State-of-the-Art in Risk Management Technology: Implementation and Trial for Usability in Engineering Practice and Policy

START_it_up

Common Strategic Paper

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COMMON STRATEGIC PAPER

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EXECUTIVE SUMMARY

START_it_up is a project in the 5th call of the Alpine Space Programme 2007-2014 and was designed as a capitalization project. Hence the major objective was to compile the huge pool of available knowledge in natural hazard engineering and risk management, furthermore to refine this knowledge to generally accepted standards and provide these standards to the engineering and policy practice. Generally speaking activities in START_it_up are characterized as knowledge management and quality assurance supporting expert´s decisions, fostering the public trust in risk policy and enhancing the efficiency of protection measures. The transfer of knowledge from the research and development to the "state-of-the-art" in engineering, from innovation to application, requires transdisciplinary work methods. This challenge was taken by a consortium of project partners from science, administration and engineering practice from 5 Alpine Space countries with core competence in the capitalized pool of knowledge.
The thematic focal points of START_it_up – selected from the wide spectrum of knowledge in natural hazard engineering and risk management and referring to floods, debris flow, avalanches and mass-movements – were the following:

- Hazard and risk assessment
- Hazard and risk maps and their implementation in areal planning and regional development
- Hazard protection systems and engineering solutions
- Good risk governance and information technologies

The START_it_up approach to standardization goes far beyond a one-dimensional unification concept. As the design of technical systems applied to natural hazards has to take into account fragmentary knowledge on hazard processes, imperfection in available information and uncertainties in the prognosis of frequency and intensity of natural events, reliability, robustness and functional efficiency are the most important quality criteria. Thus standardization means not only the provision of commonly approved norms and regulations (voluntary or de jure), but rather a standardized way of thinking, common methods of decision-aid (support) and documentation, approved processes for optimization of alternatives (variants), system design adapted to societal desires, environmental conditions and legal/political framework or simply the establishment of good practice procedures. In order to integrate all these divers approaches of standardization, a simple core model for the consolidation of knowledge was established in START_it_up, in which standards – symbolized as wedges – support the achieved level of quality. The following concepts and instruments for consolidation of knowledge were applied:

- Technical standards (norms) and harmonized policy procedures (regulations, police briefs, best practice)
- Decision making considering traceability of expertise processes and quality (reliability) of information content and sources
- Transnational assessment and benchmark of methods and procedures
- Solution-oriented knowledge management, considering all relevant approaches (methods)
- Provision of reliable and approved methodology to practitioners
- Good governance, involving stakeholders and the concerned public

The tangible results of START_it_up are "state-of-the-art" reports, conceptual models, best practice procedures and databases that have in common to provide comprehensive knowledge in an applicable, reliable and easily accessible form to consumers, such as decision makers, engineers and educational institutions. Among the knowledge compilations presented in this Common Strategic Paper and Final Booklet are reports on the state of the art in monitoring, the application of artificial avalanche release systems, the state of the art in protection work effectiveness assessment, the risk/vulnerability assessment for critical infrastructure, the implementation of forest protection function in risk management for shallow landslides and the legal basis for rock fall protection. New approaches for expert networking and think tanks were developed, such as the START_it_up State of the Art Conference in Natural Hazard Engineering and the Risk Policy Dialogue. Various concept of databases were implemented to provide the available knowledge – standardized and compiled according to the requirements of the target group – to the consumers and concerned public (Risk Technology Platform and Database, CLV Platform for Avalanche Warning Services, Database on assessment of impact to objects).
START_it_up was only a first step towards common standards in natural hazard engineering and risk management and will pave the path for further standardization processes in and beyond the Alpine Space Programme 2014–2020.

MISSION STATEMENT

Sustainable protection is of existential significance for social welfare, regional development and economic growth in the Alpine Space, a region exposed to multiple natural hazards and risks. Hence engineering solutions and safety decisions at the highest possible quality are required. START_it_up project is dedicated to the acquisitions, consolidation and standardization of knowledge in the field of natural hazard engineering and risk management by creating a common "state-of-the-art" and making the huge pool of knowledge and technologies accessible to decision makers, end users (engineers, practitioners) and the concerned public. This mission was supported and reached by three major initiatives:

- Compilation and provision of the available knowledge in norms, "state-of-the-art" reports and best practice recommendations
- Expert decision support and confidence by approved methodologies, standard procedures and quality assurance
- Creation of a transnational expert network and a knowledge exchange platform

Figure 1: Application of quality standards for natural hazard engineering under extreme conditions (picture: die.wildbach)

START_it_up has paved the path for a wide range of strategic initiatives in knowledge management and standardization for the benefit of risk management in the Alpine states. With this project trend-setting approaches in planning, engineering and risk governance, such as protection systems engineering, continuous safety quality improvement and regional risk governance were introduced. Based on a well established transnational cooperation in risk management in the Alpine Space, new procedures and instruments for the transfer of knowledge and the expert networking were tested and proposed for implementation, in due consideration of the Alpine Space Programme (ASP) 2014–2020.
High quality standards in risk engineering and expert decision making directly support the prevention of catastrophes and fatalities. Hence the efforts taken by START_it_up partners are essential contributions for the adaptation of natural risk management to the challenges of global change.

Background and Project Idea

In the course of time a multitude of projects of former innovation programs of the European Territorial Cooperation (ETC) as well as national initiatives have carried out a wide range of valuable results, methods and procedures. However, after these project's closures it habitually happened, that most of the results neither have been promoted sufficiently, nor did undergo further testing and evaluation for common applicability, nor were easily accessible for practitioners and decision makers. A simple principle holds true:

"When money is gone, often also initiatives die!"

START_it_up project has strived to overcome this substantial problem by collecting, evaluating and disseminating the good practice examples and pre-standards that already exist in great number on different levels in the Alpine Space countries and to promote them on the transnational level. The focus was on collecting and testing these documents, seeking general agreement and providing them to potential users. This process was closely coordinated with the partners and observer consortium who represent the primary consumer community of these products. The resulting standards were made accessible on a public database that assists users searching the appropriate knowledge for their daily endeavours. The idea of a common share of available knowledge and technologies for public safety was strongly promoted to gain a great forum of participants on voluntary basis.
On that purpose a consortium of 8 institutions from 5 Alpine countries together with a multitude of observers formed the project START_it_up within the framework of the Alpine Space Programme's 5th call and thus co-funded by the European Regional Development Fund (EDRF). In the project life cycle from September 2013 to November 2014 the partner consortium faced the challenge to promote a common "state-of-the-art" in the fields of natural hazard engineering and risk governance on international level. Due to the short duration the project itself was only able to set the scene and provide the basis for consecutive standardization and harmonization processes. The aim of project partners was therefore to create an appropriate framework for the consolidation of knowledge by fostering future standardization (harmonization) initiatives and an expert network in order to hump these activities and disseminate the results.

Project Objectives and Major Results

START_it_up was initiated as a direct respond to the ASP objective *"to prevent and mitigate natural and technological hazards and manage their consequences".* The project was designed to deliver innovative and strategic approaches for capitalizing existing knowledge in the field of natural hazard management and risk governance. Projects and activities in START_it_up were focussed on the following categories of natural hazards: floods, debris flow, avalanches & mass-movements. Actions within the project concerned engineering as well as risk management purposes and targets.
The abstract objective, to create and establish a transnational common "state-of-the-art", was approached by a three step procedure: (1) acquisitions, (2) consolidation and (3) generalization of available knowledge aiming at the continuous consolidation of knowledge and quality improvement in safety services. In a demonstrative model (Fig-

ure 4) protection quality is improved by a continuous "PDCA" quality process cycle (Plan-Do-Check-Act) (inspired by ISO 31000:2009), wherein standardization consolidates and generalizes approved knowledge. By definition standardization is a process of developing and implementing common standards, which can help to maximize compatibility, interoperability, safety, repeatability, or quality. The idea of standardization is close to the solution for a coordination problem, a situation in which all parties can realize mutual gains, but only by making mutually consistent decisions. The understanding of standardization within START_it_up reaches far beyond transnational unification, technical norms or legal regulations; in point of fact the conception addresses other strategies to consolidate knowledge, particularly by quality assurance in expert decision making, by solution-oriented knowledge development, by decision support through approved methodology and documentation, by best practice selected from transnational assessment and benchmark of methods and procedures and by good governance. In other words a standard can be a technical norm as well as an approved procedure, process or even generally accepted way of thinking. The standardization processes initiated by START_it_up will strongly foster the resource efficiency in regional development, land-use planning, natural hazard engineering and risk governance by providing generalized and commonly approved standards for technology and policy, in agreement with EU legislation, strategies of the European Territorial Cooperation and regulations by the European Committee of Standardization (CEN).

Figure 2: Presentation of START_it_up objectives and results at the final conference at IRSTEA in Grenoble (France) on the 15th of November 2014 (picture by IRSTEA)

Approved quality standards will bring about competitive advantages for enterprises on the global market and security for consumers in selection appropriate protection systems and concepts. Generalized procedures in risk governance will increase the confidence of people in risk management, raise the risk perception for endangerment outlined in hazard and risk maps and improves the efficiency of risk governance administration.
Major results of START_it_up presented in this CSP are:

(a) best practice methods for hazard and risk assessment;
(b) policy proposals and common procedures for integrating hazard and risk maps into areal planning, regional development and safety planning;
(c) initiation of a transnational harmonization and standardization processes for protection technology;
(d) establishment of a risk policy dialogue;
(e) definition of gaps, potentials and new fields of research, development and policy in natural risk management.

Among the tangible product of START_it_up are: Recommendations for rockfall/landslide hazard and risk assessment; Best-practice guidelines for the implementation of forest protection function in the NHRM of shallow landslide; Common policy directive for the implementation of hazard/risk maps (based on EU Flood Directive); Practice guidelines on monitoring and warning technology for debris flows; Web 2.0 knowledge database and CLV platform for avalanche warning services; Establishment of a transnational expert network on standards and knowledge exchange (recurrent State-of-the Art Conference) in natural hazard engineering.

8 | PRINCIPLES AND VISIONS OF START_IT_UP: QUALITY ASSURANCE AND STANDARDIZATION IN NATURAL HAZARD MANAGEMENT AND RISK GOVERNANCE

Common principles of quality improvement and design processes in natural hazard risk management and engineering

Natural hazard risk management and engineering is a complex ensemble of well-tuned design and life-cycle oriented quality control activities alongside the entire risk management cycle. In this context the role of design is essential and an underestimation of its relevance results in inbuilt system vulnerabilities, which might prove to be hardly mitigated. Robust design, as a general principle of quality improvement, involves interplay between "what we want to achieve" and "how we choose to satisfy the need". Suh (2001) systematized the design thought process involved in this interplay by introducing the concept of domains in order to delineate and demarcate four different kinds of design activities, namely:

1. the customer domain, which is characterized by the needs (or attributes) that the customer is looking for in a product or process,
2. the functional domain, where the customer needs are specified in terms of functional requirements (FRs) and constraints (Cs),
3. the physical domain, where design parameters (DPs) are conceived to satisfy the specified FRs and
4. the process domain, where suitable process variables (PVs) are identified to specify the product development or the process implementation.

One necessary adaptation of this framework concerns the adoption of the Sustainability vs. Stakeholders' interests' domain (i.e. the Su – St Domain, compare Figure 3). In fact, natural hazard risk engineering ultimately seeks to find alternatives and prospects that represent different syntheses amongst: i) what society desires, ii) what complies with the natural evolution patterns (i.e. river styles), iii) what is allowed by the existing legal framework, and iv) what is prescribed in terms of protection levels (or acceptable risk levels) to be attained. As second adaptation we conceive design as an iterative process or as an envisioning-problem setting and problem solving cycle comprising the following steps:

a) Problem identification and description.
b) Formulation and visualization of the Ideal Final Result (IFR) to be achieved. Description of a "model" to be approximated.
c) Analysis of all possible physical, spatial and temporal resources for an optimal attainment of the IRF.
d) Definition of admissible system changes: The planning process is meant to address the removal of obstacles to the full attainment of the IFR.
e) Elaboration of solution concepts based on the IFR by considering the following design principles: separation, dynamization, combination and strategic redundancy (compare for details, Mazzorana and Fuchs, 2010).
f) Evaluation of the developed solution strategies. The evaluation should clearly state for each design solution (i) what has been enhanced, (ii) what has been

worsened, (iii) what has been substituted, (iv) what remains to do with reference to the attainment of the IFR and (v) whether the systemic and developmental contradictions could be solved?

g) Participatory selection of the optimal solution taking into proper consideration cost-benefit criteria.

In the light of (i) long planning horizons for protection systems, (ii) complex participatory planning processes, and (iii) the non-prejudicment principle anchored in various legal requirements, the time dimension of quality is a relevant in natural hazard risk engineering. This issue is properly addresses through a life cycle management approach.

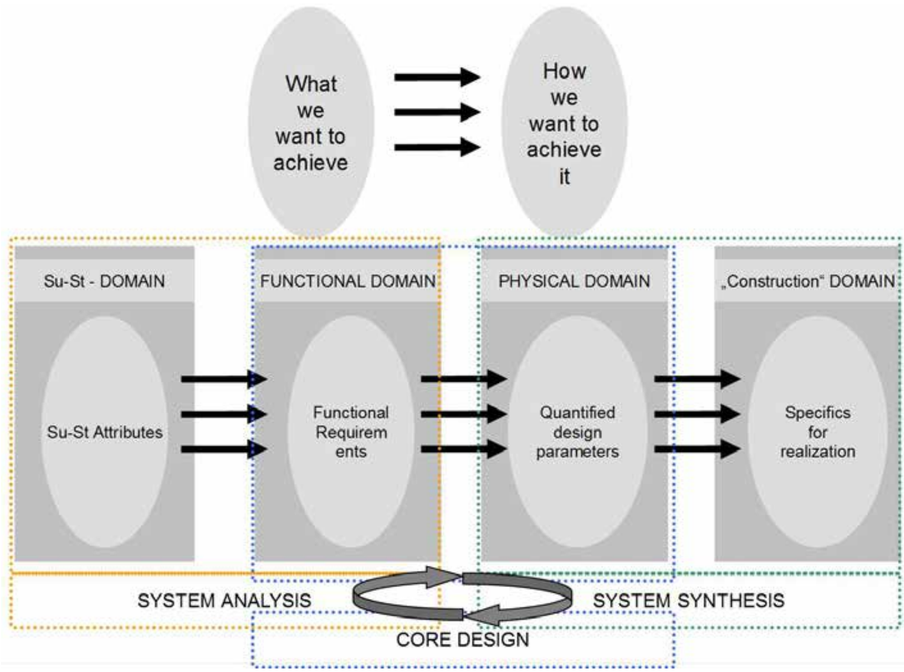

Figure 3: Conceptual planning steps – mappings in the design process (adapted from Suh, 2001)

START_it_up core model: Safety quality improvement by knowledge consolidation through standards and quality control

The demonstrative core model of START_it_up as a quality improvement process based on the well-known APDC-circle (inspired by ISO 31000:2009). PDCA (plan–do–check–act or plan–do–check–adjust) is an iterative four-step management method used in economy and engineering for the control and continuous improvement of processes and products. "Plan" addresses the establishment of objectives and processes necessary to deliver results in accordance with the expected output, applied to risk management the protection goal or expected level of safety. "Do" means the implementation of the plan, the execution of a planned process or the creation of a certain product. "Check" includes the assessment of the actual results and benchmark them against the expected protection goals or levels of safety. Identified deviations from the expected quality induce the verification of the appropriateness and completeness of the plan (procedure), the improvement of shortcomings and extinction of sources of failure and the redesign of the plan, process or measure. “Act” describes the actual corrective actions on significant differences between actual and planned results. When a pass through these four steps does not result in the need to improve, the scope to which PDCA is applied may be refined to plan and improve with more detail in the next iteration of the cycle, or attention needs to be placed in a different stage of the process. The PDCA-cycle symbolizes iteration towards an improved protection system, hence PDCA should be repeatedly implemented in spirals of increasing knowledge of the system that converge on the ultimate goal, each cycle closer than the previous.

Another core idea of START_it_up is the initiation of a knowledge management process in natural risk management and governance. Knowledge management (KM) is by definition the process of capturing, developing, sharing, and effectively using organizational or societal knowledge. Knowledge management efforts typically focus on organizational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement, which are – in an abstract and generalized sense – also applicable to engineering and policy.

In this START_it_up core model available and generalized knowledge is consolidated by standards, which are comparable to wedges preventing quality from “rolling” back on the sloping ramp of improvement. Standards are understood in the broadest sense and can be, either “de facto” standards which means they are followed by informal convention or dominant usage, “de jure” standards which are part of legally binding or generally agreed contracts, laws or regulations, or voluntary standards which are published and available for people to consider for use. Concerning the societal treatment of risks (risk policy), standardization often means the process of establishing standards of various kinds and improving efficiency to handle the risk acceptance of society as well as the related interaction and communication among people. Examples include the formalization of safety decisions by governmental institutions and authorities in catastrophe managements, and establishing uniform criteria for common safety levels (protection goals). Standardization in this sense is often discussed along with large-scale social changes as modernization, homogenization, and centralization of society.

In principle this START_it_up model of quality improvement by knowledge consolidation is applicable to any of the processes in risk management, engineering and governance. The model is meant to visualize the principle of quality improvement and quality assurance. Although the specific projects and results of START_it_up are quite heterogeneous and require adapted approaches to quality improvement, the model provides a good visualization of the meaningfulness of acquisitions, consolidation and generalization of knowledge in all sectors of natural hazard engineering and risk management (governance).

In other words: The model shows – bolt and simple – the common understanding of safety quality improvement of a interdisciplinary group of experts in the START_it_up partnership.

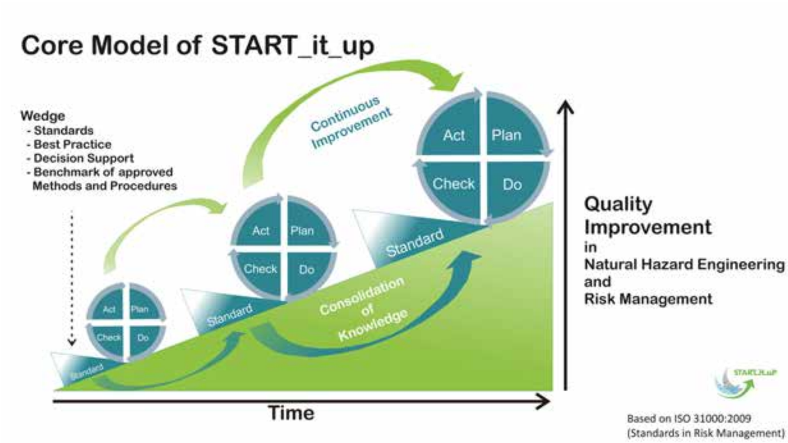

Figure 4: Quality improvement model based on APDC-cycle (inspired by ISO 31000:2009)

This model is a clear and easy understandable representation of the START_it_up objectives. However, one must recall that it should be considered as a conceptual proposal and a "way of thinking" rather than a definitive solution. Some issues related to process quality assessment in the context of natural hazards still remain:

a) First, in many cases, standards should be considered as a shared information or practice rather than a fully normalized document (such as ISO, Afnor, ...) standards. To a certain extent, standards should be supplemented by indicators: indeed, quality exists if and only it is possible to check or measure its achievement. One input of the START_it_up project has been to share this point of view and prepare the evaluation process rather than providing a definitive unified approach.
b) Secondly, in the natural hazards contexts, information is often fragmentary and it is not always easy to apply directly methods coming from industrial context. As an example, safety and reliability analysis is currently used for technological devices. However, the application of this technique to natural hazard context is not direct. Technical systems, such as protection works are closely linked to a natural environment and it remains quite hard to determine systems failure probability in comparison with an industrial, fully monitored device.

Decision making in risk management: indicators and benchmarks for quality improvement

Risk management decision processes appear as quite complex. Therefore, it appears that the decision contexts have to be clearly described in order to be able to contribute to decision support systems. A deep dialogue with decision-makers is needed. Key issues consist in correct modelling of the decision problem, information imperfection assessment and decision support systems validation. To model the decision problem, corresponding to strategic regional or local decisions, a simple 5WH approach is proposed to describe decision context (Figure 5): **W**hat, **W**hy, **W**ho, **W**hen, **W**here, **H**ow is it decided? (see the generic framework proposed in the ASP-Paramount project). Several cross-cutting methods are available and must be used (e.g. multi-criteria decision-making, dependability, reliability and safety analysis, numerical modelling, uncertainty propagation, expert-based models, economic approaches, geographical information systems) (Figure 6). Economic approaches such as cost-benefit approaches (CBA) are perfect but they rely on strong assumptions about probabilities and monetary estimation of losses which are known to be questionable when dealing with cost of human life, indirect and remote effects of phenomena.

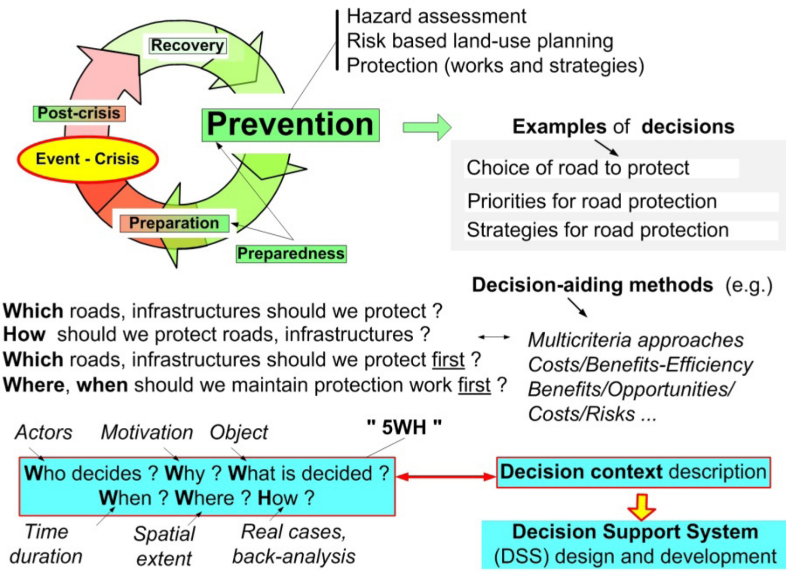

Figure 5: Decision processes have to be clearly described (Tacnet et al. 2012 – Paramount project)

At the end, quality indicators in risk management process can be summarized as follows: Number, nature and diversity of used methodologies.
The use of the state-of-the art concepts is required with at least bibliographic and critical comparison with other existing approaches. No single approach (e.g. numerical modeling, economic approaches, expert assessment) should be used exclusively. Integration of approaches should be the rule (Figure 6).

1. Use/number of ad-hoc frameworks to consider information imperfection: practical needs and usability should not lead to ignoring lack of used methods and knowledge.
2. Data, information and reasoning processes traceability level: clear description of hypothesis, tools, sources of information, methods, knowledge capitalization level etc.
3. Information imperfection quality and sources reliability assessment levels: any decision process should be documented. Any numerical modeling should be associated to uncertainty, sensitivity, robustness analysis.
4. Adaptation level of decision-facilitating methods: references to state-of-the-art existing methods, design and validation process have to be discussed and should integrate a critical analysis. A clear elicitation of decisions contexts is always needed.
5. The ability to assess effectiveness, quality of measures, strategies decisions: risk management decision processes and related decision support systems must include a way to assess their validity and relevance.

6. Interoperability, sharing of information and tools has to bee proven and tested (particularly in a trans-national European perspective).

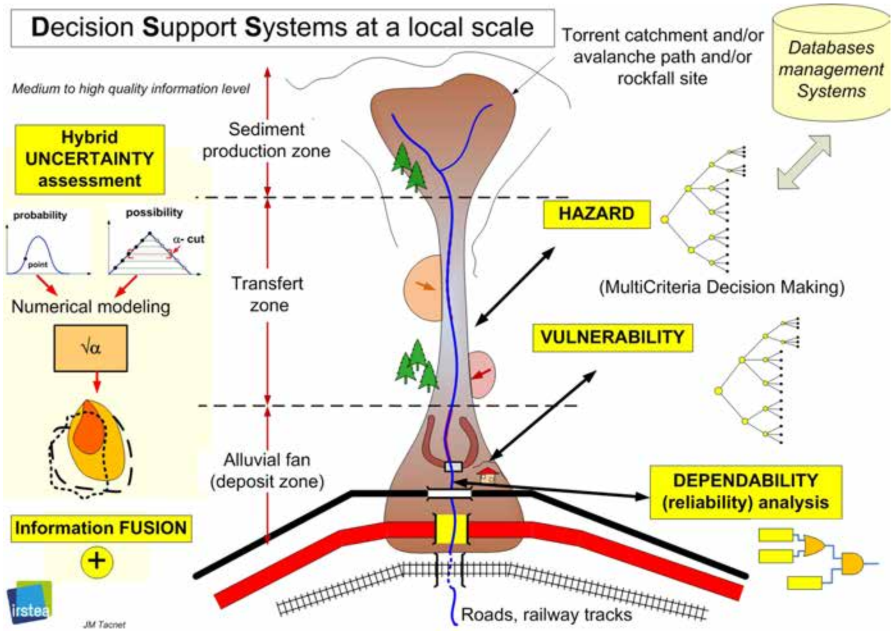

Figure 6: Methods have to be integrated in the risk management process (Tacnet et al., 2014)

(New) developments have recently been proposed and can be (are already) implemented in practice and used as standards (see CSP) but to move from the classic approaches, some needs remain:

1. To assess and propagate information quality (uncertainty) in risk management process;
2. To use decision-aiding methods (e.g. multi purpose, multi-scales decision-contexts identification, comparison, benchmark);
3. To assess risk reduction measures, protection works and strategies effectiveness: safety and reliability-based techniques implementation, introduction/ assessment of resilience concepts;
4. To integrate approaches (technical, economic): move from the classic approaches (physics) to real, multi-scale, integrated decision support systems;
5. To improve and develop information systems developments (e.g. traceability, interoperability (sharing), crowd sourcing).

PROCEDURES (TOOLS) FOR CONSOLIDATION OF KNOWLEDGE AND QUALITY

Consolidation through standardization and harmonization

The most direct and tangible strategy of consolidation of knowledge is by standardization and harmonization. Standardization, on the one hand, describes a framework of agreements to which all relevant parties must adhere to ensure that all processes associated with the creation of a object, technical system, process or service are performed within set guidelines. This is done to ensure the end product has consistent quality, and that any conclusions made are comparable with all other equivalent product in the same class. Harmonization, on the other hand, aims at the creation of consistent regulations, standards and good practices, so that the same rules will apply to as many actors and institutions in one or more countries. The principles of standardization and harmonization apply as well for engineering and technology as for policy and governance.

A *technical standard* is an established norm or requirement in regard to technical systems. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices. A technical standard may be developed privately or unilaterally, for example by a corporation or regulatory body. Standards can also be developed by groups such as expert networks, associations of institutions or working parties. Standards organizations usually develop voluntary standards: these might become mandatory if adopted by a government. *Harmonization*, on the contrary, is usually not comprehensive but is relatively partial and unsystematic. It takes place either on a overarching level of governance or by individual actors and is focussed on specific topics of common interest. The instruments of harmonization aim at change,

Figure 7: Standards in natural hazard engineering and risk management (examples)

in particular improving and establishing consistent conditions for the operation of engineering and policy principles.
There are several manifestations of standards existing. Most existing standards emerge as “de facto” standards as a consequence of an informal convention or dominant usage fostered by the market or traditional techniques or procedures in engineering. In a next step standardization organizations (e.g. ISO, CEN, EOTA) issue voluntary standards, which are published and available for people to consider for use. Governmental organizations transfer voluntary standards with high relevance for public safety and health to “de jure” standards which are part of legally binding contracts, laws or regulations. Standards become mandatory either by being incorporated into a legal act (law, ordinance) or by an act referring to normative document (former voluntary standard). Legally binding standards as a rule are publicly accessible without restriction and free of charge, while some voluntary standards are customary. There are at least four levels of standardization: *compatibility, interchangeability, commonality* and *reference.* The existence of a published standard does not necessarily imply that it is useful or correct. The people who use standards or related services (engineers, trade unions, etc.) or specify it for application (e.g. building codes, governmental ordinances, industry) have the responsibility to consider the available standards, specify the correct one, enforce compliance, and use the item correctly. Furthermore voluntary standards need not be applied if tantamount or better techniques or procedures are applied.

Figure 8:
Flexible rockfall barriers are subject to technical standardization and approval (picture by Rudolf-Miklau)

A basic principle of START_it_up was to make standards publicly accessible free of charge as far as possible or at least transfer standardized knowledge into an applicable form. Thereby it was not the target to establish an additional standardization organization or working party on transnational level; it was rather the goal to fill the abundant gaps which exist in general standardization processes, to satisfy the specific needs and cope with the peculiarities of natural hazard engineering and risk management. START_it_up fosters tailored standardization (harmonization) by a clear 4-“I”-procedure:

1. Identification of knowledge appropriate for standardization and harmonization;
2. Integration in a comprehensive “best practice” in natural hazard management and risk governance and compilation in a knowledge pool;

3. Implementation and trial for usability;
4. Initiation of a formal standardization process.

Explicitly ETC/national project results were gathered, completed, selected and benchmarked, compiled in the web 2.0-database, discussed on expert level in conferences, workshops and a policy dialogue forum, tested for usability in practice and finally disseminated as approved standard or best practice. The dissemination was carried out within an institutionalized expert networks in close cooperation with the observers. If useful the quality label "state-of-the-art" was authorised together with participating authorities or standardization bodies and approved by evaluation and review of an expert panel.

Consolidation through quality assurance in expert decision making processes

The risk management process is a complex decision framework related to different geographical areas (release area, displacement track and deposition zones). It involves multiple actors (e.g. public bodies, technical experts, decision makers, concerned public) during the different temporal steps (crisis management, recovery, prevention and preparation) in the risk cycle (Figure 9). Information is collected and processed during to help and make decisions. Classical corresponding to hazard, vulnerability and risk assessments are often based on technical, physically-based methods. However, needs for integration, information quality or uncertainty assessment and propagation are

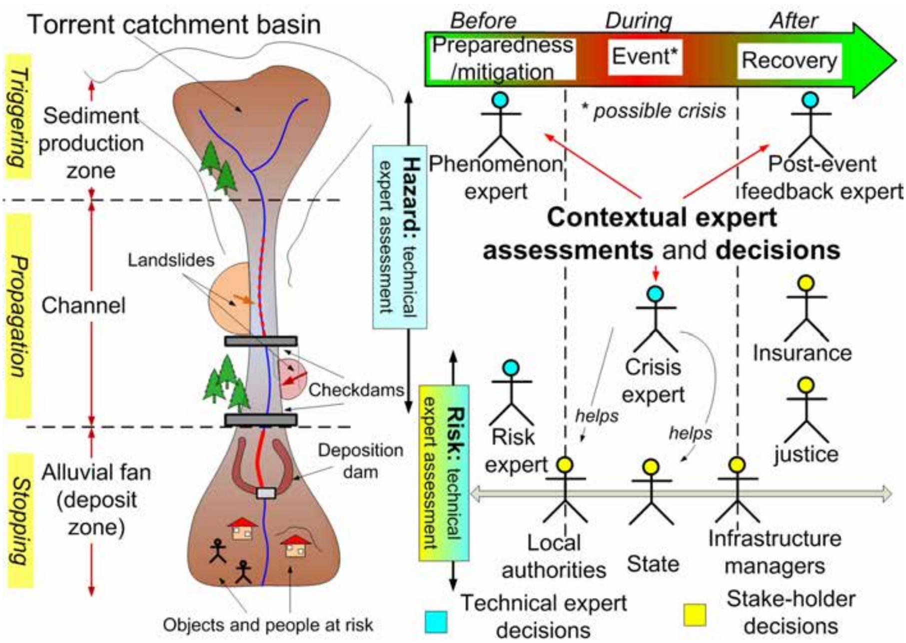

Figure 9: Complexity and context of decisions related to mountain risk management (Tacnet et al., 2014)

recognized. A global information quality management framework in the risk management process is expected and proposed in the START_it_up project (see also InterReg Alpine Space PARAmount project).
Risk managers, local authorities and infrastructure managers face different decision needs corresponding, as an example, to the choices of best combination of these structural and non-structural measures, to the choices of the best maintenance strategy or to chose the most cost-effective protection concept. Decisions often result from a combination of several sources (e.g. expert assessments, eye-witness accounts, numerical modelling, historical databases). However, making those best decisions in the event of a natural hazard in mountain region encounters problems in the assessment and management process because of the lack of information and knowledge on natural phenomena and the heterogeneity and reliability of the information sources available (e.g. historical data, field measurements, and expert assessments). Decisions are therefore often based on imperfect information (uncertain, imprecise, incomplete, conflicting) provided by multiple and heterogeneous sources (e.g. numerical models, expert assessments, Geographic Information Systems (GIS) or historical databases).
The START_it_up project is a capitalization project aiming to identify the "state of the art", which also refers to standard process and expert decision quality (reliability). One major goal was to assist decision-making and to trace the expertise process while considering the availability, quality and reliability of information content and sources. In the START_it_up project, users and decision–makers are the center of the development target. One input of the project is therefore to extend the classical approaches, somewhere hazard-focused, to more decision- and information-based approaches.
Classical approaches are mainly based on physical and deterministic approaches to assess hazard, vulnerability and then risk using expert assessment and numerical model-

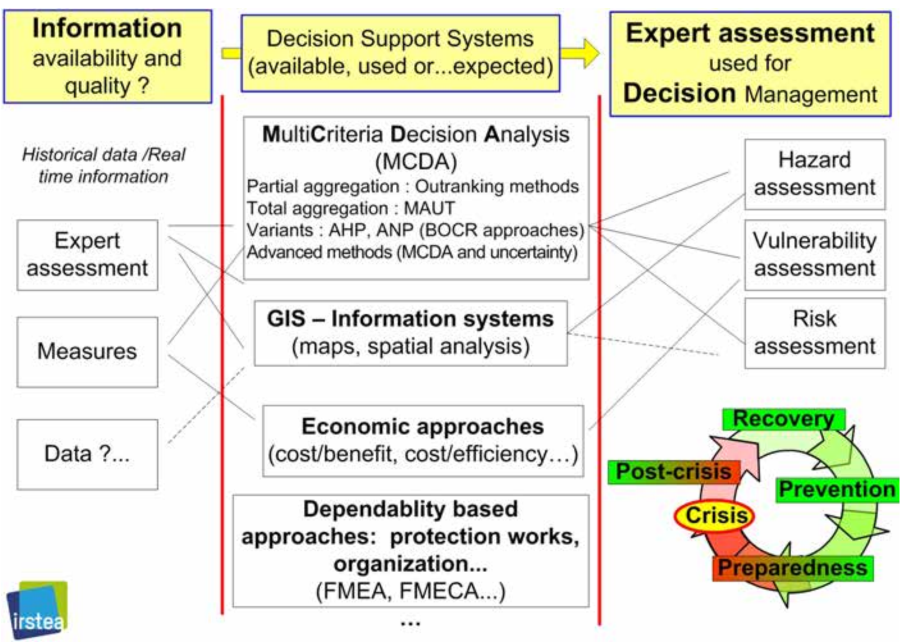

Figure 10: Different tools and methods involved in the information-decision-expertise process (Tacnet, 2014)

ing. However, decision-making is often the expected result of all technical assessment steps. Recent developments and approaches have been proposed to introduce a more decision-based approach and also to consider the information imperfection assessment and propagation in this global process. This requires a realistic analysis of the decision processes and also a review of existing methods to help decision and also to assess information imperfection. The input of START_it_up report are based on recent developments included those related to decision-making processes that should be considered in new developments and guidelines to be developed or adapted. Some of them are already usable in practice with some remaining needs to transfer: that is the reason why this contribution is important and useful in the START_it_up project as much as a state-of-the-art contribution than possible recommendations. It provides an overview of available and needed techniques to improve the risk management process (Figure 10).

Concerning the decision-aiding methods, conclusions of the project START_it_up can be summarized as follows:

- Decision-making methods appear as a valuable complement to classical approaches since they allow to formalize and to trace the reasoning process.
- Decision processes description is essential but not so easy: even if the domains, the physics of phenomena are the same from one country to another, legal, technical, administrative frameworks remain different with consequences on expected standards.
- Integration of knowledge management, information capitalization is crucial (specific information systems are needed). Specific methods can be used to gather bibliographic, technical and scientific information.
- Information traceability (data, models, hypothesis) from raw to processed data (in expert assessment, legal documents such as risk prevention maps) is needed.

Consolidation through transnational assessment and benchmark of methods and procedures

A quality improvement process in Mountain Natural Risk Management (MNRM) has to be consolidated by a bottom up participative assessment reaching all stakeholder's type. It should involve not only high level experts, researchers and politicians but also practitioners and local decision makers to ensure that real needs are effectively identified, that relevant problems are tackled and that adequate propositions are prepared for governments.

The institutional framework for quality improvement in MNRM has already interested organizations at transnational level with the existence of groups of experts in NRM like the PLANALP platform under the Alpine convention, INTERPRAEVENT, FAO, WPMMW, etc. START_it_up activities reinforced tools of INTERPRAEVENT (START_it_up platform and database) in order to facilitate knowledge sharing and networking between international experts.

Those existing transnational structures if they have the aim to play a role in transnational assessment of methods and procedures in MNRM should be first of all reinforced with the participation of officials of all states belongings to the Alpine space which is not the case for the moment (there is a need for an institutionalization process to make transnational assessment possible). As they are already playing a role of reviewers for scientific workshops and publishing of reports, existing experts groups will be there-

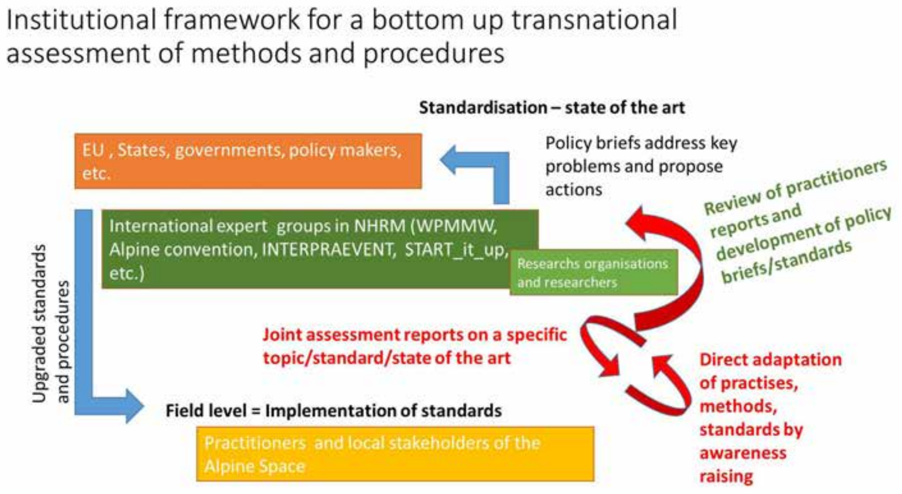

Figure 11: Institutional framework for a bottom up transnational assessment of methods and procedures (by Delvienne)

fore appropriate to review transnational technical assessments. Policy briefs, issued from the review of transnational assessment reports, should be one of the product of international experts groups that contribute to quality improvement and to the establishment of common standards.

Consolidation through solution-oriented knowledge

Throughout the distinct problem solving phases in natural hazard engineering (i.e. diagnosis or system analysis, prognosis or expected system development and synthesis or

Figure 12:
Laboratory models support the solution of complex engineering problems that cannot be solved by traditional methods or even numerical modelling (by die.wildbach)

system design) a solution-oriented knowledge management is required. This entails an integrated and balanced use of knowledge

1. from event documentation or subjective sources (empirical approaches),
2. from the application of numerical models and
3. from the insights gained from scaled laboratory models.

Whereas the state of the art in event documentation is well established for all process types, professionally applied numerical modelling and as well laboratory experiments are, so far, fully reliable only for floods and bed-load transport process characteristics. However, extensive research with a great progress and a potential added value for practical applications has been accomplished in the last decades, both, in numerical and experimental modelling of debris floods and debris flows (e.g. Rosatti and Begnudelli, 2013). For the performance assessment and the design of specific torrential hazard mitigation measures, still more effort is required in order to provide reliable numerical models or modelling approaches which are applicable to situations in practice and thereby fully accepted by the stakeholders.

The illustrated limitations should, however, not discourage the application of numerical models and laboratory experiments, since, conversely, through backward oriented knowledge generation approaches, the interpretable problem spectrum is limited to what past events highlighted and serious difficulties may arise both in quantifying process intensities and frequencies. Moreover the pure backward oriented strategy is practically useless for inferring possible process behaviors outside the occurred range of historical hazard events. This strategy alone is suitable for a complete and verified system design if and only if perfect analogy and comparability with previously solved problems exist.

Reflecting the available approaches within the solution-oriented knowledge generation process, a considerable mutual dependence between the different knowledge sources becomes apparent. Basically, numerical-mathematical simulations as well as laboratory experiments require the availability of data from field surveys and historical event documentations for an adequate parameter setting and for the models calibration and validation. Furthermore, regarding the zone of influence and the impact area of specific torrential hazard mitigation measures, numerical models are often applied to a larger extent. They provide process input data for the laboratory experiment (Figure 12), which is specifically focusing on the mitigation structure within a rather small area. They also allow for an assessment of the mitigation measure on a considerably larger scale. Accordingly, with the intention of a comprehensive solution-oriented knowledge management, the consideration of all approaches and their interrelationships appears mandatory.

Consolidation through decision support by approved methodology and tools

The natural hazards risk management improvement involves the consolidation of decisions based on approved methodologies and tools. Even more, in this time of economic hardship, the solution of the problems related to the management of natural hazards through the implementation of defense structures (e.g. artificial avalanche release systems, Figure 13: GazEx) appear anachronistic and inappropriate. Often, in fact, the creation of these structures, costly in economic terms, solve specific problems linked to very specific cases. Moreover, these works require, in the following years,

Figure 13: The effectiveness of new technology in risk management (here: GAZ-EX © avalanche release system) requires reliable and approved methodology for support of decisions by responsible experts

major interventions for maintenance and to ensure their effectiveness and efficiency. Vice versa, the implementation of consolidated methodologies and tools allows to extend the solution of the problem to wider geographical areas that are not related to a specific problem or territory, but which may extend to all natural hazards risk even beyond national borders. All of this involves a lower economic resources expenditure with the advantage of extending the benefit to a greater number of end users.
Of course, the tools and methodologies, to be effective and to meet the real needs of land management, have to pass through an attentive validation phase, which can require years of testing and controls. This validation phase consists of surveys and tests on experimental sites, but also on the real sites where to apply the methods, to identify their strengths and weaknesses and try to extend the methodology to wider regional contexts. Even in this case, as in the design of engineering structures, still more effort is required in order to provide common natural risk management methodologies, through the development of reliable numerical models or modeling approaches which are applicable to situations in practice. In addition, the management implications arising from the methodologies application should be fully accepted by the stakeholders. These land management methodologies and tools in relation to natural hazards, more often, are closely linked to innovative technologies that, over the years, with the improvement of technology, can make evolve them, hand in hand, without changing their functionality and, especially, with a limited cost. These innovative technologies, very often, concern the communication of information to the citizen. This means, therefore, that the land management methodology is more accessible to the citizen, making it more conscious and involving them in decision-making processes that often seem imposed from above.

Example of the methodology applied to land management within the project Start_it_up is the development of web platform to support decision-making for the CLV. A tool that required a small cost, but that allows you to optimize the management of avalanche risk on an entire region.

Consolidation through good governance

Good governance in sense of risk governance incorporates criteria as accountability, participation and transparency within all procedures by which risk-related decisions have to be made. Participation means that the specific public should get involved already on an early stage of risk management. The interest in participation depends on the degree of affection and hence mainly proper information coming from authorities is needed. On the other hand participation of stakeholders is an advantage for decision makers and risk managers because valuable information can be gained. Nevertheless participation can be offered in several ways but should be adapted to the needs and the number of possible stakeholders.

Transparency in risk management also means to make information on natural hazards publicly accessible. Possible affected persons should at least have the chance to reach information – nowadays digitally. As information on hazards is often too specific additional attributes and "how to be used" information has to be added. For example, hazard profiles, which have been elaborated in the previous AdaptAlp project (incorporating all typical alpine natural hazards), were revised concerning layout and usability within START_it_up. With that potential users have the possibility to see their own affection by natural hazards at a glance.

Stakeholder involvement is preferably achieved by public workshops, discussion forums and negotiation processes taking into account a non-homogeneous level of information (risk perception), conflicting expectations and various willingness to compromise. Furthermore these processes bring face to face expert and laypeople views, public

Figure 14a: Involvement of stakeholders during the "flood-day" in Klagenfurt (Austria)

Figure 14b: Involvement of stakeholders during the elaboration of the flood operation map in Hermagor (Austria)

and private interests as well as economic, ecologic and social perspectives. A good example is the integrated flood risk management.
As within the elaboration of the EU-flood directive several public bodies are affected it seemed to be useful to involve stakeholders already on an early stage by informing them on:

- how and how much they are affected,
- which steps are needed concerning their involvement,
- which possible gaps in their own risk management could be found
- and how possible measures to fill gaps could look like.

Although the risk cycle shows all necessary measures of integrated risk management at a glance in practice several steps are processed by different units. Hence there is a need to fill these gaps by further intensive communication. Generally on municipal level hazard maps are mainly used as the basis for structural protection measures and spatial planning (passive protection). As hazard maps show potential threats of natural hazards they already include indications for possible disaster control measures. But to define possible intervention measures for stakeholders from disaster control stakeholders already need to be involved in the process of definition.
Even if the involvement of stakeholders seems to be a logical step, in practice participation takes additional resources, work and time. But there is a huge advantage concerning results after stakeholder participation: under professional guidance problems, chances and solutions can be highlighted from different point of views.

SELECTED PRODUCTS AND OUTPUTS OF START_IT_UP

Preface

START_it_up was designed as a capitalization project aiming at the refinement and dissemination of knowledge and innovation from preceding ETC-, transnational and national R&D projects. Products and outputs of the project partners aim to meet the requirements of

1. contributing to a common state of the art,
2. support and improve expert decision quality,
3. representing solution- and application-oriented knowledge and technology,
4. being approved by testing, validating, formal certification and recurrent application, and
5. being commonly accepted as good governance or good practice.

The following examples demonstrate the added value of the capitalization process performed in START_it_up for safe and efficient solutions in natural hazard engineering as well as sustainable strategies and procedures in risk management and governance. The paramount importance of standardization as a principle and mean to consolidate and disseminate knowledge gets comprehensible. (The examples shown in the CSP were selected as representative actions, further projects of START_it_up are presented in the Final Booklet, published digitally.)

Example 1: State of the Art for monitoring and warning technology for debris flows

Monitoring can be defined as »the systematic repetition of observations of a particular object or area«. For debris flows (DF), different monitoring parameters can be selected, generally grouped into triggering parameters, such as precipitation rates and/or intensities, and process parameters (transport/dynamics parameters), such as direct ones (head height, flow depth, head/flow velocities, impact and shear forces) respectively indirect ones (ground motion/seismic waves, air motion/air waves/acoustic emission). Different measuring devices are applied for each parameter: for precipitation different types of rain gauges (standard, tipping bucket, weighing, optical, acoustical) and distrometers; for transport/dynamic parameters different types of laser (optical) sensors, high speed video cameras, acoustic (ultrasound) Doppler radars, vibration sensors (geophones), (differential) pressure transducers etc., or simple wire sensors and light sensors across a DF channel at selected elevations. All continuous/discrete monitoring data must be recorded by such sensors and then transmitted and stored/archived in a database (digital archive); a secure energy supply of the monitoring system is also important. For a successful DF monitoring system, a well-tuned/integrated/validated system of individual components (sensors, data loggers, control units, communication units, energy, and storage devices) is essential.
Early warning system (EWS) was defined within the EU 7th FP SAFELAND as »The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss«. The UN-ISDR defines 5 key elements of the human-centered EWS: a) knowledge of the DF risk; b) monitoring, analysis, and forecasting of DF hazards;

c) operational centers; d) communication or dissemination of alerts and warnings; e) local capabilities to respond to the warnings received. The EWS are usually based on DF hazard maps (hazard zones within the maximum run-out zone), meteorological forecasts (rainfall forecasts, rain radars), and monitoring data from hazard areas, issuing DF pre-trigger warnings (using different empirical thresholds) or post-trigger warnings (event triggered warnings). The EWS is normally associated by evacuation plans/guidelines and/or safe sheltering, including instructions for closure of transportation routes, and must therefore run in real time, allowing large enough lead time for preventive actions.

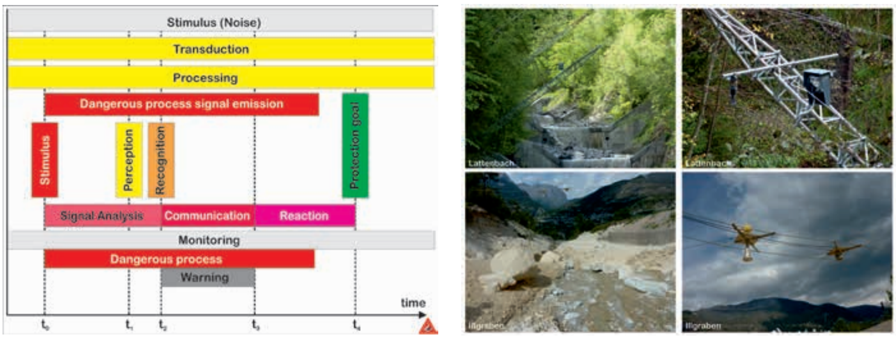

Figure 15: System of debris flow monitoring and warning technology, examples (Hübl & Mikoš, 2014)

Example 2: State of the Art in protection work effectiveness assessment in European Alpine Regions

According to this global context, this study was focused on decision-making related to protection works effectiveness assessment methods. It describes particularly multi-criteria decision making methods and methodology, safety/reliability and dependability analysis based methods and also economic approaches. The developments described below consist in

1. the analysis of existing methods to assess economic effectiveness, and
2. an application example of multi-criteria decision-making method: the chosen decision context relates to consideration of protection works into land-use planning regulation rules.

All over European mountainous regions, protection systems against natural risks have been set up to reduce natural risks for more than 120 years. For instance, in France, more than 19,000 works have been built in French public forests since the end of the 19th century. Different types and scales of protection systems exist ranging from isolated (protection) work, such as dams, snow-nets or barriers, to group of works (so-called device). Analyzing and comparing their effectiveness to reduce risk with their cost (investment and maintenance) is a key question in the risk management process.
For isolated and device scales, the effectiveness assessment is mainly technical: how far do civil engineering structure resist to the defined constraints? How far do they fulfill their planned functions? Assessment is generally based on expert knowledge and indicators can be different from one country to another. Comparing indicators and using dependability analysis improves these technical assessment. At the watershed scale, protection systems aim to reduce the risk. Their effectiveness is directly related to their

effect on risk reduction introducing economic questions. At this scale, the main questions are: what is the baseline risk, without protection? What is the effect of protection on risk? Defining a common risk definition and analysis method between European countries is possible but need to be compared with implementation. To analyze the effect of protection works, the combination of expert knowledge and numerical or analytical modeling is usually used. Methods (including their limits) and applications in different countries are compared. Taking decisions needs knowing risk reduction impact and costs of each strategy to compare them at each system scale. The Cost-Benefit Analysis (CBA) is the most used method. It is based on a monetary valuation of costs and risk considered as an expected value of damage. Other decision-aid methods exist: the MCDA-methods can integrate non monetary cost and damage. Considering physical effectiveness and related effect of protection systems is still needed. Integrating structural and functional analysis of protection systems is essential to estimate their effect. For each phenomenon and system, common indicators have still to be defined (including their imperfection representation).

Following a continuous improvement process, land-use planning rules updates are under consideration. In the framework of the project, the contribution consists in a methodological contribution to decision-maker's needs (e.g. MEDDE). The question under consideration are: how to consider (or not to) protection works in risk prevention plans (PPR)? The principle is not to provide a new regulation rule but to show how technical inputs related to decision-making methods, safety and reliability analysis can contribute to such a decision process, introducing and using new approaches and methods which are candidate to become future standards. The inputs of the methodology is to identify needs and practices, terminology and glossary, to formalize expert knowledge and to propose a practical implementation of multi-criteria decision making method. Different multi-criteria decision-making methods exist but this application shows that those techniques have a valuable added-value to help decisions. Using the proposed framework is a way to trace and improve the decisions processes.

The outputs of this action in the START_it_up project are described below

1. a state-of-the-art in France to value costs and benefits of flood management strategies in France with a critical view on their drawbacks and applicability in the context of mountain torrent floods,
2. the proposition of a global framework to analyze the different features of protection works effectiveness including structural, functional and economic approaches (Figure 16),
3. the introduction of the use of decision-making methods to assess the indicators related to protection works effectiveness, and
4. the application and use of decision-making method and safety/reliability/dependability analysis concepts to land-use regulation guidelines update (consideration of protection works in risk zoning application).

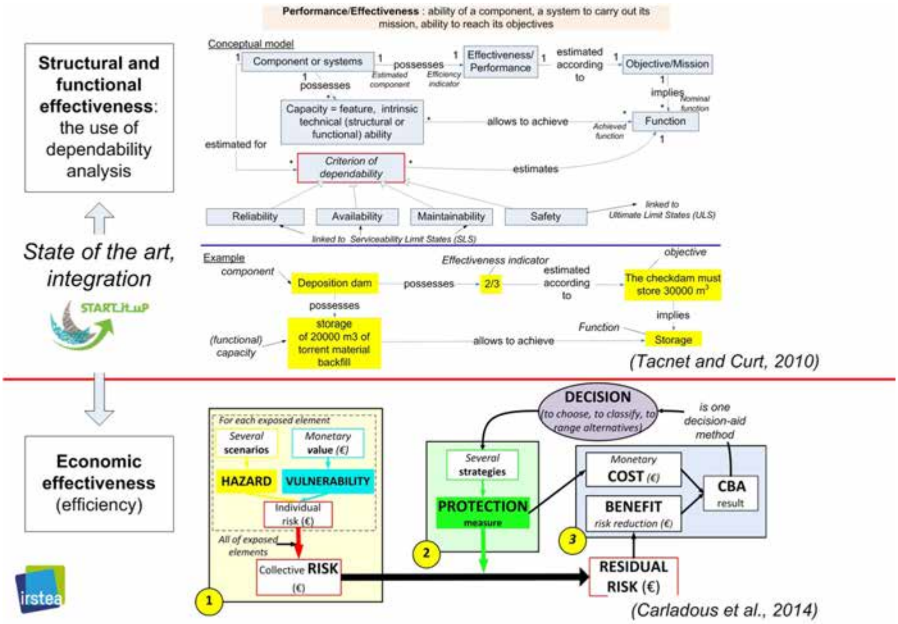

Figure 16: Structural, functional and economic features of protection works effectiveness

Example 3: Vulnerability of strategic infrastructure

With respect to the vulnerability of strategic infrastructure recent research prevailingly explored graph-theoretic methods as means of both representation and assessment. In the field of natural hazard risk management, however, limited research efforts has been devoted to a thorough understanding of the vulnerability of strategic infrastruc-

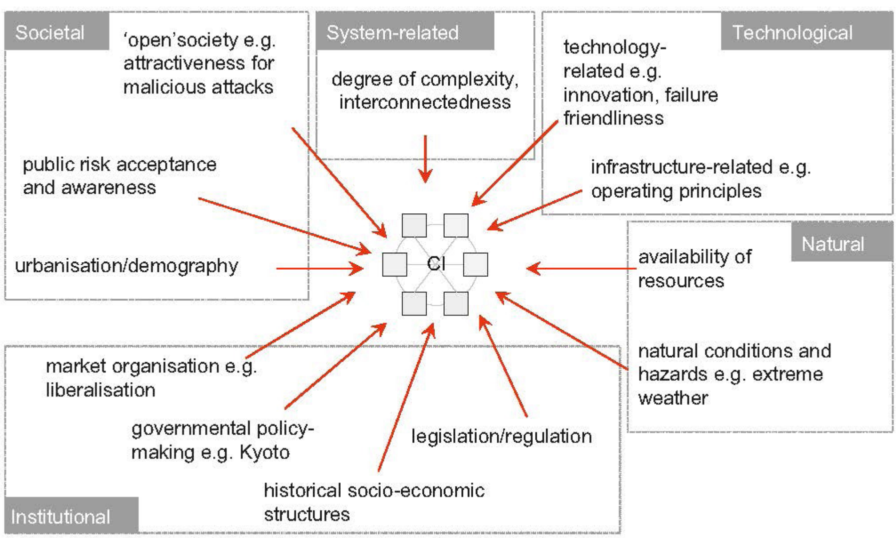

Figure 17: Factors shaping the risks faced by critical infrastructures (Kröger 2008)

 ture. Gaps exists in relation to data availability (in relation to quality, quantity, coverage and level of aggregation) for a complete and spatially reliable representation of the networks under consideration. As a consequence the representation of such networks is approximate and incomplete and external key variables are often neglected. In spite of these limitations network-based methods in combination with spatial and temporal assessment approaches seem to be appropriated to represent vulnerability of strategic infrastructure and capture its complexity.
As an examples of the usefulness and importance of a geo-spatially integrated approach one may consider the occurrence of a natural disaster, where a controlling authority (e.g. state government, private utility) may want to divert a node's power to serve only the areas with the greatest amount of people and the most critical infrastructure, such as hospitals, fire departments, and shelters. In this case, the controlling authority may choose to shut down substations that serve fewer people and divert that power to a node with larger concentrations of critical infrastructure and population.
Kröger (2008) identified several factors that can shape the vulnerability to critical infrastructure. These factors are categorized by: societal, system-related, technological, natural, and institutional. Societal factors include attractiveness for attack (exposure for natural hazard contexts), public risk awareness, and demographics. System-related factors include the complexity and inter-connectedness of the network. Technological factors include failure friendliness (propensity) and infrastructure related operating principles. Natural factors include availability of resources and natural hazards. Finally, institutional factors include historic structures, legislation, and market organization (Figure 17).

Example 4: CLV Platform for Avalanche Warning Service

The management of local avalanche hazard has always been one of the vital aspects in mountain areas. Besides being a job of great social commitment, it entails a deep knowledge of local territory and avalanche dynamics, snowpack formation and micro-Alpine meteorology. For this reason, with the innovative regional law n. 29/2010, the Aosta Valley (IT) has regulated the Avalanche Local Commissions (CLV), set up to support the local authorities in managing avalanche hazard.

- CLV are engaged in forecasting and monitoring of snow and weather conditions;
- evaluation of the snow cover stability;
- early warning, emergency management and intervention in case of avalanche hazard.

The 3.260 km^2 of Aosta Valley Alpine region (with total area exposed to avalanche hazard) has been subdivided into 17 zones (by grouping all 74 municipalities) in the urbanized territory, each under the supervision of one CLV.
To facilitate the management of local avalanche situations with uniform criteria and methodologies, thanks to the Alpine Space project Start_it_up, in collaboration with CELVA-Consortium of Local Authorities of Aosta Valley, the Region of Aosta Valley is starting the implementation of a platform for the visualization and data storage about snow, weather and avalanches as well as the verbalization of actions performed and suggested by CLV in avalanche emergency.
Based on the experience of Austrian colleagues, the platform is developing through open source tools and frameworks to reduce the cost of software managing and the hardware architecture will support plug-ins to facilitate future new deployments (Segor et al., 2014).

Figure 18: The new platform supports and documents the decisions of local avalanche commissions (CLV)

Example 5: Best-practice guidelines for the implementation of forest protection function in the NHRM of shallow landslides

Shallow landslides represent a relevant process in the alpine regions and are related to different types of risks. The demand for common standards in this field is strongly requested in order to support the better quality and reliability of expert decisions and public administrations. The project START_it_up has offered the possibility to contribute to the international knowledge exchange on the analysis and quantification of shallow landslides in the context of "resource efficiency and ecosystem management".
Within the context of the standardization of natural hazard engineering and risk management, the study provides an overview on the "state-of-the-art" for best practice methods and to promote a knowledge exchange on the characterization and quantification of shallow landslide processes in the alpine region. A review was carried out in four thematic sections that summarizes the information of seven alpine countries:

1. Event analysis,
2. Mapping and modeling,
3. Slope instabilities in torrent processes, and
4. Implementation of protection forests in shallow landslide hazard analysis.

In the presented review we describe the state-of-the-art of these four major topics related to the assessment of shallow landslide hazards in the alpine countries. We pointed out the efforts that have been made in the past decades to set up databases on event analyses in different levels of detail, and how this information has yet to be implemented in the hazard assessment. We identified major improvement potential in the detailed description of events (e.g., more information about vegetation cover) and in the application of remote sensing analyses. We showed that there is wide heterogeneity regarding the state-of-the-art of shallow landslide hazard analyses and mapping across the alpine regions. In some countries, shallow landslides hazard analyses are supported by detailed thematic information (geology maps, soil maps, digital elevation models, etc.) and results of numerical models (e.g., some hazards maps in CH), whereas in other countries shallow landslides are not even considered in hazard mapping. In a wider context, there is the general agreement that shallow landslides are also important processes for hazard analyses at catchment scale, in relation to debris flows or flood hazards. Therefore, a better quantification of the interaction between shallow landslides and torrential processes should be strived for in future. In particular, the lack of quantitative tools for the assessment of such processes at practical level needs to be improved, possibly by the further adaptation/development of existing research results (Mazzorana, 2014). Finally, we discussed that although the protection effect of forests against shallow landslides is recognized in all alpine countries (from a cultural and legislative point of view), the lack of quantitative methods is causing difficulties in the consideration of the effect in hazard/risk analyses. For this issue, further research is needed in order to provide more solid knowledge for practical application.

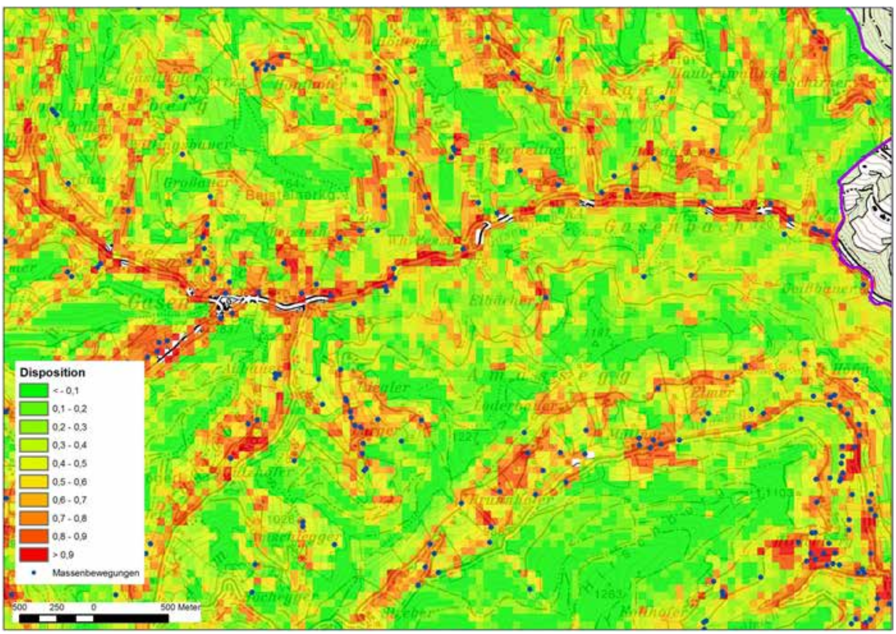

Figure 19: Modelling the disposition for shallow landslides in the area of Gasen and Haslau (Styria), based on documented events of the catastrophes in 2005 (© Geological Survey of Austria)

Figure 20: Risk Policy Dialog in Hinterstoder (Austria): A new format for expert think-tank in risk governance

Example 6: Risk Policy Dialogue

Risk communication is an emerging topic which involves stakeholders from various disciplines and levels. There are various exchange forums in the context of natural hazard and risk management and in synergy to these the aim of the Risk Policy Dialogue was to create a new format for the interdisciplinary discussion and development of policy briefs in natural hazard risk management in the Alpine Space. This think-tank enabled a divers group of experts to discuss the topic of natural hazard risk management controversially, aside from daily business in a confidential atmosphere, which was ensured by introducing the so-called "Chatham House Rules" at the beginning of the event. The specific topic of the Risk Policy Dialogue 2014 was: "Risk communication on local level: Avoidance of conflict escalations within the evaluation of risks".

After a brief introduction the two-day event started with an excursion to a concrete example of conflict potential. In the next step this example was abstracted by a penal discussion and a very polarizing keynote presentation. Therefore the aim of the first day was to listen and discuss on conflict potentials and problems, however not giving any solutions. In contrary to the second day, which was a very active day for all participants. The program involved different discussion rounds and presentations of the subsequent results on potential solutions to the areas of conflicts that were collected on the first day. The different sequences were structured in a way that the broad picture was condensed and cumulated in a concise draft of policy briefs. After the event this common position was structured and a document was drafted before reconsulting the participants for their agreement.

Overall the event itself but also the format was appreciated by the participants which is also mirrored in the active participation and the profound results of the first Risk Policy Dialogue.

Example 7: Risk Technology Database and Network

One of the core products for capitalization within START_it_up was the launching of a knowledge platform and database for the provision of standards and documents regarding specific fields of natural hazard engineering and risk management. The concept of the database is either to provide and promote the results of START_it_up but also to collect available and approved good practice methods (provided by partners on a voluntary basis), standards and norms and make this information accessible. To have a quick overview for users about the status and applicability of these documents, all of them have to go though a system of classification and evaluation carried out by an expert panel. This expert panel reviews the uploaded documents according to certain criteria like the scope of application, bindingness and target groups. The documents themselves or the referring links will be published clustered in thematic fields on the publicly accessible part of the database.

It is important to notice that Start_it_up can only motivate partners to participate in this knowledge transfer, as intellectual property (copy rights) and liability for correct and safe application of methods have to be respected. On the other hand most of the innovations were financed by public funds and should therefore be public interest.

With the Natural Risk Technology Database START_it_up on the one hand gives institutions, researchers and experts the platform to present their good practice methods, norms and standards (on their own interest) and have them evaluated, and provides on the other hand a tool for practitioners and decision makers to easily find available documents and methods in the certain disciplines together with information about status and applicability.

To ensure the maintenance and it's currentness the database will be established within the framework of the INTERPRAEVENT website and is online with a constantly growing user community since April 2014.

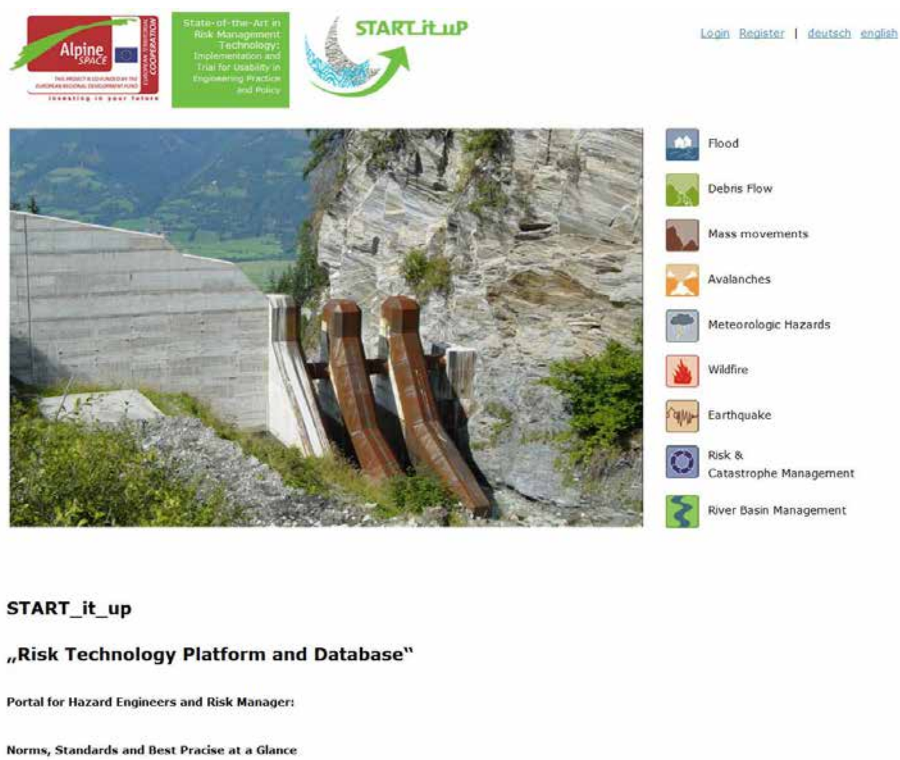

Figure 21: Risk Technology Platform and Database: www.interpraevent.at/start_it_up

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STRATEGIC RECOMMENDATIONS AND POLICY BRIEFS

START_it_up was designed as a capitalization project and therefore emphasizes existing in natural hazard engineering, policy briefs for risk governance and general recommendations for risk management at the European scale. The following recommendations and policy briefs shall be integrated in the strategies for societal and regional adaptation in the Alpine Space as well as in the goals and funding principles of the Alpine Space Programme 2014–2020.

Standardization and Transfer of Knowledge

Available knowledge and technology in natural hazard engineering shall be compiled and provided in standards and norms (de jure or voluntary), that are commonly approved and publicly accessible.
Relevant knowledge shall be provided in comprehensive, coherent and applicable form to political or administrative decision makers, preferably as standardized policy briefs.
Standardized knowledge shall be accessible for educational purposes (academic, professional education, in-job training) in form of courses, handbooks, best practice recommendations and through the internet. Knowledge transfer shall be based on commonly agreed definitions and terminology (also multilingual).

Expert Decision Support and Quality Assurance

Decision support methodology shall be established as standard (mandatory) procedure in all fields of risk management and governance.
Expert and policy decisions in risk management shall be based on the traceability of expertise (decision) processes and the reliability of decision-making basis.
Decision processes in risk management shall be defined and standardized concerning the decision steps, the tools and methodology and the quality assurance of data and information used.

Information Technology

Information on natural hazards and risks shall be publicly provided through the internet to the largest possible extent and comprehensible for all target groups. Information provision in a standardized form shall be a public task, while the use and application of this information shall be an obligation and responsibility of the user.
The classical data acquisition methods related to natural hazard process shall be enhanced to a standardized transformation of data into applicable information, adapted to the requirements of the target group and concerned public.
Information databases (e.g. CLV avalanche warning commission, Risk Technology Platform) shall be further developed and enhanced by implementing new functions and tools (e.g. statistical analysis, scenario assessment, sophisticated search functions), furthermore a transnational use shall be reached by multilingual (GE, FR, IT, EN, SLO) content.

Risk Assessment and Documentation

Standardized procedures (tools) for documentation and acquisition of information on hazard events (especially mass-movements) shall be established; furthermore uniform nationwide storage of event date in central databases shall be brought into use.
A commonly approved benchmark framework on process simulation and application of process models shall be established in the Alpine countries aiming at comparable data quality, scenarios and assessment of model results.
A standardized method for assessment of damages (caused by catastrophes) including the economic valuation shall be harmonized and implemented by Alpine countries.

Hazard Mapping and Consideration in Development Planning

Common minimum (formal) standards for the public presentation of hazards and risk, furthermore for the application and consideration of hazard and risk maps in areal planning and regional development shall be harmonized among Alpine countries.

Hazard and risk scenarios and the related assessment process shall be further developed taking into account climate change. A common understanding of scenarios in a coherent form shall be established in an interdisciplinary form across sectors and target groups.
The legal and formal basis for the consideration of hazard maps (for all kind of natural hazard) in areal planning and regional development shall be harmonized among Alpine countries, following the example of the integrated approach of the European Flood Directive.

Protection Systems and Engineering Solutions

Comprehensive protection systems shall integrate structural and non-structural measures in the most efficient combination.
The priority of protection measures shall be assessed on risk-based economic criteria.
Protection forests shall be treated as green protective infrastructure in European (Alpine Space) environmental policy and funding principles. The prerequisite are harmonized standards for protection for protection forest mapping and condition assessment.

Early Warning and Organizational Measures

Standardized procedures in early waning and alert, including recurrent testing and training, shall increase the public trust in warning systems and reduce the risk of false alarm.
Efforts shall be taken to develop a real-time early warning system for landslides, facilitating a regional prognosis of risk due to meteorological, hydrological and geotechnical criteria.
Comprehensible threshold values for warning system shall be defined and communicated. Changes of these threshold shall be traceable and justified.

Good Governance and Stakeholder Involvement

A new think tank format for the discourse and exchange of experts, opinion leaders and decision makers shall be established as a recurrent event, such as the START_it_up Risk Policy Forum, allowing unbiased discussion and confidentiality in order to issue objective policy briefs.
New procedures and types of events shall be created and implemented in order to actively involve stakeholders and attract decision makers.
Good risk governance shall foster the resilience of society in the Alpine Space and aid to the reduction of vulnerability along the entire risk cycle.

Further Development and Research

A transnational network for the exchange of knowledge and technology, especially in the field of natural hazard engineering shall be established and further expanded integrating existing institutions like INTERPRAEVENT, PLANALP, IUFRO and FAO.
Connectional methods of decision making shall be subject to further research focused at the application for the solution of complex engineering problems.

START_IT_UP LINKS

Start_it_up Website
http://www.startit-up.eu/

Start_it_up Risk Technology Platform and Database
http://www.interpraevent.at/start_it_up/

Start_it_up Database for Rock Fall Embankments
http://www.interpraevent.at/rockfall/

CLV Web-Platform for Avalanche Warning Service
http://piattaformaclv.regione.vda.it/

Partner Institutions:

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH	**Leadpartner:** **Federal Ministry of Agriculture, Forestry, Environment and Water Management, Dep. III/5 - Torrent and Avalanche Control Service** • Marxergasse 2, 1030 Vienna, Austria **Florian Rudolf-Miklau** • T: +43 1 71100 7338 • F: +43 1 71100 7399 • florian.rudolf-miklau@bmlfuw.gv.at National Authority, public
	Autonomous Province of Bolzano - South Tyrol, Department of Hydraulic Engineering • Ripartizione 30, Via Cesare Battisti 23 • 39100 Bolzano, Italy **Bruno Mazzorana** • T: +39 0471 414567 • F: +39 0471 0414599 • Bruno.Mazzorana@provincia.bz.it Regional authority, public
ONF International	**ONF International** • 2, avenue de Saint-Mandé • 75570 PARIS Cedex 12, France **Quentin Delvienne** • T: +33 4 9253 1971 • F: +33 4 953 1987 • quentin.delvienne@onfinternational.org Consulting company, public ownership
GeoZS	**Geological Survey of Slovenia** • Dimičeva ulica 14, p.p. 2552 • 1001 Ljubljana, Slovenia **Mitja Janža** • T: +386 1 2809 822 • F: +386 12 809 753 • mitja.janza@geo-zs.si Technological and scientific research center, public
irstea	**Irstea, Grenoble regional center, Snow avalanche engineering and torrent control research unit** • 1 rue Pierre-Gilles de Gennes, CS 10030 • 92761 Antony, France **Jean-Marc Tacnet** • T: +33 4 7676 2768 • F: +33 1 4096 6145 • jean-marc.tacnet@irstea.fr Technological and scientific research center, public
LAND KÄRNTEN	**Regional Government of Carinthia, Department 8 - Environment, Water and Nature Protection** • Flatschacher Straße 70 • 9020 Klagenfurt am Wörthersee, Austria **Norbert Sereinig** • T: +43 50536 18331 • F: +43 50536 18300 • norbert.sereinig@ktn.gv.at Regional Authority, public
Région Autonome Vallée d'Aoste Regione Autonoma Valle d'Aosta	**Autonomous Region of Valle d'Aosta: Department of Public Works, Soil Conservation and Public Housing** • Directorate for Hydrogeological conditions of the mountain basins • Loc. Amérique, 33 • 11020 QUART, Italy **Valerio Segor** • T: +39 0165 776604 H382 • F: +39 0165 776827 • v.segor@regione.vda.it Regional Authority, public
Berner Fachhochschule	**Berne University for Applied Sciences - School of Agricultural, Forest and Food Sciences** • Länggasse 85 • 3052 Zollikofen, Switzerland **Massimiliano Schwarz** • T: +41 31 910 2179 • massimiliano.schwarz@bfh.ch University/Institute of applied science, public

Figure 22: Members of START_it_up partnership (Kick-off Conference in Ljubjana/Slovenia)

OBSERVER INSTITUTIONS:

AUSTRIA (AT):

- Austrian Standards Institute (ASI)
- Geological Survey of Austria (GBA)
- Austrian Federal Railways (ÖBB)

FRANCE (FR):

- French Ministry of Ministry of Ecology, Sustainable Development and Energy

SLOVENIA (SLO):

- Association of Municipalities and Towns of Slovenia (SOS)
- Administration of Republic of Slovenia for Civil Protection and Disaster Relief (URSZR)
- Slovenian Railways (SZI)
- Slovenian Road Agency (SZR)

GERMANY (GER):

- Bavarian Environment Agency (LfU)
- Working Group on Natural Hazards/Natural Risks – German Association for Geography (DGfG)

ITALY (IT):

- Servizio Bacini montani – Provincia Autonoma di Trento (SBM)

SWITZERLAND (CH):

- Swiss Federal Institute for Forest, Snow and Landscape Research (WSL)

International:

- INTERPRAEVENT (IP)
- PLANALP_Alpine Convention

START_it_up, transnational initiative for common quality standards in natural risk management, was started in September 2013 as a so-called capitalization project within the Alpine Space Programme and therefore co-funded by the European Regional Development Fund. 8 partner institutions of 5 Alpine countries are facing the challenge to promote a common "state-of-the-art" in the fields of natural hazard engineering and risk governance on international level. This booklet contains principles, procedures and recommendations for knowledge consolidation, quality assurance and standardization in natural hazard management and risk governance. Furthermore the reader will find information about activities of the START_it_up partner consortium.

www.startit-up.eu

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

ONF International

GeoZS

irstea

LAND KÄRNTEN

Région Autonome Vallée d'Aoste
Regione Autonoma Valle d'Aosta

Berner Fachhochschule