Date of Submission	20 April 2019

IPL Project Proposal Form 2019

(MAXIMUM: 3 PAGES IN LENGTH)

Project Title: (2 lines maximum)

Development of early warning technology of rain-induced rapid and long-travelling landslides in Sri Lanka

1. Main Project Fields

Select the suitable topics. If no suitable one, you may add new field.

(1) Technology Development

A. Monitoring and Early Warning, B. Hazard Mapping, Vulnerability and Risk Assessment

(2) Targeted Landslides: Mechanisms and Impacts

A. Catastrophic Landslides, B. Landslides Threatening Heritage Sites

(3) Capacity Building

A. Enhancing Human and Institutional Capacities

B. Collating and Disseminating Information/ Knowledge

(4) Mitigation, Preparedness and Recovery

A. Preparedness, B. Mitigation, C. Recovery

2. Name of Project leader: Kazuo Konagai

Affiliation: (office and position). ICL Headquarters, Kyoto, Japan, Principal Researcher

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Core members of the Project

Names/Affiliations: (4 individuals maximum)

Asiri Karunawardena / National Building Research Organization (NBRO), Columbo, Sri Lanka

A A Virajh Dias / Central Engineering Consultancy Bureau (CECB), Columbo, Sri Lanka

Kyoji Sasssa / ICL Headquarters, Kyoto, Japan,

Khang Dang / ICL Headquarters, Kyoto, Japan

3. Objectives: (5 lines maximum; what you expect to accomplish?)

The early warning technology of rain-induced rapid and long-travelling landslides suitable for Sri Lanka is established by integrating the following newly developed technologies. They are 1) time prediction of heavy rainfalls and pore water pressure build-up, 2) site prediction of landslide initiations and motions, and 3) effective risk communication and public education.

4. Background Justification: (10 lines maximum)

Landslide prone areas in Sri Lanka cover approximately 30% of its total land area, and it is occupied by about 35% of the population of the country. Recent studies have revealed that nearly 70% of the

landslides in Sri Lanka are influenced by human induced interventions in these areas. Sri Lanka, being an isolated island in the southern tip of India, usually experiences extreme weather patterns with two peaks of rainfalls in two monsoon seasons. Particularly rainfalls in the south-western monsoon from May to September are getting worse in the recent past being increasingly affected by the effects of global warming, and the numbers of both landslides and victims have remarkably increased over the past few years. With the above-mentioned backgrounds, it is an overriding priority to develop a cutting-edge technology for early warning of rain-induced rapid and long-travelling landslides and implement it in the society.

5. Study Area: (2 lines maximum; where will the project be conducted/applied?)
   Two pilot study sites are 1) Aranayaka in Kegalle District and 2) Athwelthota landslide in Kalutara District, Sri Lanka.
6. Project Duration: (1 line maximum) from 2019 to 2025
7. Resources necessary for the Project and their mobilization, Personnel, Facilities, and Budgets
   Personnel /institutions: Major participating institutions are the International Consortium on Landslides, the Disaster Prevention Research Institute of Kyoto University (DPRI), the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), the Forest Produce Research Institute (FFPRI), Kochi University, Toyama University, Teikyo-Heisei University and consulting companies.

   10 to 20 researchers from National Building Research Organization (NBRO, implementing agency), and supporting agencies that include Department of Meteorology (DOM), Department of Irrigation (DOI) and Disaster Management Center (DMC) of the Ministry of Public Administration & Disaster Management and the Central Engineering Consultancy Bureau (CECB), Department of Civil Engineering of the University of Moratuwa (UOM), Department of Civil Engineering of the University of Peradeniya (UOP), and Department of Civil and Environmental Engineering of the University of Ruhuna (UOR) will contribute to the joint research in Sri Lanka and support the experts from Japan in the implementation of proposed project.

   Facilities: Necessary pieces of equipment to pursue this project will include: (1) Workstations for hill slope heavy-rain forecasting and for early warning and data analysis (around 8,500,000 JPY), (2) a Landslide Ring-shear simulator (around 28,000,000 JPY), (3) satellite data (ALOS-2 Radar Data, ALOS 3D topographic data), etc.

   Budget: 175,000,000 JPY from Japan Science and Technology Agency, and 300,000,000 JPY from the Japan International Cooperation Agency (JICA)
8. Project Description: (30 lines maximum)

   A coupled non-hydrostatic atmosphere-ocean-land general circulation model called Multi-Scale Simulator for the Geo-environment (MSSG) allows seamless transition from global to local areas in simulations of weather and climate. The developers of this cutting-edge computer-simulation platform, MSSG, at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) join the project to help develop a system for 24 hours-in-advance prediction of heavy rainfalls in mountains of Sri Lanka, taking into account of precise topographic effects on the cumulonimbus clouds development over upwind slopes for the better prediction of rainfalls in mountains. The landslide-prone areas in Sri Lanka

are in general draped thick with weathered gneiss. Two pilot study sites are selected as representatives of two major types of rain-induced rapid and long-travelling landslides (RRLLs hereafter). One is Aranayaka landslide area in Kegalle District, 70 km east of Colombo, where a fluidized landslide mass flowed over a 2 km distance killing 125 people. The other is Athwelthota landslide area in Kalutara District, 62 km southeast of Colombo. Though the landslide of this type in not surprisingly large, they can occur all at once, and eventually cause extensive losses of human lives and properties as a whole. Careful field investigations at the two pilot sites, monitoring, material testing and analyses including computer simulation are conducted to develop a model for the initiation and the motion of RRLL for predicting groundwater pressure build-up, and for identifying locations of RRLLs and their moving areas. The above-mentioned individual technologies are integrated as a practical RRLL early warning system (RRLL EW system, hereafter). The performance of the developed RRLL EW system will be examined at some additional testing sites, and finally effective guidelines for the use of the system will be developed.

9. Work Plan/Expected Results: (20 lines maximum; work phases and milestones)

   The project will be pursued by three groups of experts from both Sri Lanka and Japan. Their workplans and milestones are given below:

   Group 1: This group, with leaders from all involved organizations joining, oversees the whole project integrating the individual technologies developed in each Group, organizing workshops, providing young researchers with studying the advanced technologies. The developed system with guidelines and manuals is provided for the use in other areas in Sri Lanka.

   Group 2: The mission/ milestone of this group is to develop models for 24 hours in-advance prediction of mountain heavy rainfalls on the computer simulation platform, MSSG, and resulting ground water pressure build-ups based upon thorough scientific in situ/ laboratory observations.

   Group 3: The mission/ milestone of this group is to develop technology and framework for effective risk communication to community people living in mountains and local cities. The system allows each resident/ officer to see the augmented reality of rainfall and landslide hazards predicted 12 or 24 hours in advance, with real diorama displayed as its background on a smartphone, an iPad and/or a desktop computer with a feedback system of the behavior of each user built in.

10. Deliverables/Time Frame: (10 lines maximum; what and when will you produce?)

    The 1st phase (2019): Preparation

    The 2nd Phase (2020-2021): Field surveys at two pilot sites, and development of 24 hours in-advance prediction of mountain heavy rainfalls on MSSG, and resulting ground water pressure build-ups based upon thorough fields and laboratory tests.

    The 3rd Phase (2022-2023): With the information on forecast from the above-mentioned individual technologies, a framework for effective risk communications to community people and local officers is developed. The system is improved through its application to the other areas.

    The 4th Phase (2024): Effective guidelines will be developed.

    The 5th Phase (2025): The developed and revised systems are uploaded as landslide teaching tools. The team also considers an application of ISO to the acquisition.

11. Project Beneficiaries: (5 lines maximum; who directly benefits from the work?)

    The direct beneficiaries are the local people and authorities. The project also merits governmental organizations who are in charge of landslide disaster management.

12. References (Optional): (6 lines maximum; i.e. relevant publications)

Note: Please fill and submit this form by 30 March 2019（extended to 20 April 2019） to ICL Network <icl-network@iclhq.org> and ICL secretariat <secretariat@iclhq.org>