IPL Project Proposal Form 2024

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title: *Integrated Toolsets for the Assessment of Landslide Impact scenarios (ITALI)*

    (1) New project

2. Main Project Fields

    (1) Technology Development

    B. Hazard Mapping, Vulnerability and Risk Assessment

3. Project leaders:

    Veronica Tofani

    Department of Earth Sciences – University of Florence; Associate Professor

    Via La Pira, 4 – 50121 Florence (Italy); veronica.tofani@unifi.it

    Carlo Esposito

    CERI Research Center – Sapienza University of Rome; Associate Professor

    P.le A. Moro, 5 – 00185 Rome (Italy); carlo.esposito@uniroma1.it

    Mario Parise

    Department of Earth and Geoenvironmental Sciences – Università degli Studi di Bari "Aldo Moro"; Associate Professor

    Via Orabona, 4 - 70125 Bari (Italy); mario.parise@uniba.it

Core members of the Project

All members of the ICL Italian Network

4. Objectives:

The research project aims to contribute to decision-making processes (with a focus on large-scale planning and/or nowcasting) through the development of toolboxes that, starting from already existing and available tools and analysis methods, enable the comprehensive evaluation of landslide event scenarios in a risk-oriented perspective and considering the entire chain that takes into account predisposing factors and preparatory and triggering processes, as well as the propagation of failed masses.

5. Background Justification: (10 lines maximum)

The Italian ICL network on landslides is formed by well-established scientific institutions, recognized both at the national and international levels, with a long-dated expertise on landslide research for geo-hydrological hazard assessment and landslide disaster risk reduction. The network partners have also developed strong and widespread synergies with national, regional and local administrations, technical stakeholders, and end-users for developing policies and procedures for landslide disaster prevention, management and mitigation.

Nowadays, there is an increasingly need to implement actions for the effective transfer of scientific knowledge, which is constantly evolving and being updated, to the operational level. Such transfer, however, requires careful examination to account for the actual availability of ancillary data, as well as the needs of stakeholders, generically referable to the category of risk managers. In this context, the members of the Italian network of ICL are involved in research (and development) projects on landslide-related issues with specific views to the needs of stakeholders.

Among all these activities, the RETURN project, funded under the Next Generation EU initiatives, should be mentioned. Most of the members of the Italian ICL network are involved in this project in order to gather know-how and experience that will allow the transfer of scientific knowledge into operational solutions to support decision-making in the broad field of geohazard prevention and mitigation.

6. Study Area:

As stated in the following sections, the research activity will be carried out on "virtual" sites, intended as realistic but not necessarily real contexts to prove the reliability of the proposed solutions.

7. Project Duration:

To fully accomplish the proposed objective, the expected duration of the project is of 36 months.

8. Resources necessary for the Project and their mobilization

Due to the involvement of the whole ICL Italian Network, personnel and facilities of the adhering organizations will ensure the feasibility of the project. As regards the economic resources, it is worth underlining the availability of a significant budget guaranteed by the above-mentioned RETURN project funds.

9. Project Description:

Predicting landslide impact scenarios means first of all knowing the intrinsic susceptibility of the territory linked to time-independent factors (spatial component of hazard) and assess how transitory forcing over both long-time spans (preparatory processes) and triggering processes increase susceptibility. In a risk-oriented perspective, in addition to aspects related to initiation (where and, if possible, with what temporal frequency slope failures are expected) the scenario must also take into account the propagation of landslide masses, at least in terms of spatial footprint, but, if possible, also in terms of the associated energy metrics.

The scientific literature offers many good examples of methods and analysis tools addressing one or more of these aspects. However, for their application on a practical and operational level, it is necessary to systematize them in such a way that the entire chain of relevant factors and processes is treated in a single logical-operational flow, up to the restitution of scenarios related to specific levels of intensity of forcings. Thus, the project takes as its starting point a thorough review of the scientific literature and in particular the extraction of available and usable analysis tools (to the extent that they can be considered as "open-source white boxes"). As a second step the project then aims to construct - for specific combinations of landslide types and analysis scale - conceptual frameworks, understood as logical structures in which to concatenate the identified analysis tools to provide an overall assessment of the scenarios and inclusive of all aspects that contribute to generating them. The "comprehensive frameworks" thus conceptualized will refer not only to specific landslide types and scales of analysis but will also be characterized by boundary constraints (i.e., the morpho-climatic and geologic characteristics of the contexts in which the tools were developed, tested and validated) and input and output metrics (qualitative, quantitative and semi-quantitative log). In a next step, the project will move from the conceptual framework to operational toolboxes capable of linking tools and toolsets to implement the logical sequence of analytical operations through to the creation of forecasting scenarios. A phase of verification of the functionality of the toolboxes is carried out through the creation of proofs of concept, i.e. test and validation domains that are not necessarily replicas of the real world but rather realistic contexts, precisely to certify generalizability, subject to the above-mentioned validity constraints within which the initial individual tools or toolsets were designed, tested and validated.

10. Work Plan/Expected Results:

Following the logical structure of the proposal, the project is carried out in 2 macro-phases, in turn divided into work packages. A first phase will be addressed to the in-depth study and systematization of case studies that can be considered cornerstones, as the object of development and validation of analytical methods for the assessment of the effects of predisposing factors and/or preparatory and triggering processes on slope stability conditions. In the next phase, integrated methods, also to be understood as a concatenation of individual analytical tools, will be developed for the assessment of potential instability conditions and the prediction of event scenarios for specific forcings, considering multi-hazard effects (particularly compound and cascading).

The first phase deals with the Learning stage (milestone 1) and will then be based on the literature review to provide a selection of case histories from which operational tool can be retrieved. This phase will be implemented according to the following sequential work packages

- WP1. Collection of case studies, to be considered learning examples (i.e., cases whose results can be of general or generalizable value). Since the main goal of this proposal is of providing effective screening tools specifically for the Italian territory, the main criterion for the eligibility of a case study as a learning example deals with the possibility to consider it of general or generalizable value (i.e., framed in a geo-environmental context widely diffuse in the national territory end/or affected by instabilities relevant for that context).

- WP2. Deepening and rationalization of the analysis tools. As a first step, a summary sheet will be filled to inventory and classify the analytical tool(s) provided by each learning example. Specifically, in view of setting homogeneous toolboxes (i.e., dealing with specific landslide types and made up of tools linkable one to another), each analytical tool will be characterized and labelled in terms of: landslide type and factors/processes dealt with (i.e., predisposing, preparatory and triggering or propagation), applicability/validity constraints (i.e., analysis scale and boundary conditions such as morpho-climatic and geological settings), input requirements (quality and quantity of input data), file format / code language (if the tool consists in an algorithm), and output metrics (qualitative, quantitative, semi-quantitative). The main WP output is then a DB properly designed to summarize the main features of each identified analysis tool in a hierarchical structure, to support the design of possible workflows to implement comprehensive analysis sequences from the susceptibility assessment to the definition of instability scenarios for specific preparatory/triggering factors, also in a multihazard perspective.

The second phase focuses on the Generation of predictive scenarios (milestone 2). These activities will be articulated in a sequence of work packages:

- WP3. Creation of a conceptual framework for systematizing the identified and rationalized analysis tools, through the construction of sequences of analytical procedures (toolboxes) capable of generating predictive scenarios of ground deformation effects for different types of instability processes.

- WP4. WP4. Design and implementation of Proof of Concepts for the demonstration of the operability of the conceptualized analytical sequences (toolboxes test and validation). A set of demonstration cases will be selected to test the functionality (in terms of operativity) and assess the reliability (in terms of outcome) of the toolboxes; the demonstration cases will be well-known case studies representing different combinations of landslide types and geo-environmental conditions as to provide the "ground truth" for validation. Furthermore, the availability for each demonstrator of reliable ancillary data at different scales is expected to enable their function as use cases to test the scalability range of the analytical processes of each toolbox.

The results of the activities carried out in the WPs will be published in the Open Access Book Series P-LRT as well as presented during the yearly ICL/KLC conferences. Yearly reports of activities will be submitted to ICL secretariat.

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

The project will be divided into 4 main Work Packages, above described in detail, and that will be carried out according to the following timetable:

	Year 1			Year 2			Year 3		
	M4	M8	M12	M16	M20	M24	M28	M32	M36
WP1	▨	▨							
WP2		▨	▨	▨	▨				
WP3				▨	▨	▨	▨		
WP4							▨	▨	▨

12. Project beneficiaries: The beneficiaries of this project will be several: Civil Protection offices and institutions, Public administrations, Managing Authorities, and in general all stakeholders involved in landslide risk prevention and management.

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

Note: Please fill and submit this form by 15 August 2024 to:

KLC secretariat <klc2020@landslides.org> and ICL Network <icl-network@landslides.org>