Internal Ex-Post Evaluation for Technical Cooperation Project

conducted by Sri Lanka Office: April 2022

| Country Name | |
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| Democratic Socialist Republic of Sri Lanka | **Project for Improving of Meteorological Observation, Weather Forecasting and Dissemination** |

**I. Project Outline**

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| Background | The Democratic Socialist Republic of Sri Lanka experiences natural disasters such as floods, cyclones, landslides, whirlwinds and lightning almost every year which cause damage to social and economic infrastructure and economic loss. The government strengthened its natural disaster prevention system and enacted the Disaster Management Act (2005) which established a comprehensive legal framework for disaster prevention. The Act focuses on disaster preparedness including control and mitigation of loss and damage, changing from previous disaster management policies focusing on post-disaster response. The government established the National Council for Disaster Management and the Ministry of Disaster Management (currently Disaster Management Division of the State Ministry of National Security, Home Affairs and Disaster Management). The Department of Meteorology (DOM) is under the Disaster Management Division and responsible for grasping meteorological phenomena accurately and providing forecasts and warnings to the relevant organizations. As the conventional forecasting was limited to subjective analysis, the challenge was to improve forecasting based on objective materials. | | |
| Objectives of the Project | The project aimed to disseminate more accurate and timely meteorological information to the public and the disaster related organizations by the improvement of maintenance and calibration of meteorological observation equipment, transmission and reception of meteorological data, weather forecasting using obtained meteorological data, warning, and dissemination of meteorological information, thereby contributing to the effective utilization of weather information by the public and the disaster related organizations.<br>1. Overall Goal: Weather information disseminated from the DOM is well utilized by the public and the disaster related organizations.<br>2. Project Purpose: More accurate and timely meteorological information is disseminated to the public and the disaster related organizations. | | |
| Activities of the Project | 1. Project site: Whole area of Sri Lanka<br>2. Main activities:<br>To review the current situation, to provide necessary equipment, to develop manuals and to conduct training for the improvement of maintenance and calibration of meteorological observation equipment, transmission and reception of meteorological data, weather forecasting using obtained meteorological data, warning and provision of meteorological information.<br>3. Inputs (to carry out above activities)<br>Japanese Side<br>1) Experts: 19 persons<br>2) Trainees received: 8 persons<br>3) Equipment: Equipment for meteorological observation and weather forecasting<br>Sri Lankan Side<br>1) Staff allocated: 27 persons<br>2) Project office and utilities<br>3) Operation cost | | |
| Project Period | (ex-ante) July 2014-June 2017<br>(actual) September 2014-August 2017 | Project Cost | (ex-ante) 324 million yen<br>(actual) 302 million yen |
| Implementing Agency | Department of Meteorology (DOM) | | |
| Cooperation Agency in Japan | International Meteorological Consultant Inc., Japan Weather Association | | |

**II. Result of the Evaluation**

1 Relevance

<Consistency with the Development Policy of Sri Lanka at the Time of Ex-Ante Evaluation >

This project was consistent with Sri Lanka's Disaster Management Act (2005) which established a comprehensive legal framework for disaster prevention. The Act focuses on disaster preparedness, changing from previous disaster management policies focusing on post-incident response. Other related policies are: The Roadmap for Disaster Risk Management (2006-2016), National Policy on Disaster Management (2010), Sri Lanka National Disaster Management Plan (2013-2017), National Emergency Operations Plan (NEOP) (2013) and Comprehensive Disaster Management Programme (2014-2018).

<Consistency with the Development Needs of Sri Lanka at the Time of Ex-Ante Evaluation >

This project was consistent with the needs for capacity development in provision of accurate and timely meteorological information as mentioned in "Background" above.

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

Japan's Country Assistance Policy for Sri Lanka (2012) prioritized social infrastructure development for the mitigation of vulnerability.

<Appropriateness of Project Design/Approach>

The project was designed based on the use of Very Small Aperture Terminal (VSAT) communication satellite service, but VSAT stopped due to budgetary constraints. The project decided to use Internet Protocol-Virtual Private Network (IP-VPN) instead, but it did not work as expected because its coverage was limited. These drawbacks came out after the project started using the technology and it would have been difficult to foresee them. Therefore, there was no particular problem in project design and approach.

<Evaluation Result>

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

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the Time of Project Completion>

The Project Purpose, "More accurate and timely meteorological information is disseminated to the public and the disaster related organizations" was partially achieved at the time of project completion. Through the procurement of standard instruments and calibration devices and the implementation of training courses, the traceability of pressure and temperature was established during the project (Indicator 1). Weekly forecasts guidance was conducted in 2017 on a trial basis at Colombo and Ratnapura (Indicator 4). Rainfall forecast guidance 12, 24 and 36 hours ahead at Colombo and Ratnapura and short-range weather forecast guidance (every 12 and 24 hours) for precipitation for Colombo were operating, and accuracy of short-term forecast was improved (Indicator 3). The missing rate of real-time observation data transfer from observation stations was 100% because the Very Small Aperture Terminal (VSAT) communication satellite that the DOM was using stopped the service in January 2016 due to budgetary constraints (Indicator 2).

<Continuation Status of Project Effects at the Time of Ex-Post Evaluation>

The project effects have not been continued till the time of ex-post evaluation. Traceability of meteorology instruments is sufficiently ensured all over the country (Indicator 1). However, due to the underperformance of Internet Protocol-Virtual Private Network (IP-VPN) system that replaced the VSAT service, real-time observation data of Automatic Weather System (AWS) data at the stations are not transferred to Colombo (Indicator 2). As DOM uses European Centre for Medium-Range Weather Forecasts (ECMWF) since July 2017 and they are less reliable, the accuracy of rainfall forecast is not high (Indicator 3). Weekly forecast also based on ECMWF is published for whole Sri Lanka on the DOM website (Indicator 4). While the project supported strengthening of capacity in numerical weather prediction using DOM's own data, it is not performed.

<Status of Achievement of the Overall Goal at the Time of Ex-Post Evaluation>

The Overall Goal, "Weather information disseminated from the DOM is well utilized by the public and the disaster related organizations" is not verifiable. DOM regularly issues information to other agencies and it is assumed that they are utilized for disaster mitigation, but there is no mechanism or system to ascertain on how they are being used (Indicator 1). Community uses information from DOM to prepare hazard maps and evacuation plans, but DOM does not have information on the number of communities or examples of tools developed by the community (Indicator 2).

<Other Impacts at the Time of Ex-Post Evaluation>

No negative impacts have been observed.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is low.

Achievement of Project Purpose and Overall Goal

| Aim | Indicators | Results | Source |
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| (Project Purpose)<br>More accurate and timely meteorological information is disseminated to the public and the disaster related organizations. | Indicator 1<br>Traceability of meteorology instruments<br>(Availability of national standards/frequency of inspection) | Status of the Achievement (Status of the Continuation): Achieved (Continued)<br>(Project Completion)<br>Through the procurement of standard instruments and calibration devices and the implementation of training courses, the traceability of pressure and temperature was established during the project. "Guidelines to meteorological instrument calibration" and "Manuals for meteorological instrument calibration" were developed and the procedures of the calibration of pressure and temperature were well defined and standardized. DOM started operation of the new instrument calibration.<br>(Ex-post evaluation)<br>Traceability of meteorology instruments is sufficiently ensured all over the country with equipment purchased by the government and those donated by JICA. Procedures follow the guidelines developed under the project, while a complete calibration manual has not yet been prepared. The instruments are usually inspected twice or three times per year, but it was not the case since 2020 due to COVID-19. | source: JICA documents, questionnaire and interviews of DOM |
| | Indicator 2<br>Number of missing observation data | Status of the Achievement (Status of the Continuation): Not achieved (not continued)<br>(Project Completion)<br>The missing rate of real-time observation data transfer from 36 observation stations was 100% because the VSAT communication satellite that the DOM was using stopped the service in January 2016 due to budgetary constraints. After completion of the transition from VSAT to IP-VPN system, it was expected that the missing rate of real−time observation data transfer would be less than 10%.<br>(Ex-post evaluation)<br>IP-VPN did not work as expected because of the limited mobile network coverage and the service provider's lack of technical capacity to expand it. The project team did their best to provide technical support in expanding the service area, but the provider could not achieve the nationwide coverage during the contract period. Therefore, real-time observation data are not transferred from all the 36 observation stations as expected at the time of planning. Recognizing the difficulty in reaching the remotest areas within the country through IP-VPN, DOM has recently decided to shift to another system, General Packet Radio Service Modem (GPRS) for communication. | source: JICA documents, questionnaire and interviews of DOM |

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| | Indicator 3<br>Accuracy of rainfall forecast in the selected stations | Status of the Achievement (Status of the Continuation): Partially achieved (not continued)<br>(Project Completion)<br>To improve the accuracy of rainfall forecast, rainfall forecast guidance 12, 24 and 36 hours ahead at Colombo and Ratnapura using the Grid Point Value of DOM's numerical prediction model (Weather Research and Forecasting: WRF) was complete and semi-automatic Linux Program for Short-Range (every 12 and 24 hours) Weather Forecast Guidance for Precipitation with the WRF Grid Point Vale was operating for Colombo. DOM was able to make a regression equation for the short-range forecast of precipitation in different seasons. Accuracy of short-term forecast improved comparing to the method without seasonal division. Further improvement of accuracy was expected.<br>(Ex-Post Evaluation)<br>Automatic Weather System (AWS) data are not fully transferred to Colombo due to underperformance of IP-VPN. DOM uses ECMWF high resolution data for rainfall forecast since 2017 which are less reliable during inter-monsoon period as local effects are highly dominant. While the project supported strengthening of capacity in numerical weather prediction using DOM's own data, it is not fully utilized. | source: JICA documents, questionnaire and interviews of DOM |
| | Indicator 4<br>Number of selected stations where weekly forecast is enabled in trial basis[1] | Status of the Achievement (Status of the Continuation): Achieved (Not continued)<br>(Project Completion)<br>Weekly forecasts guidance was conducted from January to July 2017 on a trial basis at two stations (Colombo and Ratnapura).<br>(Ex-Post Evaluation)<br>The methods used under the project (Model Output Statistics (MOS) used in the trial) are no longer used. Weekly forecast is published for whole Sri Lanka by using data ECMWF since July 2017 on the DOM website, but not based on DOM's own information. Weekly forecast is published at Colombo, Mattala International Airport and Katunayake International Airport stations. | source: JICA documents, questionnaire and interviews of DOM |
| (Overall Goal)<br>Weather information disseminated from the DOM is well utilized by the public and the disaster related organizations. | Indicator 1<br>Number of the civil work projects for disaster mitigation that fully or partly utilize the improved meteorological information from DOM | (Ex-Post Evaluation) Not verifiable<br>DOM regularly issues information to other agencies (Department of Irrigation, Department of Agriculture, Department of Fisheries, Disaster Management Centre (DMC), Water Board, Ceylon Electricity Board, Road development authority, National Building Research Organization, etc.), but there is no mechanism or system to ascertain on how the information is being used. However, according to inquiries to National Meteorological Centre (NMC) and discussions with other agencies, meteorological information from DOM has been well utilized for disaster mitigation as DOM's forecasting had improved. Examples to show how the information is used are not available.<br>Number of the civil work projects is not available. | source: JICA documents, questionnaire and interviews of DOM |
| | Indicator 2<br>Number of the community level early warning system, hazard maps or evacuation plans that fully or partly utilize the improved meteorological information from DOM | (Ex-Post Evaluation) Not verifiable<br>Community uses information from DOM to prepare hazard maps and evacuation plans. Response of the community for weather forecasts and early warnings issued by DOM is gradually increasing. People's attitudes to weather forecasts are also changing.<br>DOM does not have information on the number of communities or examples of tools developed by the community (Disaster Management Center (DMC) might have). | source: JICA documents, questionnaire and interviews of DOM |

3 Efficiency

The project cost and the project period were within the plan (93% and 100% respectively). There was no change in the planned outputs. Therefore, the efficiency of the project is high.

4 Sustainability

<Policy Aspect>

There is no considerable change in disaster management policies of Sri Lanka, which focus on disaster preparedness. DOM's mission in disaster preparedness is clear.

<Institutional/Organizational Aspect>

There is no significant change in organizational structure of DOM up to now. DOM is on the process of restructuring (modernization) to improve services supported by the Climate Resilience Multiphase Programmatic Approach Project of World Bank (2019-2024, US$310 million)[2]. One of the objectives of the World Bank project is to enhance the capacity of the government to deliver improved weather and climate forecasting and early warning, and DOM is among the target organizations along with the Disaster Management Center, Irrigation Department, and National Building Research Organization.

[1] Project Purpose Indicator 4 in Japanese PDM is "選定された地上気象観測所における試行ベースの週間予報の実施数" which means "number of weekly forecast on trial basis at the selected stations." It is not the same as the English PDM that counts the "number of stations".

[2] https://projects.worldbank.org/en/projects-operations/project-detail/P160005

DOM needs more staff for weather forecasting: only eight are available among 12 posts. Staff have not been allocated for the newly created Marine and Numerical Weather Prediction unit.
<Technical Aspect>
Standard Operating Procedures (SOP) and manuals developed under the JICA project, particularly the instruments-related manuals and journals are utilized. DOM maintains instruments following JICA experts' advices. DOM improved graphical format for bad weather warnings which started during the project.
Since the project completion, eight staff with M.Sc. in meteorology related fields were newly recruited. They have knowledge but need to be improved.
<Financial Aspect>
DOM has budget from the government for its operation, but has no additional budget for continuation of some project components such as VSAT communication and spare parts such as battery pack, etc.
<Evaluation Result>
In light of the above, some problems have been observed in institutional/organizational, technical and financial aspects of the implementing agency. Therefore, the sustainability of the project effects is fair.

5 Summary of the Evaluation

The project partially achieved the Project Purpose, "More accurate and timely meteorological information is disseminated to the public and the disaster related organizations" at the time of project completion, but the effects did not continue as expected mainly due to the technical limitations concerning data transmission. Overall Goal "Weather information disseminated from the DOM is well utilized by the public and the disaster related organizations" is not verifiable as the information is provided and utilized but there is no mechanism to grasp how they are utilized. There are some problems in institutional/organizational, technical and financial aspects of sustainability. As for efficiency, both the project cost and project period were within the plan.
Considering all of the above points, this project is evaluated to be unsatisfactory.

**III. Recommendations & Lessons Learned**

Recommendations for Implementing Agency:
1. Due to the non-function of VSAT and IP-VPN communication, data transfer process from all stations to Colombo office has been disabled and it hinders the operation of the stations. It is recommended that DOM should continue to pursue an alternative option for AWS and achieve nationwide data transfer as soon as possible.

Lessons Learned for JICA:
DOM discontinued its use of VSAT in 2016 because they could not cover the hefty operation expenses for satellite services. DOM's decision to replace it with IP-VPN and the project team's support for the decision are considered valid, as it was the most viable technological option available at the time. However, unlike satellite services, mobile communications network had its coverage limitations in Sri Lanka, and it would have been difficult for IP-VPN to achieve the nationwide data transfer from all the 36 observation stations as expected at the time of planning with VSAT. Given the nature of IP-VPN, the project team could have considered adjusting the indicators and goals accordingly, in order to make the numbers more realistic and achievable.

V-SAT of Aralaganvila Station

AWS of Mannar Station

Antenna of Polonnaruwa Station

Rain gauge of Polonnaruwa Station

Antenna of Ratnapura Station