recording system and no proper spare parts were provided. Thus, daily water level is recorded, transmitted and input manually as mentioned above.
	Meteorological and hydrological information newly provided Weather radar data, probability long-range weather forecast, aviation weather information, flood forecast for the 5 tributaries in the Mekong River basin.	(Project Completion) (i) Rader products, (ii) 1-month and 3-month forecast of rainfall and temperature, (iii) Information on meteorological phenomenon which may cause aeronautic accidents such as serious thunder, heavy rain and microburst, and (iv) Flood forecast for the five tributaries in the Mekong River basin by automatic water-level measurement at 4 rehabilitated hydrological stations and by telemeter at an existing station. (Ex-post Evaluation) All of the (i)–(iv) above are still regularly provided to respective party (the public, ministries, airports and others on demand)
	Types of information, database, promotion materials to be open and provided on web technology: 4 (baseline) to 8.	(Project completion) (i) Weather report, (ii) Radar images, (iii) Satellite images, (iv) Weather chart, (v) Numerical Weather Prediction (NWP), (vi) Weather forecasts, (vii) Hydrology, and (viii) Climatology. (Ex-post Evaluation) All of the (i)–(viii) above are on the web. (i) and (viii) are updated monthly, and the rest are updated daily.
(Overall goal) Accurate meteorological and hydrological information will contribute to natural disaster management, agricultural development and transportation.	Situation on utilization of meteorological and hydrological information in the sectors of disaster management, agricultural development and transport (aviation).	(Ex-post Evaluation) (i) Disaster management: Forecast and early warning (daily) are provided to and used by provinces, districts and villages (ii) Agricultural development: Rainfall and other parameters (weekly and monthly) are provided to and used by National Agriculture and Forestry Research Institute (NAFRI) for crop calendar and advisory to farmers (iii) Aviation: Encoded format of World Meteorological Organization (WMO) and Meteorological Division of International Civil Aviation Organization (MET-ICAO) report (hourly) is provided to and used by service of flight and airports.

Sources : Project Completion Report; interviews with DMH.

<sup>1</sup> There were some problems of the weather radar system after project completion, but they were repaired with assistance from a JICA senior volunteer and by coordinating with the supplier. However, the interference problem could not be solved by the Lao side because the frequency of interference signals is outside of the designated range of the International Telecommunications Union (ITU) for this region.

<sup>2</sup> Before the project completion, it had been concerned that people's preference on listening to Thai radio than Lao radio (because the former had been more informative) would hinder effectiveness and impact of providing weather information to the public through Lao radio (source: Terminal Evaluation Report). At the time of ex-post evaluation, DMH commented that the Lao media became more popular.

### 3 Efficiency

Both the project cost and the project period exceeded the plan (ratio against the plan: 131% and 131% respectively) mainly because of the extension of the project period to fully attain the project purpose. Therefore, efficiency of the project is fair.

### 4 Sustainability

In the policy aspect, this project is still given importance in the current development policy as the NSEDP (2011-2015) holds a measure, “together with the relevant sectors, to undertake research and improve efficiency of early warning systems”, and the MONRE Strategic Plan (2011-2015) aims at “collection, analysis and provision of meteorological and hydrological information”. In the institutional aspect, the organizational arrangement above DMH became strengthened as WREA was upgraded to a ministry (MONRE) merging departments related to natural resources in 2011. DMH commented that all posts are filled and the existing staff have managed to carry out observation, data processing analysis and provision of information, although more staff with good quality of work would be needed (DMH plans to recruit new staff every year). Besides, data measurement and reporting at provincial hydrological stations are carried out by key responsible villagers selected and contracted by DMH.

In the technical aspect, DMH considers the skills of its staff are generally insufficient. DMH has a training system in which it provides orientation to new employees and refresher training to provincial staff, and the manuals and guidelines developed by this project such as on meteorological/hydrological observation, data input and forecasting are still used. However, only a few staff who were well trained during the project period remain and continue the work, and according to DMH, other new staff are still in need to improve their capacity. DMH also commented that it needs further assistance to solve the above-mentioned problem of interference signal/echoes from outside to the radar system. Regarding hydrological stations, the key responsible villagers are trained and can manually measure and record water level, but there are the spare-parts problems mentioned in “2 Effectiveness/Impact” above. As for the financial aspect, since project completion, DMH has secured budget for operation and maintenance of the radar system at a close level to the budget that were provided during the project implementation period<sup>3</sup>, and that budget as well as allocation from the national budget have increased every year.

From these findings, it is considered that the project has some problems in technical aspect of the implementing agency; therefore, sustainability of effects of the project is fair.

### 5 Summary of the Evaluation

This project has achieved the project purpose and the overall goal. For the project purpose, DMH became able to collect, process, analyze and provide meteorological and hydrological data regularly. For the overall goal, it was found that such activities are mostly continuing at the time of ex-post evaluation, and weather forecasts, early warning and other meteorological and hydrological information provided by DMH are used by concerned users including the public, local authorities, agricultural institutions and aviation services. As for sustainability, this project is supported by development policy at the time of the ex-post evaluation, and the institutional arrangement was reinforced. Also, allocation of national budget to DMH as well as operation and maintenance budget for the weather radar system are increasing. However, there are problems in the technical aspect such as insufficient skills of staff and unavailability of some spare parts in Lao PDR. In the light of the above, this project is evaluated to be satisfactory.

## III. Recommendations & Lessons Learned

### Recommendations for Implementing agency:

It is advised that DMH repairs the automatic recording system of hydrological stations, if that is indispensable for sustainability of project effects, with consideration of taking necessary measures to purchase spare parts from abroad. Overall, DMH is advised to maintain its equipment with an established maintenance system and to provide regular capacity building for new staff in order to keep providing meteorological and hydrological information for target users in accurate and timely manners.

### Lessons learned for JICA

It was also found that DMH, at the time of the ex-post evaluation, felt the skill level of its staff to carry out data collection, analysis and provision of meteorological and hydrological information in timely and accurate manner is still limited especially for new employees, even though it has a training system for working staff. Therefore, JICA should check the counterpart agency's staff training system at the planning stage and/or during the project period, and if it is found insufficient, it should be included in the project as a component to strengthen a mechanism of transferring knowledge and skills to new staff to ensure technical sustainability.



Radar tower at the Department of Meteorology and Hydrology, Vientiane



Automatic Hydrological Station at the Meuang Mai (River: Nam Ngiep), Bolikhamxay Province

<sup>3</sup> Data on operation and maintenance budget for observation stations were not available.