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Mr. Hans Das
Head of Unit
A/5 Civil Protection Policy
European Commission
DG Humanitarian Aid and Civil protection - ECHO
L-86, 07/01
BE-1049 Brussels,
Belgium

Camerino, 03/04/2017

Subject: **Final Technical Implementation Report and Final Financial Statement**
LANDSLIDE Project - Agreement n. ECHO/SUB/2014/693902

Dear Mr. Das ,

In reference to the LANDSLIDE project (Agreement n. ECHO/SUB/2014/693902), please find attached the Final Technical Implementation Report and Final Financial Statement, covering the period 1 January 2015–31 December 2016.

Please do not hesitate to contact me should you need any clarifications.

Thank you very much in advance,
Best regards,

Pierluigi Maponi,
Coordinator Landslide Project

Final Technical Implementation Report

Period: 1 January 2015-31 December 2016

LANDSLIDE Project - Agreement n. ECHO/SUB/2014/693902

1. GENERAL REMINDER OF PROJECT OBJECTIVES, PARTNERSHIP AND EXPECTED DELIVERABLES

Methods for landslide evaluation are today mainly based on scientific literature of geomorphologic studies and of historical landslide events which do not consider or underestimate the impact of climate change. Therefore, it is important to provide new tools that can adapt to the new conditions by correctly evaluating and predicting landslide hazards which is a fundamental prerequisite for accurate risk mapping and assessment and for the consequent implementation of appropriate prevention measures.

Overall aim

The aim of the **LANDSLIDE** project is to develop an innovative **Hazard Assessment Model and Software** to predict and evaluate landslide hazards. This enables to make completely automatic predictions on a day to day basis of landslide hazards, as well as to correctly evaluate the impact of climate change, in a medium-long term.

LANDSLIDE Partnership

The partnership is made up of 6 organisations: **University of Camerino**, Italy (Coordinator) responsible for the development of the Landslide Model; **Institute of Information and Communication Technologies-Bulgarian Academy of Sciences**, responsible for the development of the Landslide software; **National Observatory of Athens-Institute of Geodynamics**, Greece who participates together with the *Region of Western Greece* acting as Test site 1, **Marche Region, Italy** (as from 1 June 2016), Test site 2, (Marche Region replaced the **Province of Ancona** who resigned as of 1 April 2016, due to transfer of civil protection competences from the Province to the Region) the **Regional Government–Smolyan**, Bulgaria, Test site 3, and **Bielsko-Biala District**, Poland, Test site 4.

Specific project objectives

A) to develop a Landslide Hazard Assessment Model and Software for shallow landslide events triggered by rain fall, that on the basis of weather forecasts, predicts the corresponding landslide hazard, and sends this prediction to appropriate territorial authorities; B) To test and transfer the Model and Software into the civil protection systems of the partner territories involved: C) To involve other sectors concerned, in risk prevention and mitigation, by providing them with the new landslide hazard/risk maps, enabling to consider risk prevention into their respective planning and development policies – cross-sector approach; D) To involve the people directly concerned by the identified risks, to make them engage in self-protection and prevention activities and to distribute the responsibility for risk prevention at different levels of the community (land-owners, farmers, industry, citizens, etc.).

Main Deliverables of the Landslide Project

1) Landslide Hazard Assessment Model and Software that can obtain a completely automatic evaluation of daily landslide hazards; 2) The definition of a standard method for the adaptation procedures of the model; 3) 4 sets of hazard-, vulnerability-, risk maps and risk scenarios; 4) a Training Platform, training course, and training package in EN/IT/GR/BG/PL; 5) A tutorial web based tool (FAQ); 6) Practical Handbook in English; 7) Project website and 4 Online Bulletins; 8) Project brochure in EN/IT/GR/BG/PL; 9) Final Project Publication (layman's report); 10) Two Progress Reports and one Final Progress Report to the European Commission.

2. GENERAL SUMMARY OF PROJECT IMPLEMENTATION PROCESS

The 1st phase, "the development of a Landslide Hazard Assessment Model and Software" (01/01/2015-01/01/2016) concerned the very development of the Landslide Hazard Assessment Model and Software. In this phase partners have carried out all actions as foreseen: selection of the four hydrographic basins as cases of study and model sharing; collection of geomorphologic and meteorological data needed to create a common framework for correct adaptation of the model to the selected test areas, model and software development Fine-tuning activities have continued until the project end.

The 2nd phase, "transfer and testing of the Landslide Hazard Assessment Model and Software in the four hydrographic basins", covering the period 01/12/2015-31/12/2016 was launched in February 2016, the partners

responsible started to develop the 3 training modules and the training platform. However, the completion of the modules and the training platform was not finalised by 30 April 2016, and therefore the training courses for the civil protection staff of the partners territories involved could not be completed as foreseen by April 2016. However, this was not problem as the training was already planned and then implemented in June-July 2016. This phase ran up to December 2016. Civil protection partners then started to widely test and use the model and software within their daily risk mapping and assessment activities. During the pilot phase a help-desk was established to support partners in correctly using and applying the model and software.

The third phase "a sustainable approach to risk prevention – cross-sectors and at various levels" (01/05/2016-31/12/2016) launched in June 2016 at the 4th SC-meeting in Poland, aimed at building a sustainable approach to risk prevention: to this end "local cross-sector risk prevention platforms" were established in each pilot territory and involved other relevant services and sectors concerned (agriculture, planning, etc.) to present the model and software and to share the new risk mapping methodologies and to discuss how the model and software can be used by these actors in view of making risk prevention part of development policies and plans across different sectors. All territorial partner authorities have carried out a series of meetings with the relevant local stakeholders (see below section 4 "Activities", Task E). A series of awareness raising events were finally also carried out in each local territory (in Bielsko-Biala district, region of Smolyan, Marche region and the region of Western Greece, to make the people (residents, volunteers, farmers, industry, etc.), directly concerned by the identified risk, engage in risk prevention activities. Any delays in the first and second period was caught up in the second and third period.

3. EVALUATION OF PROJECT MANAGEMENT / IMPLEMENTATION PROCESS

Management activities have been carried on to coordinate project activities and partners, including monitoring and follow-up on project progress and implementation process. Project implementation started after the official communication about project approval and communication by the European Commission. The setting up of a well-defined management structure has facilitated transparent management, communication and implementation: i.e. the creation of a Permanent Secretariat, provided by the CO, and; appointed SC-members and other project staff, committed by the project beneficiaries, e.g. the thematic staff for the model development, -territorial mapping activities and -pilot activities (i.e. geologists, civil protection staff, administrative and financial staff, , etc.).

The elaboration of a tool box consisting of: financial and administrative guidelines and individual budget schemes of each partner, guidelines for reporting activities, project implementation guidelines including role, tasks, templates and results expected from each partner, etc. have been very useful instruments in guiding partners towards successful project implementation. All partners have filled in a series of evaluation questionnaires relating to project implementation carried out. Synoptic evaluation reports, based on questionnaires concerning the implementation of project activities, have been made.

The SC-meetings have been very important to follow-up, plan and organise project activities among partners. The preparation of planning and monitoring tools with clear guidelines was necessary to achieve desired results. A positive experience was the skype SC-meeting, which was placed between the first and second SC-meeting. This meeting saved resources and time and has demonstrated and confirmed the feasibility of replacing at least one SC-meetings with a virtual SC-meeting. Another positive experience was both the exchange session and the peer review meeting which gave the project direct feedback and impetus from other high-level experts operating at a European level from outside the project, as well as the local cross-sector and prevention day meetings involving local stakeholders from outside the project. In this way, both European and local external feedback and involvement could be obtained.

The main topical difficult was that partners and civil protection authorities in Europe are at very different stages of risk mapping and thus, also data and information were sometimes difficult to collect in certain territories, as well as it was sometimes difficult to interpret existing data, due also to the counties' different parameters and data "languages". The landslide model does not depend on the geomorphological data of the basin under consideration, but these data are needed for the correct model setting, so it was necessary to wait for this information to be able to calibrate the model for each test area. In some cases some advanced data was not available as it did not exist. Therefore, the hydrological and landslide event database could not be completed.

Main administrative issues were: the VAT eligibility question, i.e. AB4 Regional Government Smolyan, whose request to recover VAT was rejected, had some difficulties to understand why VAT was not recognised for them.

Furthermore, due to national and regional legislations, the Province of Ancona AB3 was subject to a transfer of civil protection competences, from the Provincial- to the Regional Authority (Marche Region). As a consequence, the Coordinator, at the request of the Province of Ancona, asked the Commission to substitute the Province of Ancona with the Marche Region (already involved in the project through a letter of support). This partners change was in practice quite smooth as the Italian test area is already situated in the Marche Region, and thus the test area has remained the same. To ensure an as smooth transition, the Marche Region was fully supported by the Coordinator with regards to both administrative and technical issues. Above issues were subject to an amendment to the Grant agreement that entered retroactively into force, as of 1 June 2016.

Cooperation with the European Commission was good and positive. The administration of the project by the Commission has been less bureaucratic than in many other programmes and in such way more work could be dedicated to ensure effective project implementation than on heavy administrative requirements or reporting procedures. Efficient communication, flexibility and support by Ms. Schmidt, the Landslide's desk-officer, very much facilitated successful project administration and implementation.

The numbers of pages (max 4) for project reporting is too short, we recommend to extend the max number of pages, to be able to describe the various sections a bit more detailed.

4. ACTIVITIES

All partners have actively contributed to the implementation of all main project activities, mostly in line with the project's timeframe and expected results as detailed below:

Task A- Project management and Reporting to European Commission
Start-up of the project including setting up a framework for management, coordination and decision-making; implementation of four SC-meetings (and one follow-up SC-meeting); implementation of publicity, communication and networking activities under Task B and of thematic activities under Task C and D. Ongoing monitoring and follow-up of project implementation by the Coordinator and Permanent Secretariat through reports received, e-mail, several skype conferences and phone calls. Evaluation through discussion at SC-meetings and evaluation forms. The Coordinator has supported the Marche Region with technical and administrative issues, in consideration to their entry as a new project partner as of 1 June 2016.

Task B – Publicity
Action 1: The project's Communication Plan has been developed, including stakeholder analysis and stakeholder list. The Communication Plan itself and annexes have been developed by the CO on the basis of the stakeholder analysis and communication objectives developed by each project partner. The Communication Plan and strategy was also discussed and evaluated in the *'communication seminar'* held at the 1st SC-meeting, also to improve and get further input from partners. Each partner has developed a stakeholder analysis and list for its respective territory. A European stakeholder list has also been developed and used, e.g. for Bulletin dissemination.
Action 2: The Landslide website (http://landslideproject.eu) was developed containing the following sections: Home, Landslide project, Tools, About us, Media gallery, Online bulletin, Contact us, News and events. Intranet with shared folders was also added. To evaluate number of visitors, a function to measure website hits was installed, i.e. at the end of the project there were more than 14.000 website hits, which means that the website is very visible and visited (average rate of 583 hits per month). Bulletin No 1 was disseminated in the beginning of the 2nd period and Bulletin No 2 was developed, (but disseminated in the beginning of the 3rd period). Bulletin No 3 and Bulletin No 4 were developed and disseminated according to the time plan. Dissemination was made to all stakeholders included in the stakeholder lists. Also, the four Bulletins have all been uploaded on the website (http://landslideproject.eu/index.php/online-bullettin). Various media activities have been made (media interviews, press conferences, press releases), and numerous press articles have been issued in the various partner territories. Many of them are also available on the website.
Action 3
- Project brochure: http://landslideproject.eu/index.php/project-brochure
- Project logo http://landslideproject.eu/index.php/logos
- Final project publication: http://landslideproject.eu/index.php/project-publication.

AB1/IICT-BAS, responsible for the project logo, has in the 1st period elaborated several proposals and partners have then voted on their preferences and final selection of logo was decided. AB1/IICT BAS responsible for the project brochure, developed the content, provided lay out and has coordinated the work with the partners regarding

contributions (text/translations, photos, and contact). The Brochure was then translated and printed out into 5 language versions in 2nd period. It is uploaded on the website and has been disseminated through partners different communication and networking activities (see B.4). A final Project Publication has been developed in English and printed in 300 hard copies. The publication has been widely disseminated by partners and in the final conference.
Action 4: Network building, discussed and launched at the Communication Seminar (1st SC-meeting), was an ongoing activity that all partners have been engaged in. All partners have identified at least five organisations or actors that have been involved more closely through direct contact and involvement in various exchange and project activities, just to mention a few: NOA participated in several informal meetings with decision-makers of the Region of Western Greece, together with whom the final conference was organised, Poland has built relations with various relevant stakeholders e.g. the University of Agriculture in Krakow and the Commune office of Kozy. A member of the Commune office of Kozy also participated in the transnational exchange meeting in Smolyan, as well as the Province of Ancona brought a member of the Marche Geologist Order. Networking with another EU project, RECALL, was made and joint activities have been realised, e.g. participation and support of RECALL in the Landslide final conference. The Coordinator has been active in various network building activities, e.g. it has realised face to face meetings with the CNR ISAC (the National Research Institute for Geo-Hydrological Protection of Bologna) and Istituto Mora of Mexico City and it participated together with Bielsko-Biala District in the European week of Cities and Regions in Brussels on the 10-13 October 2016, in order to promote the project with other actors outside the partnership. It has also participated in the conference "Il Sistema di allertamento per il rischio idrogeologico ed idraulico: l'organizzazione, gli strumenti e la modellistica di supporto", held in Ancona, Italy, on the 28th April 2016 in order to speak about the Landslide Hazard Assessment Model and Software with other potentially interested actors. A final European landslide conference entitled "Landslides; Risk Assessment: Engagement of Society" took place in Patras on the 10th and 11th November 2016. This final event brought together about 50 people who were informed about the Landslide model and software. Experience from the pilot activities, the local cross-sector risk prevention platforms and the implementation of the "prevention days" carried out in the four test areas was also shared among participants.

Task C – The development of a Landslide Hazard Assessment Model and Software
Four actions have taken place under this Task:
Action 1: "Model sharing and identification of basin": successfully concluded as planned: the proposed model for the soil moisture dynamics and the landslide hazard evaluation have been illustrated, analysed and shared among all partners, also through a 'methodological exchange session' held at the 1st SC-meeting. Necessary methodology for the adaptation procedures and data required by the model were shared within the partnership. A hydrographic basin prone to landslide events was selected for each partner country, as test areas, for the application of the proposed model. Test site 1 Greece: The Panagopoula landslide area situated in the northern part of the Prefecture of Achaia, northwestern Peloponnesus, about 15km east of Patras; b) Test site 2 Italy: mid-part of the Esino River basin, in the central part of the territory of the Province of Ancona in the Marche Region; Test site 3 Bulgaria; Sokolovtci-Smolyan-Srednogortci in Smolyan; Test site 4 Poland: Small Beskid mountain range, Kozy quarry, Bielsko-Biala District. The test sites were all selected on the basis of landslide risk and past events.
The Coordinator has kept constant contact with partners to clarify all doubts regarding interpretation of the initial methodology (geomorphologic parameters and meteorological variables necessary for the development of the model in C.2 and C.3).
Action 2 and 3: According to the guidelines of the 'methodological framework' and to the indications given during the 1st SC-Meeting: National Observatory of Athens, Greece, Region of Smolyan, Bulgaria, Province of Ancona, Italy and Bielsko-Biala District, Poland have performed drilling operations in the field in the respective selected hydrographic basin (test sites) to collect relevant data necessary for the adaptation process of the two sub models (soil moisture, diffusivity of the soil, valdose zone depth, etc.) and have collected all other necessary data. In particular, information about historical events, past related meteorological data and other useful information (land cover, land use, etc.). Thanks to this initial information the process of adaptation of the two sub-models were launched. The first findings were really encouraging as was, for example, demonstrated by an event incurred in the Italian test site in late spring 2015, where the first trial running (beta version of the model) shows that the safety factor related to the considered area in the moment of the event, decreased significantly, by going under the level of security just before the happening of the event. The running of the model itself and events happening in real time, makes up a concrete self-evaluation tool.
Action 4: The work regarding the development of the software was concluded in the second implementation period. In particular the Bulgarian partner IICT-BAS analysed problems connected to the structure of the software, the user interface and its capacity to collect real time data (meteorological data). To guarantee the support to this activity, the CO and IICT-BAS carried out an extra meeting in Sofia, 8 July 2015, where both IICT-BAS, the CO, and the representative of the selected ICT company as foreseen in Action C4 met to discuss more in detail practical

and technical aspects connected to the integration of the two sub-models into the software operatively. The meeting was used as an occasion to meet also with the Region of Smolyan, whose representative including one geologist came to Sofia to discuss about ongoing territorial data acquisition. When the web application was developed, fine tuning activities started while partners were testing the software. The completion of the software took some more time as the model is complex and had to be adapted to each territory. However, at the end of the previous reporting period the software was ready (and fine-tuning started). In effect, fine-tuning, made on the basis of the test activities and a constant feedback from the test areas, continued throughout the entire pilot phase and as such a continuous evaluation and improvement process took place.

Task D – Transfer and testing of the Landslide Hazard Assessment Model and Software in four Hydrographic basins

Training activities were launched a bit later than foreseen, i.e. planning and organisation of the training modules/material, the online training courses and the design of the training platform (web based training application) and the training modules. The implementation of the training courses, involving civil protection staff and relevant local stakeholders, took then place in the month of June and July 2016. On the 21 June 2016 a coordinated training course among the 4 partner territories was realised to concentrate, coordinate and benefit from help-desk support and assistance (to course participants), from both model and software developer, during the whole day. Although each partner could tailor the course to its specific needs and participants, training contained the following main elements: Each partner presented the project, the three training modules and the training material. The software was then presented and all its functions were demonstrated, including how to use its buttons. Participants could then work on the platform to use menus and options. Regional Government Smolyan involved 16 participants from both the Region and the municipality of Smolyan. Bielsko-Biala District organised several training sessions and apart from different departments of the District (crisis management, civil engineering, environmental protection, agriculture and forestry) it also involved Kozy Commune Office (construction office) and the Bielsko District Forestry Management. The National Observatory of Athens co-organised the training sessions with the Region of Western Greece. Their training session included 60 people consisting of engineers, technical offices members, civil servants, mayors, researchers and volunteers. Marche Region mostly involved civil protection staff of the region. An important part of the training was the peer evaluation, feedback and suggestions that followed the practical training to be able to review and improve certain functions. Some stakeholders, not part of civil protection authorities, found it important to make some of the training material more practical. Thus, on the basis of evaluation and feedback three User Guide Videos were developed to further improve accessibility, learning and use of the software.

Test and pilot activities were then carried out by each partner territory, whereby the software was tested, used and applied to the 4 test areas, in the framework of the daily activities of the civil protection services. A helpdesk, made up of both the model developer (UNICAM), the software developer (IICT-BAS) and the designer of the training platform (NOA), was available during the whole pilot period to support, assist and answer to any inquiry or request made (a specific helpdesk e-mail was created). In such a way, any difficulties coming up during pilot implementation could be continuously addressed, and in addition, further "training/teaching" on the software could be made, thanks to the help-desk. All main questions and difficulties during the pilot phase have been summarised into a question an answer tool (tutorial web based tool) to benefit from the difficulties experienced by the civil protection staff, and from the answers already given. Pilot application of the software included daily control of the software outputs, i.e. the maps. This was important, in particular when the meteorological forecast predicted rain fall, in order to examine the conformity of the increasing hazard degree in the map with the amount of cumulative rainfall and related soil moisture. The test and pilot phase also resulted in some final fine-tuning of the software.
An electronic practical handbook in English was finally developed with the support and input of all partners. The handbook contains a brief introduction focusing on the principal characteristics of the Landslide software, a description of the mathematical models used for the Landslide software and how to use the output maps generated by the system, the principal commands of the web based platform, to better explain how it works and the principal results, and also an interesting simulation example. The final part pays attention to the innovation of the tool for territorial management and soil use.

Task E – A sustainable approach to risk prevention – cross-sectors and at various levels

A) A series of **'Local cross-sector risk prevention platforms meetings'** were carried out by the four territorial partner organisations:
Four Cross-sector risk prevention meetings were carried out in the region of Smolyan, dividing representatives into different groups (NGOs, Civil Protection and the businesses). Two national experts from the Ministry of Interior took also part. The event was attended by 20 people for each group. During these events a Regional

Council for reducing disaster risks was established, in order to improve coordination and interaction between organisations and institutions in the Region Smolyan. The members of the council are the Regional Governor, mayors, members of Municipal Councils, the heads of the Fire department, of the Police, of the agency of "National Security", and other people involved in the reduction and prevention of the disaster risk. Bielsko-Biala District carried out fours 'local cross-sector risk prevention' meetings, each one focusing on different relevant sectors, involving: Chief Officers of combined rescue services, the directors of the district organisational units, the officers in charge of the interacting units, Forest rangers, the management and selected heads of the District Office Departments in Bielsko-Biala (i.e. the department of: Environment, Agriculture and Forestry, Construction, Health, Communications and Transport, and Property Management, Organisation and Supervision) including employees of the of Crisis Management Department. One meeting also involved different cities, mayors and city governors in the district. Marche Region organised meetings with the two universities in its territory, Ancona and Camerino, in which more than 30 students took part. The National Observatory of Athens carried out four Local cross- sector risk prevention platform meetings with Research Institutes/Academies, Regional and Local Authorities (Municipalities), the National Electricity Company and volunteers' association. One of these events was carried out jointly with the RECALL project, addressing volunteers' associations (joint event with Prevention days event).

B) A series of **'Prevention Days'** were also carried out by the four territorial partner organisations:
The Regional Government Smolyan carried out four meetings involving self-organised volunteer teams and representatives of the business and NGOs from the region and representatives from the state and municipal institutions, as well as media. Bielsko-Biala District carried out four Prevention Days, each of them focusing on different groups: volunteer fire brigades, residents/tourists, youth of the district and employees of other departments including the management of the District Office in Bielsko-Biala. The Marche Region carried out Prevention Day meetings involving civil protection staff and meteorological area of the Regional Functional Centres. In the region of Western Greece 4 Prevention Days were organised. The participating actors were Research Institutes/Academies, Regional and Local Authorities (Municipalities), Private constructing companies, Kids Summer Camp, National Electricity Company and Volunteers' association.

5. PRESENTATION AND EVALUATION OF THE TECHNICAL RESULTS AND DELIVERABLES

The Landslide project has produced several results and deliverables, the main result/deliverable, is the Landslide system (the Hazard Assessment Model and Software) and some of its connected deliverables, that are presented here below:

Landslide Hazard Assessment Model and Software: (http://93.123.110.111/landslide)
The main technical deliverable and result of the project, built on a common methodological framework for correct adaptation and fine-tuning of the model for the different territorial areas involved. The purpose is to understand the methodology necessary for the adaptation procedures, data required, methods and tools used to acquire and collect the data. The Model and Software itself consists of the following technical sub-deliverables:
a) a common sub-model for the soil moisture dynamics adapted to the 4 hydrographic basins (test areas), i.e. the computation of a complete set of geomorphologic parameters in each test area;
c) a common sub-model for the landslide hazard evaluation (i.e. for the computation of landslide hazards);
d) the web based software produced to be able to evaluate landslide hazards both in the short and medium/long term.

This deliverable gives a broader overview of the main calculation parameters which take place in the variable estimations where we can do precise guesses having in mind the meteorological and soil conditions for the particular test area. The software representation of the model gives visual outputs of all collected parameters which in general have been divided in dynamic and static. The dynamic are the meteorological ones and are collected on 3 to 6 hours intervals, depending on the availability. The static parameters give information for the soil structure and thickness. All of these parameters work in combination in the model estimating the probability for landslide movement where the final result are coloured maps with the probability depicted. Every day one can see four hazard maps calculated on a three to six hour intervals, based on data of the weather forecast and humidity conditions of the soil when the model starts running. The LANDSLIDE Model and Software also produces, with the same steps of the hazard map, the depth map, an output which gives information about the depth of the potential surface of slide.
The Landslide Hazard Assessment Model and Software has, in the last project action phase, been tested in the 4 test areas and is being used by civil protection staff. On the basis of the practical application of the model and software,

evaluation and fine-tuning of the software has been made to further adapt it to the involved territories. The four pilot areas are very different one from another, in terms of geological, hydrological and geomorphological setting; as such the software is very adaptable to different contexts and can easily be transferred to other test areas. It also allows to be used with high flexibility. The only specificity is the meteorological data which has to be available from the selected test areas and the soil initial drainage parameters that has to be done first. Also the extension of the pilot areas was different, showing how performant the tool could be.
No other similar tools exist worldwide at this moment.

Training Platform including training modules and material
The LANDSLIDE Training Platform for project training purposes is hosted in: http://elearning-landslides.net
It is based on Moodle toolbox that allows flexibility, ease in use and dynamic tailor made customization. All partners' languages can be selected, through an option that changes the language in all menus. Three courses (training modules) have been created for all languages using the developed training material and translation in partners' languages where needed. There is also an option for a chat room where interaction between the trainers and the platform supporting team. The training platform and all the training material collected and available on the website are important for a better knowledge and usage of the LANDSLIDE system (videos, presentations, exercises, a user guide for the software and a description of the mathematical model and how it works). The different modules have been studied to gradually conduct training inside the project; the first module is the scientific core of the training platform, explaining the model and what data are requested to be able to function. The other two modules are related to the web based software and to the importance of a correct management of landslide risks. In the website one can find help to understand and appreciate the system and to learn its use, also by support tools like the tutorial FAQ or by testing the scenario generation. User video guides (http://landslideproject.eu/index.php/tools) are very helpful to learn the different buttons of the platform, together with the user guide. The training platform has been done in a very intuitive manner in order to allow that every user, familiar or not with such tools, are able to extract all needed information and skills needed in order to operate and use the LANDSLIDE project tools. These steps of creating training and information can be used in many other cases.

Practical Handbook
The Practical Handbook is the logical conclusion of integrated common efforts of the LANDSLIDE consortium to deliver an understandable and easy to use methodology, that in cases of not very deep (i.e. shallow landslides), but dangerous landslides (up to 20th meter deepness in the soil) can become active under certain conditions which are described therein. These conditions and their parameter representation in the modelling process have been given in a user friendly way, where also the web-based tools accompanying the theoretical part have been presented. Starting from a brief introduction concentrating on the principal characteristics of the software, then introducing the mathematical model and an interesting simulation example. The handbook is focused on the principal commands of the web based platform, to better explain how it works and the principal results. The final part pays attention to the innovation of the tool for the management of the territory and soil use. It is also very useful because it explains the importance and the different applications of the results (risk management, planning sector, etc.). Final outcomes and lessons learned have been shared among the stakeholder groups in every test case area.

As such the Practical Handbook represents a valid publication focusing on the main results of the Project; The final results presented in the Handbook can give, to the wider public, information on how monitoring and maintenance procedures can be done in shallow landslide prone areas, where people live. Financial losses are in these cases very probable, which means that the responsible authorities can use the LANDSLIDE tool as a user worst case scenario generator in order to estimate the possible financial losses or any other risk of infrastructure damages in the potential landslide areas.

To conclude this project teaches us that there are many types of landslides, depending on geological, hydrological and morphological assets, despite this, it is possible to use a common tool to study and evaluate landslide hazards from weather conditions. The different tools created to define the LANDSLIDE system are various, simple and very easy to use, therefore they can reach all kind of people interested by this theme. The model is widely described in many parts of the project, and every factor that it considers is mentioned and presented. The training platform considers all the results of the project, so the learning processes are very fast. The web platform is simple, easy to use and to understand; furthermore, it permits different ways to use output maps and data input; one can see aggregation of meteorological data, making it possible to evaluate the trends in different periods; one can compare hazard maps at different time, or in the past. The system could also be very helpful during meteorological events,

because it permits to determine the zone with a probably low value of Safety Factor and so related to potential landslide event; this action could be done with a PC and internet network, without personnel on-site, if there is no real need.
Daily monitoring of the LANDSLIDE outputs could be useful in the different areas, especially when there are severe weather conditions. Implementation of the system in other areas, both by extending the areas of the project partners as well as to extend it to other territories outside the partnership, could be very interesting having the purpose to create a growing zone modelled by LANDSLIDE.

The LANDSLIDE system is very useful and could be very important in civil protection activities and risk management, for many reasons as mentioned above.
It is important to consider the platform as a tool that could support and help in the delicate phase of decision-making of landslide risks, activities related to rainfall events, and even for economic planning of the territory.

The LANDSLIDE tool developed in the present project is a comprehensive object taking into account the relevant factors influencing the landslide hazard. However, it can be seen as an initial prototype to face the complex problem of landslide hazard evaluation, and a number of improvements must be considered by future actions:

- introduction of downscaling procedures for weather data in order to use weather forecasts and stations measurements on grids with higher spatial resolution,
- installation of suitable environmental stations for the direct measurement of water content in deep soil (20-30m)
- the computation of safety factor by other methods (such as three-dimensional method of slices, finite element method), in fact the Infinite Slope Model used in the present version of the tool may be unable to deal with complex horographies.

On the other hand the system developed in the LANDSLIDE project is an innovative fast alert system, so, due to its novelty, three main steps must be considered in order to obtain an effective tool:

- integration of the automatic results provided by the system with the results of standard analysis methodologies such as susceptibility zonation based on historical landslide events and triggering factors such as anthropic actions,
- analysis of the level of uncertainty in the data (such as basin features and weather data) and the sensitivity of the models to assess the accuracy of the system output,
- a rigorous test procedure where the output of this evaluation system for landslide hazard is compared with the landslide events really occurred in the test period.

Finally, the LANDSLIDE system can be a first step toward a multi-hazard platform, in fact the water information and weather data are fundamental inputs for the hazard evaluation process of other natural events, such as floods, wildfires, droughts, heat waves, and so on. The operation of the eventual platform should be supported by suitable computational resources or it can be based on proper upscaling procedures. This platform could also take into account climate data, such as seasonal forecast and long-term scenarios in order to provide seasonal multi-hazard evaluations and territory susceptibility with respect to climate change, respectively, improving the current decision-making procedures for risk prevention and reduction.

6. FOLLOW-UP

The Landslide partnership will continue to maintain the Landslide Platform and the project website for at least three more years. This will give the option for the creation of a 5 year database for every test site in reference to weather and soil details. This information can also be used within other monitoring systems for these test sites.
As such, the LANDSLIDE system could be very important for different approaches and methodologies related to management and landslide risk evaluation. The maps as outputs of the web application, related to the Safety Factor for the slope stability and depth of the potential slide surface, are daily updated and elaborated for a six hour period, thus four maps in a day are produced. They are very useful because they support the decision-support and management of landslide risks and the protection of people and economic activities during or after rainfall events (for example, to face and overcome an emergency situation). Furthermore, the analysis of a time series of elaborated hazard maps could also be a very valuable instrument to be used for the study of climate change and its impact on the territory.

Form T1

SUMMARY OF THE PROJECT (No changes needed)

Objectives of the project

Landslides occur in many different geological and environmental settings across Europe, and are a major hazard in most mountainous and hilly regions. Every year landslides cause fatalities and large damage to infrastructure and property. Intense and/or long-lasting rain fall represents the most frequent trigger of landslides in Europe, and is expected to increase in the future due to climate change. In addition, population growth and expansion into landslide-prone areas is further raising landslide risks in Europe.

Actual methods for landslide evaluation are mainly based on scientific literature of geomorphologic studies and of historical landslide events, which do not consider, or underestimate, the impact of climate change. Therefore, it is important to provide new tools that can adapt to the new conditions by correctly evaluate and predict landslide hazards, which is a fundamental prerequisite for accurate risk mapping/assessment and for the consequent implementation of appropriate prevention measures.

The objectives of the project are:

- to develop a Landslide Hazard Assessment Model and Software for shallow landslide events triggered by rain fall, that on the basis of weather forecasts, predicts the corresponding landslide hazard, and sends this prediction to appropriate territorial authorities.
- to test and transfer the Landslide Hazard Assessment Model and Software into the civil protection systems of the partner territories involved, all located in landslide-prone areas.
- to involve other sectors concerned, in risk prevention and mitigation, by providing them with the new landslide hazard/risk maps, enabling to consider risk prevention into their respective planning and development policies (cross-sector approach).
- to involve the people directly concerned by the identified risks, to make them engage in self-protection and prevention activities and to distribute the responsibility for risk prevention at different levels of the community (land-owners, farmers, industry, citizens, etc.).

The novelty of this proposal is the practical approach used in developing an innovative method for the dynamic landslide hazard assessment (hazard depending on meteorological variables), the possibility to evaluate the medium and long term landslide hazard from a possible weather scenario, as well as through the statistical analysis of the day by day dynamic landslide hazard results; all elements which will support the prevention capacity. The main scientific tools for the construction of this system are the mathematical models for soil moisture dynamics, and landslide hazard computation. Both these models will be developed on the basis of a wide scientific literature, and through an adaptation process carried out in four different hydrographic basins in four countries selected as test areas. Furthermore, the model and software will also be tested and transferred through the involvement, not only of the civil protection system, but also of the relevant authorities and socio-economic actors. This process of joint development, test and transfer will ultimately allow to provide other territories with proven methods, instruments and tools. The project will consider and capitalise results of several European projects such as SAFELAND, HYLAND, IRASMOS, LAMPERE and SLID.

Actions and means involved

To achieve the above objectives, the following main action phases are foreseen:

1) The construction of the Landslide Hazard Assessment Model and Software, through 4 specific actions:

a) sharing of mathematical models and of adaptation processes between partners and selection of a hydrographic basin in each partner country as a case of study; b) adaptation of the soil moisture dynamics model to every test area; c) adaptation of the landslide risk model to every test area; d) development of the computer information system by using the adapted models. The means required are: a computer with a high performance for the adaptation processes and for the on-going functioning of the overall system; meteorological stations for "in situ" measurement of rainfall, air humidity, wind velocity, temperature; means for measurements of the soil moisture in the selected basins; European and regional landslide databases; weather forecast systems.

2) Pilot implementation and trying out of the model and software in 4 countries, accompanied by a "helpdesk" service, and preceded by an online training course, to test and transfer the model into the civil protection daily mapping and assessment activities of the 4 partner territories, by means of an online web based training application and helpdesk.

3) Establishment of local cross-sector risk prevention platforms, to involve the relevant and concerned services and sectors (urban, agriculture, spatial planning, etc.) to share risk maps, inform about risk scenarios and to make risk prevention part of development policies and planning cross-sectors.

4) Carrying out of prevention days by involving the people, also at an individual level, directly concerned by the identified elements at risk, through means of risk maps, risk scenarios, best-practice examples for appropriate prevention and mitigation measures to be implemented.

Expected results

- A Landslide Hazard Assessment Model and Software making it possible to obtain a completely automatic evaluation of daily landslide hazards; application and use of the model and software in 4 civil protection systems; and available to other local/regional authorities, thanks to instruments and tools produced to facilitate the use and application of the model outside the partnership.

- Better capacity to adapt to climate change both in the short-term, due to day to day automatic prediction on the evaluation of landslide hazards, as well as in the medium and long term, thanks to the capacity given by the model to elaborate risk scenarios on the basis of climate change trends or by statistical analysis on real past data given by the model and software after a certain period of time. This will enable to elaborate more correct medium and long term risk forecasts and risk scenarios, and on the basis of these; more appropriate prevention and mitigation measures for potential elements at risk.
- Integration of risk prevention and risk management considerations into planning and development policies cross-sector.
- Capacity of the risk groups identified in 4 hydrographic basins, to know how to access risk maps/risk information and how to engage in prevention activities/self-protection (land-owners, farmers, industry, citizens, etc.).
- Contribute to a culture of prevention, cross the sectors and at various levels (i.e. also at private and individual level).

Project table showing achievement of deliverables

Project Acronym	LANDSLIDE				
Task ID	Task Title	Start Date	End Date	Actions	Deliverables within 30/08/2015
A	**Management and reporting to the European Commission**	**01/01/2015**	**31/12/2016**	**A.1** - Project management, coordination and reporting **A.2** - Steering Committee meetings **A.3** - Monitoring, follow-up, evaluation and setting up of tools	1 Kick off meeting with the DG ECHO **OK** 1 Toolbox - project implementation guidelines **OK** 4 Steering Committee Meetings **OK** 2 Progress Reports to the EC **OK** 1 Final Report to the EC **OK** 4 Synoptic Evaluation Reports **OK** 1 Final meeting with the DG ECHO
	Publicity	**01/01/2015**	**31/12/2016**	**B.1** - Communication Plan **B.2** - Website and online bulletins **B.3** - Project brochure, logo and final project publication **B.4** - European mainstreaming conference and network building	1 Communication Seminar (at 1st SC-meeting) **OK** 1 Communication Plan **OK** 6 Stakeholder analyses **OK** 5 Press conferences **OK** 20 Press releases **OK** 40 press articles **OK** 1 project website **OK** 4 online Bulletins **OK** 1 project logo **OK** 6 language versions of the project brochure **OK** 1 Final Project Publication/ layman's report **OK** 1 exchange meeting (during 3rd SC-meeting) **OK** 1 European mainstreaming conference **OK** 2 face to face meeting with relevant organisations **OK** 1 participation in a European event **OK**

Project Acronym	LANDSLIDE				
Task ID	Task Title	Start Date	End Date	Actions	Deliverables
C	**The development of a Landslide Hazard Assessment Model and Software**	**01/01/2015**	**01/01/2016**	**C.1** - Model sharing and selection of hydrographic basins as cases of study **C.2** - Adaptation of the sub-model for the soil moisture dynamics **C.3** - Adaptation of the sub-model for the landslide hazard evaluation **C.4** - The development of a web based software	1 methodological session (during the 1st SC-meeting) on the model development – **OK** 1 common methodological framework – **OK** 1 sub model for the soil moisture dynamics adapted to 4 hydrographic basins – **OK** 1 hydrogeological database related to 4 test areas 1 sub model for the landslide hazard evaluation adapted to 4 hydrographic basins – **OK** 1 database of historical landslide events occurred in the 4 test areas 1 standard method for the adaptation procedure of the Model – **OK** 1 web based software for the evaluation of the landslide hazard – **OK**
D	**Transfer and testing of the Landslide Hazard Assessment Model and Software in four hydrographic basins**	**01/12/2015**	**31/12/2016**	**D.1** - Training for civil protection staff **D.2** - Pilot implementation of the Landslide Hazard Assessment Model and Software in the four partner territories **D.3** - Development of a Practical Handbook – "Landslide Risk Assessment Model for Disaster Prevention and Mitigation: A Practical Handbook"	1 training package/manual in 5 languages – **OK** 1 online training course – **OK** 1 online web based training application – **OK** 1 tutorial web based tool **OK** 4 set of hazard/ vulnerability/risks maps **OK** 1 Practical Handbook **OK**

E	**A sustainable approach to risk prevention - cross-sectors and at various levels**	**01/05/2016**	**31/12/2016**	**E.1** - Local cross-sector risk prevention platforms **E.2** - Prevention days **E.3** - Transnational exchange and peer review	15 risk prevention platform meetings **OK** 14 targeted prevention days **OK** 4 set of information material and facts about the identified risk areas and the elements at risk **OK** 1 peer review session (during the 4th SC-meeting) **OK** 1 set of good practices **OK**