

Country Name	Project for Landslide Management
Republic of Mauritius	

I. Project Outline

Background	Mauritius is a small volcanic island state which is geographically characterized by steep slopes causing high risk of landslides. Besides, in the recent years, the population growth and expansion of urban areas brought about an increase in the number of houses and inhabitants on slope areas. In March 2005, 54 houses in Chitrakoot, located in the northern part of the capital city of Port Louis, were seriously damaged by large-scale landslides. In order to cope with that situation, the government of Mauritius has taken disaster prevention measures by formulating committees and establishing the Landslide Management Unit (LMU) in the Ministry of Public Infrastructure and Land Transport (MPI) in September 2009. Since then, under the “Cyclone and Other Natural Disasters Scheme” prepared by the Prime Minister’s Office, MPI has been responsible for the monitoring of landslides and emergency response. However, the disaster prevention measures have been limited due to insufficient human resources and technical capacities of MPI. Therefore, identification and monitoring of landslide risks and improvement of land-use in risk areas based on scientific and technical analysis have not been sufficiently implemented.		
Objectives of the Project	<p>Through preparing a landslide management plan and a project implementation plan for LMU, the project aimed at implementation of a feasibility study and pilot projects by selecting urgent projects, thereby contributing to mitigation of landslide risks and safety of residents in the high-risk areas of landslide.</p> <ol style="list-style-type: none"> Expected goals through the proposed plan¹: The risk of landslide and other slope disasters is mitigated, and residents in the high-risk areas of landslides are secured. Expected utilization of the proposed plan: A landslide management plan and feasibility study are approved by the government of Mauritius and implemented by the responsible organizations. 		
Activities of the Project	<ol style="list-style-type: none"> Project site: Mauritius Island Main activities: (1) basic survey, (2) formulation of a landslide management plan, (3) feasibility study, (4) pilot project, (5) technical transfer. Inputs (to carry out above activities) <div style="display: flex; justify-content: space-between;"> <div> <p>Japanese Side</p> <ol style="list-style-type: none"> Mission members: 14 persons Trainees received: 10 persons Equipment: equipment for survey (distance meter, GPS, stereo scope, GIS, PC and others) </div> <div> <p>Mauritian Side</p> <ol style="list-style-type: none"> Staff allocated: 8 persons Facilities and equipment: office </div> </div> 		
Project Period	April 2012 - April 2015 (extension: September 2014 - April 2015)	Project Cost	(ex-ante) 400 million yen, (actual) 306 million yen
Implementing Agency	Ministry of Public Infrastructure and Land Transport (MPI) (since December 2014) (former Ministry of Public Infrastructure, National Development Unit, Land Transport and Shipping)		
Cooperation Agency in Japan	Kokusai Kogyo Co., Ltd., Nippon Koei Co., Ltd., Central Consultant Inc., Futaba Inc.		

II. Result of the Evaluation

1 Relevance
<p><Consistency with the Development Policy of Mauritius at the Time of Ex-Ante Evaluation and Project Completion></p> <p>The Prime Minister’s Office had formulated the “Cyclone and Other Natural Disasters Scheme” (2011-2012) and kept updating annually. The Scheme organized the emergency response system and responsibility sharing among related ministries for landslide disasters. The Scheme has been updated as the “National Disasters Scheme 2015” including the Landslide Emergency Scheme and has regularly updated. Therefore, the project was consistent with the development policy of Mauritius at the time of ex-ante evaluation and project completion.</p> <p><Consistency with the Development Needs of Mauritius at the Time of Ex-Ante Evaluation and Project Completion></p> <p>Landslides have become serious issues due to increasing natural disasters caused by the climate change along with the increasing land development on slope areas for housing and tourism. Therefore, the project was consistent with the development needs of Mauritius at the time of ex-ante evaluation and project completion.</p> <p><Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation></p> <p>The project was consistent with the Japan’s ODA policy for Mauritius at the time of ex-ante evaluation. Mauritius is a small island state and vulnerable to climate change and negative impacts by the natural environment. Therefore, the Japanese government continued its economic cooperation focusing on the measures for environment and climate changes and disaster prevention.²</p> <p><Evaluation Result></p> <p>In light of the above, the relevance of the project is high.</p>
2 Effectiveness/Impact
<p><Status of Achievement for the Objectives at the time of Project Completion></p> <p>The objectives of the project were achieved by the time of project completion. The Landslide Management Plan has been formulated (Output 1) and a feasibility study and a pilot project were conducted (Output 2) by the project. According to the Final Report (2015) of the</p>

¹ The degree of achievement of expected goals is not to be assessed in principle at the time of ex-post evaluation, since it is defined as the medium-to-long-term goals which will be attained as a result of crystallizing the proposed plan (“output” of the project).

² Ministry of Foreign Affairs, “ODA Country Data Book 2012”

project and the interview survey with the officials of MPI and the Geotechnical Unit (GU), the former LMU, which was restructured on July 2018, the technical capacity of GU and other agencies involved were enhanced through the activities of the project (Output 3).

<Utilization Status of the Proposed Plan at the time of Ex-post Evaluation>

The Landslide Management Plan prepared by the project has been utilized. Legislation and institutionalization of the Landslide Management Plan is waiting for the formalization of GU (Indicator 1). Although the Landslide Management Plan has been utilized by GU as a reference for their daily works and its proposed plans have been partially implemented, the Plan has not been periodically updated and distributed due to the limited manpower and technical capacity of GU (Indicator 2). Out of 26 proposals made by the Landslide Management Plan, 13 of them have been commenced and other 8 of them have been completed. Out of 9 rank A areas (high-risk areas) classified by the project, in which countermeasure construction works were expected to be completed by 2015, the works have been completed in 3 areas but not in other 6 areas (Indicator 3). Implementation arrangements for landslide management including the monitoring system involving local inhabitants, application of the Technical Guidelines, land use plans and emergency landslide response plans and others have been progressing in the 3 project target areas (Indicator 4).

<Status of Achievement for Expected Goals through the Proposed Plan at the time of Ex-post Evaluation>

The expected goals through the proposed plan has been partially achieved at the time of ex-post evaluation. The monitoring of the landslide high risk areas has been routinely conducted by GU and the National Disaster Risk Reduction and Management Centre (NDRRMC). The early warning system has been applied in accordance with the National Disasters Scheme. The awareness raising activities and simulation training for local people have been conducted according to the Landslide Management Plan (Indicator 1). Development of the high-risk slope areas has been restricted and controlled by the city councils (Indicator 2). However, these activities have been implemented in the 3 project target areas but not in other areas. The emergency response plans for the high-risk slope areas have been reviewed and updated by the City Councils, NDRRMC and MPI every after an emergency including cyclone and torrential rain taken place (Indicator 3). As a result of these activities, there has been no serious landslide or casualty in the 3 project target areas for the past 5 years from 2014 to 2018 (Indicator 4).

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

The government has acquired a total land area of 2,462m² in Chitrakoot for constructing drains as landslide countermeasures. Thirteen affected households have been relocated to state-owned lands. The land acquisitions and relocations were carried out according to the Land Acquisition Act and the State Land Act of Mauritius. No environmental or social negative impact and complain from local residents has been reported until the time of ex-post evaluation.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is fair.

Status of Achievement of Utilization Status of the Proposed Plan and Expected Goals through the Proposed Plan

Aim	Indicators	Results
Utilization Status of the Proposed Plan: A landslide management plan and feasibility study are approved by the government of Mauritius and implemented by the responsible organizations.	Indicator 1: Progress of legislation and institutionalization of the Landslide Management Plan as a plan for MPI and LMU.	(Ex-post Evaluation) Partially achieved The legislation and institutionalization of the Landslide Management Plan was prepared but has been stagnated waiting for the formalization of GU. Although LMU established by the project was reorganized into GU on July 2018 with broader responsibilities, the formalization of the mandates of GU has been delayed and its timetable is not fixed. Therefore, only the skeleton staffs were assigned to GU and its manpower and technical capacities are limited. Including the preparation for the approval, the operation of the Landslide Management Plan is supposed to be a mandate of GU, thus the legislation and institutionalization of the Plan is waiting for the formalization of GU.
	Indicator 2: Situation of periodical updating and distribution of the Landslide Management Plan to the stakeholders.	(Ex-post Evaluation) Not achieved Since the Landslide Management Plan is waiting for the approval, its periodical update and distribution has not been done. Although GU is using the Plan as a reference for their daily works, GU does not update and distribute the Plan due to the limited manpower and technical capacities.
	Indicator 3: Situation of implementation of measures proposed in the Landslide Management Plan.	(Ex-post Evaluation) Partially achieved Out of 26 proposals made by the Landslide Management Plan, 13 of them have been commenced and 8 of them has been completed. Out of 9 rank A areas (high-risk areas) classified by the project, in which countermeasure construction works were expected to be completed by 2015, the works have been completed in 3 areas. The Plan and Technical Guidelines have been referred after the project to identify high-risk areas and to implement measures to the newly identified risk areas.
	Indicator 4: Progress of the system formulation in Mauritius for landslide management (monitoring system by the participation of stakeholders, application of the Technical Guidelines, preparations for the recommendations and reviewing of the related laws and regulations including the land use plan and emergency landslide response plan, etc.).	(Ex-post Evaluation) Achieved In Chitrakoot, one of the 3 project target areas, the monitoring system involving stakeholders including local residents was formulated, and the monitoring has been conducted and NDRRMC keeps recording the results of the monitoring. The landslide monitoring has been carried out also in Vallee Pitot and Quatre Soeurs, other 2 project target areas on a priority basis. The application system of the Technical Guidelines was established by the project in the 3 areas and has been continuously applied according to the protocol. In Chitrakoot, the land use plan and emergency landslide response plan of the "Development Management Map of Port Louis Outline Planning Scheme" (OPS) was prepared in line with the "Policy EC2" for building on steep slope and approved by the government in May 2015.
Expected Goals through the Proposed Plan (not to be assessed): The risk of landslide and	Indicator 1: Situation of the landslide high risk areas after the implementation of plans prepared by the Landslide Management Plan	(Ex-post Evaluation) Partially achieved The monitoring of the landslide high risk areas has been routinely conducted by GU and NDRRMC but only in the 3 target areas of the project. The early warning system has been applied according to the National Disasters Scheme

other slope disasters is mitigated, and residents in the high-risk areas of landslides are secured.	(situation of landslide monitoring system, evacuation warning system, etc.).	also in the 3 areas. Some problems of the monitoring equipment provided by the project have not been fixed and affected the accuracy and transmission of data and function of the early warning system. The awareness raising activities and simulation training for local people have been conducted according to the Landslide Management Plan and, according to the officials of GU, the awareness of the local residents on the warning and evacuation protocol has been increased.
	Indicator 2: Suppression of development of the high-risk slope areas designated in the Landslide Management Plan.	(Ex-post Evaluation) Partially achieved Development of high-risk slope areas has been restricted and controlled by the city councils according to the Policy EC2 for Building on Steep Slopes. According to the Policy, a primary school building was demolished in Chitrakoot, and several households have been relocated and their houses were taken down in Quatres Soeurs. Households relocation also has been progressing in Vallee Pitot. The land acquisitions and relocations were carried out according to the Land Acquisition Act and the State Land Act of Mauritius.
	Indicator 3: Review of the emergency response plans for the high-risk slope areas designated in the Landslide Management Plan.	(Ex-post Evaluation) Achieved The emergency response plans for the high-risk slope areas have been reviewed and updated by the city councils, NDRRMC and MPI every after an emergency including cyclone and torrential rain taken place.
	Indicator 4: Decrease of the cases of damage (injured, dead, etc.) due to the development of landslide management system and evacuation system.	(Ex-post Evaluation) Achieved There has been no serious landslide or casualty in the 3 project target areas for the past 5 years from 2014 to 2018. According to MPI and GU, this was due to the implementation of ground stabilization works, relocation of households and demolition of structures in high-risk areas, the early warning and evacuation protocol, and other countermeasures proposed by the Landslide Management Plan.

Source: MPI, the Ministry of Housing and Lands, and the MPI local site offices in Chitrakoot, Vallee Pitot and Quatre Soeurs.

3 Efficiency

Although the project cost was within the plan (the ratio against the plan: 77%), the project period exceeded the plan (the ratio against the plan: 123%). The outputs were produced as planned. Therefore, efficiency of the project was fair.

4 Sustainability

<Policy Aspect>

The “National Disasters Scheme 2015” including the Landslide Emergency Scheme is effective at the time of this ex-post evaluation and has been regularly updated since 2015. MPI is currently preparing a bill to obligate all major construction works in the country to conduct geotechnical studies.

<Institutional Aspect>

LMU was restructured as GU in July 2018 by expanding its responsibilities and mandates for geotechnical issues including landslides. GU is still in the process of formalization and its responsibilities and mandates have not yet been officially defined. Besides, although the Landslide Management Plan proposed to assign 6 engineers to LMU, the current number of the engineer in GU has been 3. The deficiency in the number of staff and technical capacity of GU and the delay of its formalization have been one of the main causes of the delay of implementation of the projects planned by the Landslide Management Plan. A staff member of GU is expected to come back from the study in Japan in 2021.

<Technical Aspect>

Out of the 8 staff members involved in the project as counterparts, 7 of them have left their positions. Therefore, the knowledge and skills transferred in the project has not been sustained, and the technical capacity of GU has not been sufficient for prompt implementation of the projects planned by the Landslide Management Plan. Besides, maintenance of equipment provided by the project in the 3 target areas has not necessarily been properly done and some equipment is left damaged. This has caused the delay in data collection and early warning to local inhabitants. For the capacity development of and technical support for GU, one of the Japanese experts of the project has been contracted with MPI and assigned as a technical advisor. In addition, one staff member has come back in 2018 and the another one is expected to come back in 2021 from the studies in Japan, and their technical contributions to geotechnical activities of GU is highly expected.

<Financial Aspect>

The amount of national budget for landslide control has not been planned but prepared as the situation demands. For instance, while the budget of 40 million Mauritius Rupee (Rs) was prepared for the countermeasures’ construction projects in Chitrakoot in 2016, 1 million Rs was prepared for a structure demolition work in Quatres Soeurs in 2017. Although the budget for the 3 project target areas has been provided as necessary, the total amount of budget has not been sufficient for monitoring 37 landslide hazard areas designated by the “National Disasters Scheme 2015.”

<Evaluation Result>

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

5 Summary of the Evaluation

The objectives of the project were achieved by the time of project completion by preparing the Landslide Management Plan and implementing a feasibility study and a pilot project. Although the legislation of the Plan has not been completed yet, half the number of projects proposed by the Plan has been completed or ongoing. As for sustainability, there have been some problems in the institutional, technical and technical aspects. As for efficiency, the project period exceeded the plan. Considering all of the above points, this project is evaluated to be partially satisfactory.

III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- Formalization and strengthening of GU is an urgent issue. It is recommended MPI to accelerate the formalization process of GU and its capacity building.
- Since the damaged equipment provided by the project has affected proper warning to local residents, it is recommended MPI to allocate budget, staff and technical support for GU to fix the equipment and conduct routine maintenance of them.
- It is recommended MPI to take an initiative for mobilizing GU, local authorities, NDRRMC and other relevant stakeholders to establish landslide monitoring system involving local residents in order to implement the monitoring of 37 designated landslide hazard areas in the country.
- It is recommended MPI to find external funding agencies including private sectors and development partners and to start the negotiation for funding in order to accelerate the implementation of the projects proposed by the Landslide Management Plan and landslide monitoring of 37 designated landslide hazard areas.

Lessons Learned for JICA:

- LMU which was the major implementing entity of the project was restructured as GU by the initiative of MPI by expanding its responsibilities and mandates after the project in order to implement the landslide management in a unified and comprehensive manner. However, the formalization and capacity development of GU has been unexpectedly delayed, and this has negatively affected the progress of the landslide countermeasures projects proposed by the project. Restructuring of the major implementing entity of a project soon after the project completion is not recommendable in general. If a possibility of restructuring is foreseen during the period of the project, it is desirable for the project to make an intervention within the realms of possibility. When the project recognizes the restructuring necessary, the specific restructuring plan and a supervising system for its process should be planned in the project; and seek for the follow-up means by other schemes such as a technical cooperation project or a dispatch of a long-term expert if possible.
- The landslide countermeasures projects proposed by the Landslide Management Plan have been partially and slowly implemented. One of the major causes of this is financial constraints of the government. Irrespective of whether the funding for projects is promised or not during the period of the project, funding could be a critical factor in projects' implementation for most developing countries. If specific financing strategies could be incorporated in the Plan prepared by the project and the project starts its initial activities with the implementing agency during the period of the project, it might increase the possibility of implementation of projects.



Countermeasure works at Chitrakoot were duly implemented and preventing danger to local inhabitants.



Rain gauge at Quatres Soeurs, installed by Mauritius Meteorological Services as a complementary tool for the MPI's monitoring system