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The cultures of landslide risk management in Europe and India

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Five scoping studies of the policy issues, political culture and stakeholder views

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Deliverable 5.5

Five scoping studies of the policy issues, political culture and stakeholder views

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Summary

Until recently, the application of engineering and technical solutions has been the dominant strategy for mitigating landslide risk. In this report we argue for the importance of a more integrated and contextual approach to landslide risk management that can offer insights into the ways in which pathways for risk management are chosen and pursued through perspectives from social science and science studies, notably ideas about coproduction, social learning, governance and change. Specifically, we study how different political, scientific and cultural contexts influence the character and application of risk mitigation policies, and the drivers of change in different paradigms of landslide risk management across Europe and Asia through a comparative study of the situation in Italy, France, Romania, India and Norway.

The analysis is based on a desk study of national legislation and administrative structures of landslide risk management in the selected countries, as well as semi-structured interviews with legislators, scientists, planners and other risk managers in order to investigate and understand the role of legislation and science in policy processes. In addition, case-studies in Norway (Aaknes), Italy (Campania) and India (Nainital) include in-depth interviews with key stakeholders representing at risk groups to study more closely the relationship between science and community based risk management. The five countries chosen for this study are recognized as being severely susceptible to landslides and represent interesting and contrasting hotspots from both the developed and developing world.

The study demonstrates how landslide risk management and development has to a great extent emerged as a responsive rather than proactive set of actions. Individual pathways of scientific research and policy development have emerged out of dynamics of specific social, political and scientific histories in each country context which frame local as well as national risk solutions. These situational contexts are important in understanding the triggers and mediating influences that affect the transformation of policy priorities for landslide risk management. Especially so where existing risk management policies and approaches are manifestly demonstrated to have failed through disaster events and when this has resulted in the search for institutionalisation and implementation of alternative approaches. Although it is possible to observe a certain correlation between the

incidence of national and international disasters, and progress and shifts in landslide risk management, it is critical to remember that disasters are situated in social and policy contexts and that their impacts or proposed technical scientific solutions cannot be viewed in dichotomous isolation from the public sphere. Disasters can catalyse moments of change in risk management aims, policy and practice, but these are embedded in ongoing trajectories and socio-technological and political positions and relationships.

Whether linear or coproduced, science to policy communication appears at the heart of effective landslide risk management. There are many points at which policy and science connect, from a myriad of individual personal interactions to expert statements in litigation and formal advice to decision-makers at local and national levels. In order to provide research focus, and also because of its central and ubiquitous role, risk mapping– the production, access and utility of risk maps – was used as a window into this relationship. This in no way provides a complete analysis of the dynamics of science-policy exchange, but is nonetheless an important and demonstrative element in the conversation between the two realms.

Variations in the role of science and scientists, governance structures and interest groups, legislation, availability of economic and political instruments, social learning, facilitation of communication and trust, media intervention, access to information, and external pressures and shocks were some of the issues identified by this report that impact the cognition and management of risk practice in a society. Extracted from the five empirical case studies, these components offer a starting point in the development of a more comprehensive catalogue of socio-scientific dynamics that have the power to inform, transform and negotiate the production and management of landslide risk systems.

1. Introduction

In 2010 we witnessed several serious floods and landslides associated with extreme weather events, deforestation, construction work and inappropriate development in high risk areas. In June, July and August the rain was pouring down in North-western China. The continuous rain caused flooding and landslides in many provinces and affected 200 million people. At midnight on August 8, the town of Zhouqu, in Gansu province, was hit by a massive mudslide. The outflow, which slid down the valley, wiped out multi-story buildings and caused the death of 1,144 people. Geo-scientists inspecting the scene concluded that the slide was provoked by torrential rain, deforestation and the construction of a number of hydroelectric power plants in the area. In their opinion, the area should never have been developed because it was at high risk (Tang et al 2011).

Similarly, on September 27, 2010 the world awoke to a new tragedy. A mudslide had buried a village near Oaxaca in Mexico, affecting a community of 9,000 inhabitants. The landslide occurred in a mountainous area after weeks of torrential rain and flooding caused by tropical storms. 'Only' 11 persons were reported missing after the event, but the socio-economic consequences were devastating. In the aftermath, critical voices used the event to raise the problem of deforestation and corruption in the area (Bricker, 2010). Despite several warnings about the risk, it emerged that the government had done little or nothing to address the problem of landslides. On the contrary, public officials and contractors were accused of giving no-bid contracts to friends and family, and for embezzling money from highway projects by using cheap materials. As a result of poor construction work in the area, many highways and bridges collapsed and became impassable due to heavy rain and flooding, delaying the rescue teams by more than 10 hours. While massive loss of life was avoided in Oaxaca, it is not difficult to imagine that the outcome could have been much worse. In order to mitigate and prevent disastrous events of this nature from recurring, it is critical to learn from such disasters events, and change the way landslide risk is being managed and governed.

Landslides do not only affect countries in the developing world, they also pose a serious threat in many European countries. In the last decade, there have been major landslide events in many mountainous and hilly regions of Europe, with an increasing number expected as a result of the impact of climate change, land use changes, and the expansion of settlements and infrastructure into landslide-prone areas (IPCC, 2011, EEA 2010). In the coming years, we are likely to experience more landslides that endanger lives and cause human tragedy. This will most likely result in rising economic expenditures from extensive damage to property and infrastructure, and a loss of productive land (Glade, Anderson, & Crozier, 2005; Hervás, 2003; Lee & Jones, 2004). Because people and property are becoming more exposed and vulnerable to landslides, it is time to take adaptive action and develop more robust and sustainable risk management systems.

Traditionally, the problem of landslide management has largely been restricted to the preserve of engineers, with social aspects of vulnerability and exposure reduced to population level data made sense of through the spatial lens of geographical information systems (GIS). Too often there has been an instrumental approach towards hazard management where the main focus of landslide risk management lies in implementing technical solutions such as piles, anchors and retaining walls that can protect people and property against landslides, and in the provision of ever more detailed mapping programs that can help planners and other users to avoid landslide-prone areas. These are important developments, but the rapid progress in such technologies has not been integrated with an awareness of, and attempts to reveal, the influence of cultural, political and social contexts in the selection and application of science and technology. Thus far, important aspects of landslide risk decision-making such as science-policy interactions, governance and socio-technological transitions have only been incorporated into landslide risk management. In recent years there have been calls for a more critical approach towards natural hazard and risk management (Handmer & Dovers, 1996; Pahl-Wostl, Tàbara, et al., 2008; Pelling, 2010). While technical solutions provide valuable tools for risk management, social dynamics that shape risk behaviours and impact the coproduction of scientific knowledge must also be considered in risk assessments. In these approaches, risks are seen as part of social processes where the decision-making around technology is not free of subjective values, and societal dynamics that legitimate or confront the practice of risk managers, regulators and developers are seen to determine risk and loss outcomes more than the technology itself. This approach becomes even more valuable under the uncertainty generated by climate change or rapid demographic, cultural, and economic change – where fixed technology may not be able to cope with the dynamic character of hazards and where individual judgements may be as or more important than scientific evidence in making decisions on how to management risk, or at what levels risk is socially acceptable. Moreover, it is social processes that determine what science researches, how its findings are communicated, and who is able to access and control the consequences of scientific research that are increasingly shaping risk.

Because we are likely to experience growing problems with landslides in the future, it is necessary to identify and understand the deeper social, cultural and political conditions underlying current policy design, and the manner in which political change occurs and is potentially driven forward. More specifically, there is a need to understand how different actors act and communicate in the field of risk management, and how power relations can mediate the process of techno-sociological transitions. We would, thus, argue for the need to bridge the gap between technical solutions and socio-political relations in order to better understand and create more efficient and equitable landslide risk management strategies in the years to come.

This report examines more closely the ways in which landslide risks are managed and governed in four European countries, and in India, to identify key advantages and disadvantages of each management model, and understand the socio-political cultures of landslide risk management and development. Specifically, we utilise the data generated by case studies conducted in five individual country contexts to address two key questions:

1) What are the cultures of risk management and what drives changing paradigms of risk management?
2) In what way and to what extent has scientific research contributed to the shaping and implementation of policy transformation?

The second question provides greater focus on science-policy communication, which is but one element of the broader process of policy change highlighted by question one. Because there is a lack of comparative knowledge on the various national models and strategies of landslide management today, the emphasis here is to deploy more information for politicians and other expert groups on how to structure, manage and interact in this field in order to have a better management system.

2. Methodological approaches

The information used for this study was based on data collected for the SafeLand project. It documents the risk and policy issues for Italy (Scolobig, 2010), France (Angignard, 2010), Romania (Tudor, Mihai, Maftei, & Porumbescu, 2010), Norway (Bye, 2010) and India (Sharma, 2010). As the principal deliverable for Work Package 5.2, Task 1, this report aims to compare, analyse and understand risk management culture. Key outputs from this task included early input to help identify case study sites for subsequent tasks as well as this report. There is value in reading all WP2 outputs, where the logic is to drill down from this more global study to the individual decision-making processes of a single at risk site and its multiple stakeholders.

The case-studies selected for this study are all considered to be “hotspots” with respect to landslide risk management. There have been serious landslide events in Italy, France, Romania, Norway and India both historically and in recent times. These countries also represent a range of national governance contexts with differing degrees of centralisation of science and risk management regimes, and contrasting amounts of citizen participation in the decision-making processes for risk management.

The scoping studies that underpin this synthesis report were based on a common methodology to allow for a comparative analysis. The methodology was determined collaboratively in a meeting hosted by King’s College London. Here the aims of the study were presented and available secondary or expert data held by individual case study researchers was used to help frame what would be possible to collect in the relatively short time frames available for data collection and analysis (most limited to 3 months in the first instance). Key literatures from cognate studies in other risk management domains were discussed and, an analytical frame developed, as presented above.

Following from the broad agreement of analytical frame researchers individually constructed interview schedules and tools that enabled broad areas of interest to be tailored to the realities and opportunities of individual study contexts and to the contacts and expertise of individual researchers and their networks. To retain commonality a round of email exchanges were used with draft questionnaire schedules passed around the group. See Appendix 1 for a sample questionnaire.

Case studies proceeded at uneven pace, with only one, Norway, being completed to the three month deadline. Italy followed soon after, India after six months, Romania and France later still. This is a reflection of the difficulty in researching with practitioners and also of the competing demands on researcher time. Though not ideal, it was decided preferable to engage knowledgeable local actors and many had other responsibilities, indeed the French researcher could only be employed for 1.5 days a week.

An advantage of the staggering of results was an opportunity to reflect on emerging themes and in some instances to adjust research questions in the remaining studies. This was not aimed at developing rigorous and inflexible comparison but rather at a research method that built in richness as studies became available.

Synthesis was undertaken initially by the Norwegian case study researcher but midway through it became necessary to recruit a new researcher. As an embedded post-doctoral researcher in King's Hazards and Risk Research Group, Zaidi has participated in the London methods meeting for SafeLand, facilitating an easy transition. Additional comparative insights by Scolobig and Sharma on Italy and India have informed this analysis. Case study scientists were provided draft versions of the report as it unfolded, with discussions online and through a week spent in IIASA.

Individual country studies included a desk based studies of national policy and management (i.e. policy documents, websites, newspaper articles, etc.) as well as semi-structured interviews with key stakeholders at the national, regional and local levels (including scientists, planners, contractors, politicians, as well as local entrepreneurs and landowners with exposure to risk). In particular, the study included in-depth interviews with important stakeholders in some particular high-risk communities in Norway (Aaknes), Italy (Campania) and India (Nainital) to understand how landslide risks were being managed and governed at the local level. In total, the study incorporated 90 interviews and a number of informal conversations. Interviews were recorded, typed and analysed manually. The use of a common interview protocol with core thematic questions (see Appendix III), allowed for comparison across different risk management systems.

3. Theoretical Framework: Science, Learning, and the Possibility for Policy Change

Identifying the linkages and relationship flows between scientific knowledge and risk management practices is a critical exercise in problem structuring for risk-related policy development. If a policy problem is not structured correctly, that is, it does not adequately establish the exchange functions between science and action in a particular context, policy failures are likely to result. Subsequent strategies aimed at reducing and managing risk will result in ineffective policy measures without easing the fundamental tensions that underpin science and policy exchange.

3.1 Linear models and the coproduction of science

This discussion examines two dominant discourses on scientific knowledge construction that influence the formulation of risk management and risk communication policy problems (NRC 1989). The first paradigm presents scientific knowledge as being composed of objective facts, which form the foundation for rational action and decisions. A second view asserts that facts cannot be separated from values in policy related science contexts. Under the former, risk management is often seen as a regulatory response based on the selection and implementation of scientific strategies for risk mitigation; whereas the latter reflects a view of risk management as a two-way process between science and policy whereby decisions are made about risk. A discussion of risk, therefore, involves a more elementary discussion about the nature and role of science in modern, industrialised societies.

The risk management process is conventionally formed of risk estimation or assessment, risk evaluation and risk management. Linear models of science policy understand risk as a physically given attribute of hazardous technologies. Risk estimation and assessment are therefore viewed as value-free or so-called objective processes which can be explained, predicted and controlled by science and are independent of subjective influences. Such traditionally technical approaches, which have held sway in the risk analysis literature until recent times, reflect the role of engineering safety studies in the emergence of modern risk analysis (Otway and Thomas 1982; Kates and Kasperson 1984; Wynne 2004). Assumptions of scientific neutrality lead to the view that risk assessments are rational since they are produced out of an objective evaluation of technical findings. Policy failure, slow public assimilation of risk evading behaviour, or public inability to make risk decisions in a scientific manner are seen as a consequence of subjective irrationality and lack of knowledge or understanding on the part of the lay person (Callon 1999). Inadequacies in risk governance are therefore a result of defective translation mechanisms and communication flows from science to the public, rather than flaws in scientific knowledge or application. The management problem is framed in terms of economic and technical rationality and the communication problem is viewed as informing or educating the public about risk as defined by the technical expert. Effective communication is framed as the manager's ability to explain risk concepts clearly.

Although the technical approach may be suited to hazard contexts reliant purely on engineering solutions, it fails to provide purchase when used as the basis for societal policies and where uncertainty in science is important to communicate. Framing risk management problems solely in terms of technical or scientific logic ignores the additional impact of social agency and rationality. Still utilizing a linear approach, psychometric studies build on technical models to examine differences between the risk judgements of experts and lay persons, and develop a concept of risk that elaborates the statistical or mechanical understanding of the technical school. Led by Slovic and Fischhoff (Fischhoff et al 1983), advocates of the psychometric school acknowledge the importance of public response to risk, and the role of risk perception in risk management. However, as in the technical approach, risk continues to be defined and set by objective science experts, rather than the individuals who perceive the risk, or the mediating influence of broader social processes and special interests. By maintaining the assumption of a true and value-free risk science independent of subjective influence, the psychometric framework offers a subjectivist interpretation of risk from within a realist paradigm, awkwardly bridging social and technical worlds.

Fischhoff (1979) argues for greater citizen participation in risk management and decision-making. This participation is premised on first educating the public as part of an overall policy solution. In order to develop good risk management practices, research must be undertaken to clarify the subjective values and knowledge sets of all parties involved. Only after elaborating the differentiated social understanding of risk, can the 'scientific, educational, semantic, or political' solutions of the underlying problem be put forward (Fischhoff et al. 1983, 247). In this way, the task of risk communication is presented as a two-way rather than one-way process that promotes mutual learning and respect between public and experts. However, although risk management strategies are thus mediated by public perception and salience, risk estimation remains a technical task with a one-way knowledge flow to policy. Proposed solutions to inform and educate the public, and to understand and forecast public response to technologies, rely on the provision of value free risk science.

Despite the social orientation of the latter, both the technical and psychometric perspectives of risk remain linear in their approach to risk management. If policy does not accurately follow or represent risk science, it is due either to shortcomings in scientific technique, science is not well communicated in risk regulation, or special interests interfere with response to science. As a result, policy solutions using a linear approach predominantly focus on investing in further scientific research, developing improved means of communication in order to promote information transfer and minimize translation loss, and in maintaining scientific objectivity. All of these measures serve to reinforce the authority of science in policy, while maintaining its value-free neutrality.

Increasingly, science studies scholars question linear models of risk management and whether these provide an accurate representation of how science and policy are actually done. Even if they are accurate, do linear models provide good norms of risk management practice? Cultural scholars such as Otway and Thomas (1982) challenge the notion of risk as a physical given attribute by conceptualising it as social process that is deeply influenced by the humans who evaluate and experience it. This alternative framing of scientific risk and technical knowledge acknowledges the value-embedded and subjective nature of risk assessment. It approaches risk management and policy problems from an entirely different premise than that of the technical approach by presenting risk as a socially constructed phenomenon. The basis of risk management shifts from a reliance on statistical or actuarial probabilities to an emphasis on the risk perceiver, both expert and layperson. The incorporation of human agency and subjectivity into the calculation of risk brings into focus the role of social institutions and the cultural and political context in which risk is assessed and managed.

Such cultural approaches signify a move away from the prior focus on value-free technical knowledge and scientific authority, promoting alternative models of scientific knowledge and practice that are ‘situational’ (Haraway 1991), ‘co-produced’ (Jasanoff 2004), plural (Strathern 1992), ‘multiple’ (Mol 2002) or ‘intersectional’ (Lock *et al* 2000). Scientific practice is thus influenced by multiple factors and pressures rather than a single scientific logic. In Designs on Nature, Jasanoff (2005) puts forward the notion of `political culture', which, in its simplest form, refers to the processes and norms of governance. Variations in political culture at the national level are seen to directly impact the production of scientific knowledge and scientific practice. As such, science develops in parallel with the political and economic fluctuations of national life, rather than a uniform and value-neutral technical project independent of it. This is not to imply that, inverse to the technical approach, a one-way flow confers all agency on political culture, while robbing scientific developments of any influence. Instead, Jasanoff argues that technological and scientific developments feedback into existing national norms to create new political cultures. Using biotechnology as an example, she demonstrates the challenge of scientific innovations, such as recombinant DNA techniques, to subjective value systems and heterogeneous ways of life. These innovations necessitate the creation of new forms of governance, whose development is deeply influenced by national political cultures and value systems. In this manner, science and policy are mutually constituted, and experience a relationship of coproduction at the national level. An example of this is the manner in which the introduction of remote sensing data for land use mapping transformed landslide risk management.

Jasanoff (2004; 2005), and coproduction theorists in general, focus on addressing the question ‘What kind of science for what kind of society?’ In addition to its substantive significance for academic science studies, this query provides the impetus for a wider political project of democratising science and opening it up to wider public deliberation and debate. A starting point for challenging ideological dynamics that treat society and science as distinct and independent realms is a public and open investigation into the values and assumptions that drive science (Wilsdon and Willis, 2004). Space for greater public engagement and democratic participation (Leach and Scoones, 2005; Wynne, 2001) can be created once the socially constructed nature of science as a historically situated practice is recognized (Haraway, 1997). Coproduction theorists explore what research questions get asked and funded in science studies (for example, climate change), how ‘good science’ is defined and separated from policy, and the phenomenon of ‘mandated science’ or ‘trans-science’ (Weinberg 1972) that is responding to the demand of policy in order to answer questions that science can’t necessarily answer but policy needs an answer for nonetheless (for example, how safe is safe enough? What is an acceptable level of toxicological risk?). It has been noted that the tension between the supply and demand for science in policy and its impact on end-users has brought about a crisis of confidence between science and society over its authority, relevance, and validity.

3.2 Science Communication and Boundary Organizations

Beck (1992), for example, points to the growing mistrust between science and society. He posits that the average non-specialist citizen is vary of placing trust in expert scientific knowledge due to the negative impacts of science and technology, and the inability of scientists to effectively predict or manage them. In such a manner, citizens make a calculated and rational decision to ignore the advice of researchers and engineers as a result of the perceived failure of science to address the risks perceived as being encountered by society at large. According to Beck, modern societies demonstrate a tendency towards suspicion and collective mistrust towards the institutions, both political and economic, that mediate the relationship between science and society since they are seen as lacking in legitimacy and validity.

However, Callon (1999) challenge the notion of public mistrust in science by linking it back to the manner in which linear models understand the participation of lay people in scientific knowledge creation. In the technical approach, public trust (or mistrust) of science is a result of the level of information communicated to a scientifically illiterate public. In psychometric models, a two way exchange of knowledge and competencies between both scientists and lay people is given priority, but only to complement those of scientists and specialists. Despite these differences, Callon argues, both models share a common underlying assumption that maintains a dichotomy between the world of science and the public. By drawing an almost unsurpassable distinction between the 'scientific' and 'non-scientific' realms, the technical approach, in an open and absolute manner, and psychometric studies, in a more subtle and negotiated way, deny non-experts the ability to contribute in any meaningful form to the process of expert knowledge creation. Local knowledge and expertise is to be ignored and eradicated, or at best, acknowledged in so far as it supplements scientific expertise. In this way, locations of knowledge production such as laboratories and research centres remain free from the subjective influence of lay persons and non-specialists (Durant 1999).

The co-production of knowledge model, however, attempts to breakdown this dichotomy by recognising the role of lay people in generating knowledge about their own societies and systems. Knowledge, in its overall dynamic, is produced out of a constant process of exchange and contestation between standardised and universal knowledge on one side, and locally embedded and contextualised knowledge frames on the other side. Through the establishment of clear paths of communication and exchange, and recognition of the value of multiple forms of expertise, the distinctions between scientists and non-specialists are blurred such that the public is on an equal standing with scientists and the dynamic of trust or mistrust is no longer relevant to the relationship.

In an attempt to understand what separates scientists from the public, science studies scholars have pointed to the existence of 'an array of contingent circumstances and strategic behaviour' between the two groups, rather than formal methodologies, technical knowledge systems, and essential characteristics that distinguish science from non-science (Guston 2001:399). Known as "boundary work" (Gieryn 1995, 1999), this branch of science studies evolved out of an interest in the boundaries erected by the scientific community to maintain its identity and authority, and to separate itself from fraudulent or pseudo-science. Recently, it has provided useful insights into the complicated and shifting boundaries between scientific and political expertise during consultations between regulatory bodies and scientists in the process of policy making (Jasanoff 1990).

In the absence of an insurmountable divide between science and non-science, and the existence of a fluid and complicated dynamic of exchange between the two sets of actors, scholars have identified boundary objects and boundary organizations as linking mechanisms between the two domains. Boundary objects act as intermediaries between different sets of social communities, and can be employed by individuals from within both systems for specific purposes while maintaining their independent identity (Star and Griesemer 1989). They can range from individual delegates to brokering organizations, such as some of the public interest organizations that were set up mid-century to safeguard the interests of scientists while promoting political goals (Moore 1996). Boundary organizations bring stability to the relationship between science and policy-makers by providing platforms and fora for exchange and agreement. They also encourage representation and participation of both actors, as well as third party brokers, and act as a buffering and translating agency at the intersection of two distinct worlds while maintaining chains of accountability and trust with each (Guston 1999, 2000).

For example, the IPCC provides a common platform aimed at neutralising hostile or adversary international attitudes to regulatory science by creating an intergovernmental public-science partnership for the production of 'trusted' climate change knowledge assessment. In a context with high stakes and profound livelihood implications, coupled with polarized interpretations of risk evidence by different government and private sector scientists on climate and environmental outcomes, the IPCC demonstrates the advantages of multilateral agency. Because the IPCC hosts experts and scientists from across the globe, and its findings are subject to the approval of all member states, no one country can accuse it of being partial to the interests of another. As well as scientific input from thousands of scientists and assessment by government representatives, the IPCC findings have been endorsed by a number of independent scientific organizations. The process of collective assessment validation has allowed the IPCC to build a reputation for neutrality and objectivity (Hulme et al 2010).

The relative success of boundary organizations such as the IPCC suggest that traditional notions insisting on a separation of science and politics in an effort to maintain neutrality might be complemented by recent attempts to marry the interests of both domains. According to Guston (2001) the introduction of boundary organizations results in the opening up of science to political influence, which jeopardises its value neutral identity. However, the intrusion is reciprocal, leading to an equivalent 'scientization' of politics. This dynamic, Guston argues, preserves the neutrality of the boundary organization, ensuring it 'does not slide down either slope because it is tethered to both, suspended by the coproduction of mutual interests' (Guston 2001:405). However, using the example of the IPCC, scholars such as Hulme and Mahoney (2010), Bjurstrom and Polk (2011) and Demeritt (2001) point to the failure of boundary organizations to adequately address problems of representational imbalance, political bias, and uncertainty to name a few of the underlying tensions that impede the construction of value neutral and balanced engagement between policy and science.

3.3 Pathways and Policy Change

In contrast to technical models or impartial boundary organizations, John Kingdon (1984) and Paul Sabatier identify the role of 'policy streams' and 'policy advocacy coalitions' as the most significant component in the development of a theoretical framework for incremental and abrupt policy change (Sabatier, 1987, 1991; Sabatier & Jenkins-Smith, 1993). They argue that the policy process is characterized by stability, rather than change and that a 'policy window' for change first emerges when a problem is recognized as a public matter in need of attention, or when policy entrepreneurs mobilize and offer potential solutions to the problem.

Thomas Birkland (1997, 2007) examines the dynamics of policy change after natural disasters and argues that sudden and harmful events often receive increased levels of attention in the news and among policy entrepreneurs because they provide evidence of policy failure, thus creating potential 'windows for policy change' . For social scientist such 'focusing events' are of great importance since they provide an opportunity to study the dynamics of disaster led policy change, and help direct attention to the driving pressures and key actors behind processes of reform. Birkland (2007:5) says:

'A disaster can often do in an instant what years of interest group activity, policy entrepreneurship, advocacy, lobbing, and research may not be able to do: elevate an issue on the agenda to a place where it is taken seriously in one or more policy domains'.

Birkland's (2007:8) theoretical model of event-related policy change indicates that there are two likely outcomes of a disaster event. Firstly, if an event leads to increased agenda attention and mobilization appears, it is likely that there will be a profound discussion on the causes behind the event and whether existing policies are able to adequately address the problems revealed by the event. If this is the case, new policies can either be adopted or become a lesson for later use. Secondly, if the event fails to gain much attention it is unlikely to result in any mobilization. As a result there will be little or no learning that can feed into new policy. Both instances highlight the importance of public saliency in triggering policy change.

This is a very linear reading of the relationship between disasters, learning, and policy transformation. In reality, increased attention after a disaster does not necessarily lead to learning or policy change. Although disasters provide a system shock that can sometimes act as an impetus for reform, the degree, form and rate of any subsequent change relies on a number of mediating social, political and scientific dynamics in a specific society. For example, public saliency is largely linked to the role of mass media in publicising disaster events and policy failures that create focusing points for policy change. But media coverage is not a guaranteed or value free exercise, and varies tremendously in terms of which disasters are publicised, how they are publicised, the science used to support knowledge claims, and the types of policy failures that are highlighted (Vasterman et al 2004). This mediating influence breaks the simplistic linearity implied by Birkland's model of event-related policy change, instead highlighting the co-produced nature of science-society interactions on disaster risk information.

In addition, to place an issue on the policy agenda is not evidence of policy change or learning. A prosaic but prevalent constraint faced by governments in affecting policy change in risk management is the lack of financial resources and capacity. According to Mechler (2004), governments need to undertake cost-benefit analyses for investing in risk management regimes. Enacting policy change or building capacity both pre- and post-disaster involves analysing economic trade-offs, and assessing the cost of risk management against potential cost of a disaster. Economic growth and stability is prioritized over risk reduction and social welfare (ibid.). As the learning process is often driven by a combination of related events and willingness to do something about the problem, it can take more than one event (perhaps in separate but related places or policy domains) to learn from disasters and to make policy changes.

In the policy literature it is argued that policy failures inspire three kinds of learning; instrumental policy learning, social policy learning, and political learning (Birkland, 1997; May, 1992). While instrumental policy learning is about the implementation of new legislation and techniques, social policy learning is about the nature of policy responses and the redefinition and changes in policy scope and goals. Political learning, on the other hand, is related to advocacy strategies and gaining salience in the policy domain. However, to understand the learning process and how policy change occurs may not be as easy as first thought. The process is often slow and complex, and usually takes place at multiple levels through multiple actors and institutions. This is evidenced by the differentiated response to risk regulation across community and national boundaries.

Even in instances where scientific and policy consensus has been achieved on the international stage, specific standards for managing risk that are based on the same set of scientific evidence continue to diverge at the national level (Jasanoff 2000). For example, according to Vogel (2003), it is possible to evidence a shift in the overall trends for consumer and environmental protection policies in Europe and the United States. Regulatory standards in the US were more stringent, comprehensive and innovative in the 1960s through to the mid-1980s than in Europe. However, after 1990 the trend has reversed and consumer and environmental regulations in the EU are more precautionary than those in the US. The shift in the regulatory dynamics in Europe can be attributed to specific regulatory experiences and political developments within the EU, coupled with greater emphasis on cost-benefit analyses and the costs of regulation in the US.

Although linear understandings of policy change suggest that natural disasters work as catalysts for new management policy, it is also necessary to look for other drivers and trigger points for change by questioning the existence of both internal and external political, technological, economic and cultural shifts that might act as mediating influences. Pelling and Dill (2010) point to the potential for change following natural disasters as the result of either bottom-up initiatives by civil society, or as the product of top-down international pressure and diplomacy. In the aftermath of the 1999 Marmara earthquake in Turkey, for example, NGOs and the media worked together to substitute the states limited capacity to act. As a result, the earthquake became a symbol of the fight for civil rights and highlighted the need for better risk management strategies. The government also had to act in accordance with the EU directives on climate change and risk handling when applying to become a member of the European Union. This case highlights the role of governance and formal institutions in influencing the outcome and rate of learning produced after an event. The existing structures of political power and the latent degree of democratization in a system can often shape the form and degree of change brought about by a trigger event.

3.4 Policy Structures and Learning

Hofstede (2001) argues that cultures where people relate to one another as more or less equal regardless of formal position can be viewed as having smaller power distances between the powerful and the less powerful. In such cultures people expect decisions to be democratic and these decisions are more likely to be based on participation and transparency (Pahl-Wostl, Tàbara, et al., 2008). In societies with large power distances, on the other hand, power relations are much more autocratic or paternalistic. As a result it can often be difficult to establish participation, transparency and trust in management processes (Ibid). In specific, Pahl-Wostl et al (2008) argue that resistance to change will be high in communities with large power distances as powerful groups will lose their influence going towards an egalitarian society, and that more profound use of power by powerful groups will lead to little or no learning as it will keep the number of participants low and not include other experiences and views.

Hofstede's framework also considers the importance of weak vs. strong uncertainty avoidance, or the level of tolerance for uncertainly and ambiguity within a society. The principal argument made here is that societies with strong uncertainty avoidance are characterized as rule-oriented societies, while societies with weak uncertainty avoidance are less rule-oriented and more willing to take risk. Discussing how this may affect social learning and the possibility for change in resource management, Pahl-Wostl and colleagues (2008) find that societies with a low uncertainty avoidance probably are more open to support or even invest in experimentation and risk taking for policy and practice (in the mode of adaptive management), so facilitating a culture of learning, than those with a high uncertainty avoidance which might be more interested in stability, citing economic or legalistic/political advantage. Pelling et al (2008) demonstrate that societies with a higher tolerance for uncertainly are more likely to support experimentation and adaptive management than those with low tolerance for uncertainly. This produces a greater capacity to innovate, and precludes the necessity for communication through formal institutions and relationships, which can be instrumental in times of crises and emergency.

Albert Bandura (1971), a founding scholar in social learning theory, argues that social units (individuals and organizations) learn by observing the behaviours, attitudes and outcomes of others and by being reinforced or punished by the environment. That means that learning is about participation in groups, sharing experiences and information as well as reflecting on outcomes and how new mistakes can be avoided. When social units share a common interest and a desire to learn, learning within a regime becomes more legitimate and easier. But being motivated is not in itself enough, a learning environment is enhanced when it accommodates diversity of opinions and perspectives – experimental diversity is a core component of resilience - and fosters the development of trust and respect among the involved members. Without trust, experimentation and diffusion of innovation relies on slow and clumsy command-and-control (Bandura, 1971; Lave & Wenger, 1991; Weger, 1998). This calls into question the extent to which state led and directed learning is more or less effective than decentralized scientific systems in affecting change in policy and practice – and indeed how far both systems can co-exist.

In recent years, theories about social learning have been used and developed by social scientists working with natural disaster and resource management. The main idea is that social learning is an essential element of policy development and implementation, and that it can support adaption to climate change as it can assist institutions to learn from experiences and incorporate the learning as feedback into the planning process (Pahl-Wostl et al, 2008; Pelling et al, 2008). Specifically, it is argued that social learning entails developing new relational capacities between social agents and between the social-ecological system by learning how to collaborate and understand the roles and capacities of others differently. Social learning, then, ascribes to both the outcomes and process of learning. It describes changes in values, beliefs and behavioural norms and how processes of change are actuated by different social actors.

It has been highlighted by many scientists that social learning it not a straight forward process, rather it is understood as an exploratory and stepwise process that involves both small improvements and big system changes (Argyris & Schön, 1978; Hargrove, 2002). The idea that there exist different kinds or 'loops' of learning was first addressed by Chris Argyris and Donald Schön (1978) in their work on organizational learning. Their concepts about "single-loop learning" and "double-loop learning" were based on the belief that the learning process takes different forms and that it has different outcomes. While single-loop learning is about following the strategies, policies and procedures that already are in place and about improving what is already done, second-loop learning involves "thinking outside the box", reflecting on why the system is not functioning in the first place and how to change it to the better.

In recent years, Robert Hargrove (2002) has developed Argyris and Schön's concepts. In his work he distinguishes between "incremental learning", "reframing", and "transformational learning" as respectively single-loop learning, double-loop learning and triple-loop learning. In addition to give the different learning process more precise names, he adds a new and more critical way of learning. Transformational learning deals with essential questions such as what kind of learning has been produced and how this learning has been produced. More specific, we talk about a kind of learning that comes as a result of a fundamental change in the underlying values or belief system that guide the organizations and institutions in charge of, for instance, landslide risk management.

The model below, which has been developed by Pahl-Wostel (2009:361), shows how these concepts can be applied to governance regimes. Here the single-loop learning process is referred to as a policy cycle where everything is about improving performances without changing guiding assumptions and calling into question established routines, while double-loop learning is referred to as a learning cycle that deals with the reframing of priorities and goals. The last learning cycle, in turn, refers to a transformation of the structural context and factors that determine the frame of reference. We talk about a kind of societal learning that is seen in the whole regime; the way it is organized, regulated and practiced. The triple-loop-learning system, then, is a helpful tool as it can be used to understand the contexts and systems for learning as well as the different outcomes of learning.

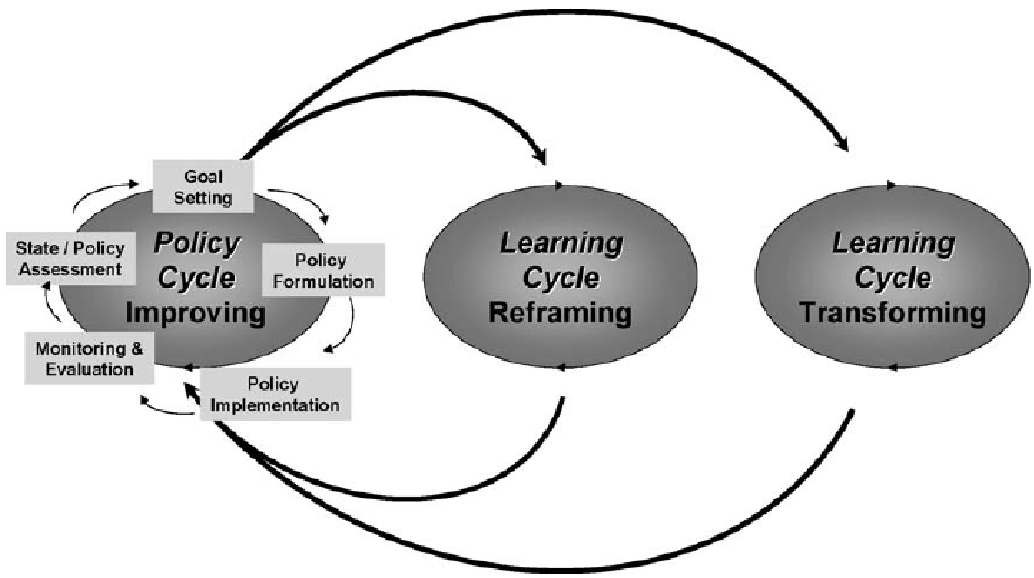


Figure 1: The concept of triple-loop learning applied to governance regimes (Pahl-Wostl, 2009:361)

Most recently, research on the ways individuals, regimes or technologies adapt and respond to climate change has generated renewed interest in these theories of science co-production and social-technological and risk management change (Pelling 2010). However, analysing the dynamics and adaptive capacity of resource governance regimes should not only focus on how learning and adaptive action take place but also seek an understanding of the institutional constraints that shape our capacity to build adaptive institutions. For example, Cash and Moser (2000) highlight the need for matching scales of bio-geophysical systems with scales of management systems and avoiding scale mismatch by utilizing boundary organizations and adaptive management strategies to bridge institutional structures with learning and local action. Within the climate-change literature, adaptive action is seen to take place in both the formal system and in the informal system. Pelling et al (2008) understand the opportunity for learning and change as taking place within in the canonical system vs. the shadow system. Their study reveals that the informal shadow system is often more effective in reacting to abrupt change than the formal canonical system. The reason for this lies in the informal system's capacity for reflexive adaption. In contrast to the canonical system, shadow systems are based on informal relations, interpersonal trust and social networks that operate outside the formal channels of communication. Shadow systems increase the speed of information and resource flow and enhance horizontal governance which contributes to resilience. In other words, we may say that the shadow system has a capacity to work outside the formal procedures and that it can also react more quickly to sudden problems caused by floods and landslides.

3.5 Facilitating Learning: Trust

In a wide range of policymaking contexts trust has been identified as an essential part for achieving cooperation and collective action. It is understood as the catalyst for successful collaboration and as the key element in implementing new politics (Lave & Wenger, 1991; Ostrom, 1997; Putnam, 1993; Rothstein, 2000). Jean Lave and Etienne Wenger's (1991) talk about 'communities of practice' or collaborative forms of learning in systems where control and power is distributed among participants rather than based in a hierarchical authority. When people strive for similar goals and visions, and trust each other as well, it is easier not only to facilitate learning but also to change the way things are done. We may therefore argue that disaster management systems based on these principles represent better environments for social learning and change, than systems where there is no co-operation and exchange of information between the affected parties and where the power relations comes between the participants. Robert Putman's (1993, 1995) work in the area of social capital drew on these ideas. His book 'Making Democracy Work: Civic Traditions in Modern Italy' (1993), which is a comparative study of regional governments in Italy, shows that trust is a critical factor for civic engagement and the development of democratic regimes. Studying the effects of new institutional reforms that give more power to regional governments revealed that these governments performed best where there were strong traditions of trust and civic engagement. In large, he argued that the success of democracies depends on the horizontal bonds that make up social capital. Social capital, then, is to be seen as key to high institutional performance and the maintenance of democracy. Similarly, Rothstein (2005) argues that most citizens will meet collective obligations if they trust that other citizens and political leaders keep to the social contract. According to Rothstein people are often caught in a 'social trap' with no cooperation, because there is a lack of interpersonal and institutional trust in the system. That means that efficient cooperation for common purposes only can come into being if people have trust in the system. Facilitating learning, then, is about establishing trusting relations that promote open dialog and where there can be an exchange of ideas and outcomes.

In recent years there has been a call for increased public involvement in disaster management decisions and an interest in integrating science and local knowledge in environmental risk management. However, the call for democratization in risk management and greater participation of lay people has drawn different responses. While some risk professionals argue that successful risk management depends on public involvement and broad public support, others have been more sceptical, arguing that risk management decisions are complex and hard to understand for most people (Failing, Gregory, & Jarstone, 2007; Faulkner & Ball, 2007; McDaniels, Gregory, & Fields, 1999). The problem of establishing participatory processes between experts, technocrats and the public to a great extent is a matter of a top-down attitude towards public education and knowledge. Discussing the issue, social scientists have shown that many experts hold a top-down attitude towards participatory processes as they think it is a step too far to communicate with the public in a simplified language and to make use of simple models that can lead to misinterpretation and wrong conclusions (Faulkner & Ball, 2007). Open dialog and participatory process are therefore by many held as problematic methods.

This section has highlighted how scientific knowledge construction and the role of the scientific expert influence the formulation of risk management and risk communication in the both technical and co-production models. The manner in which scientists communicate landslide risk and the difficulties of improving communication and establishing trust between the experts and the public in subsequent rounds of risk communication and public engagement shape science outcomes as much as science shapes public opinion in the coproduction of knowledge and perception on landslide risk.

Policy shifts in risk management are therefore facilitated by the role of experts and boundary organizations, and often take place after the occurrence of focusing events such as disasters and shocks. However, such shifts are mediated by a complex array of locally relevant issues, including financial resources and public saliency, which produce diverging cultures of risk management across different national contexts. Power relations within societies also influence the degree of learning and transformational change possible in the system, and more participatory and decentralized models of risk management result in greater trust and capacity to adapt. In this way, landslide risk policy and management practices can be viewed as the product of a complex web of relationships and communication between science, policy and the public.

4. Case Study Analysis: The history and cultures of learning and change in landslide risk management

The following section outlines the development of landslide policy and management in five case countries. In each instance, a historical review spanning 50 years is undertaken in order to illustrate shifts in institutional and social regimes, and their influence on landslide policy. This retrospective approach allows for an explication of the overall cultures of risk management for each context, and highlights the resulting catalysts and barriers to risk management inherent in the system. A summary description of the national framework, culture and practices of landslide management prevalent in each country is followed by a discussion on the comparative dynamics and perceived advantages of the different management models. The concluding section examines the relevance of epistemological notions of linearity and co-production to these five empirical examples of science-policy interaction, and outlines certain variables that might be used to explain differences in policy instruments and outcomes between cases.

4.1 Italy

Due to its relief, lithological and structural characteristics, Italy is a country in which the landslide risk is particularly high. Of the Italian territory, 6.8% is highly at risk from landslides, which represent a major issue of concern especially with regards to population exposure: 992,403 persons, that is, 1.74% of the Italian population is at risk (ISPRA 2008). As such, Italy has the highest cumulative number of deaths or missing people and the highest expected yearly loss of life in Europe, and, after Japan, the second highest landslide risk of the industrialised countries.

In Italy the history of landslide risk management goes back to the beginning of the twentieth century. The first legislative act on the construction of protection works and risk zoning came into effect in 1904. Using factors such as priority of values, focus of policy mechanism, major events (not necessarily landslides, but also other natural disasters related to significant legislative changes), and scientific developments, the development of risk management practices in Italy can be separated into four key phases. Each of these phases were characterised by the domination of building restrictions, water and soil integrated risk management, risk assessment and risk governance, respectively.

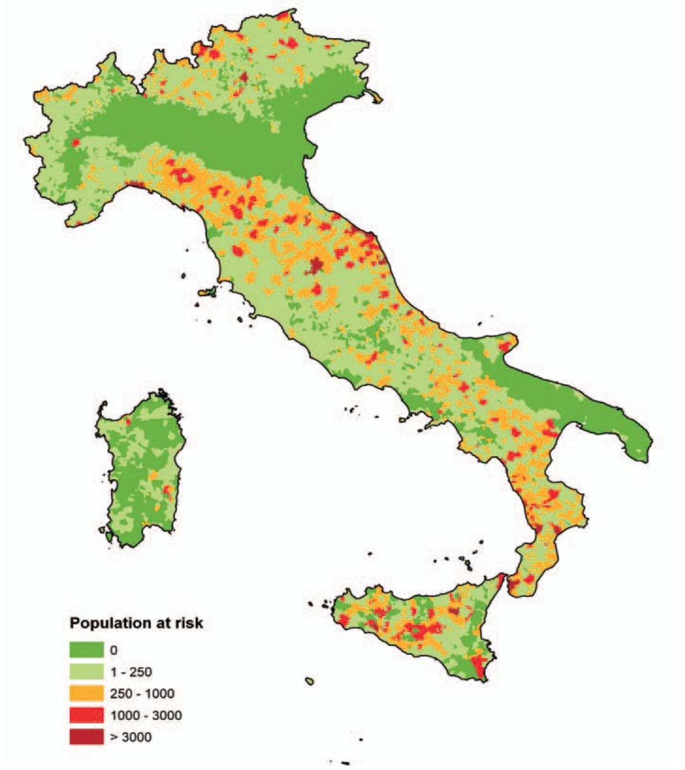


Figure 2: Population at risk in Italy, on a municipal basis

The first phase, lasting from 1920 to 1965, focused on building restrictions and risk zoning. It prioritised economic growth and regulating building speculation (uncontrolled building also in risky areas), and aimed at imposing some restrictions to private property in order to prevent natural disasters. As a result, already at the beginning of the twentieth century, building constraints were established on the national territory in a fragmented but accurate way. However, the focus on building restrictions and risk mapping took on increased prominence after the end of the Second World War, when Italy experienced strong urbanization and uncontrolled building activity. Risk management policies focused on investments in structural defence, with many aimed at soil management and landslide prevention, and building works were subject to administrative authorisation by municipal authorities. When the country was hit by the 1951 Polesine flood and the 1954 Salerno landslide, it provided an impetus for the creation of a national inventory of floods and landslides to help land-use planning in communities. The political context of the Cold War led to increased attention on the Civil Defence system and the role of the Civil Protection authorities in ensuring preparedness to resist nuclear and military strikes. Their strengthened capacity started to take a new form, associated not only with natural, but also to technological disasters (Alexander 2002).

The second phase was dominated by a concern with creating integrated water and soil risk management, and extended from 1966 to 1991. In Italy, the need for establishing an integrated water and soil risk management was driven by one key event, the 1966 Firenze flood. Together with other tragic natural disasters that took place during this phase (the 1963 Vajont landslide, the 1968 Belice, 1976 Friuli and 1980 Irpinia earthquakes), the Firenze flood presented a window of opportunity for consistent changes regarding the landslides system and especially for the promulgation of new laws on integrated risk management and civil protection issues. At the same time, the phase is characterised by the establishment of several new research institutes, whose main topics and research lines strongly influenced the character and focus of landslide scientific research.

One of the key drivers of change for the Italian landslide management system is represented by the work of the Inter-ministerial Commission for the study of soil defence and hydraulic works, known as the De Marchi Commission, a group of scientists including experts in hydrology, engineering, geology, and planning. When the De Marchi Commission investigated the 1966 Firenze flood, they uncovered several weaknesses related to water and soil management and local emergency preparedness. In their report they therefore argued for having an integrated management of water and soil resources at the river basin scale.

Figure 3: Key phases of landslide policy and management change in Italy

	Building restrictions (1920-1965)	*Water and soil integrated risk management* (1966-1991)	*Risk assessment* (1992-2000)	*Risk governance* (2001-present)
Priority of values	Economic growth and building speculation (uncontrolled building also in risky areas)	National security and welfare standards	Ecological sustainable development	Public participation for decisions concerning landslide risk mitigation
Focus of the policy mechanism	Investments in structural defense	River basin plans	Hazard, risk and vulnerability mapping and assessment	Hydrographic district plans
Major events	1951 Polesine flood (84 deaths) 1954 Salerno landslide/debris flows (318 deaths) 1963 Vajont landslide (1,917 deaths)	1966 Firenze flood (112 deaths) 1968 Belice earthquake (270 deaths) 1976 Friuli earthquake (965 deaths) 1980 Irpinia earthquake (2,914 deaths) 1985 Stava landslide (269 deaths) 1987 Valtellina landslide (53 deaths)	1994 Piemonte landslide (70 deaths) 1998 Sarno landslide (161 deaths) 1999 Soverato flash flood (12 deaths)	2009 L'Aquila earthquake (308 deaths) 2009 Messina flash flood (36 deaths)
Key laws	R.D. 3267/1923 – Limitation to private property – building restrictions	L. 183/1989 - Soil and Water Integrated Risk Management	L. 225/1992 – Establishment of the national civil protection service L.493/1993 – Watershed management plans L. 267/1998 - Actions for coping with hydro-geological risk	2000/60/CE Water framework Directive L. 152/2006 - Norms regarding environmental issues
Key innovations	Building restrictions established on the national territory in a fragmented but accurate way	Identification of river basins Establishment of River Basin Authorities River basin plans	Watershed management plans Classification of risky areas in four classes	Identification of hydrographic districts
Key scientific developments	First criteria to identify risky areas	Interdisciplinary approaches for soil and water management	Risk assessment Development of monitoring, forecasting and warning systems	Remote sensing, radar and monitoring, laser scanning, warning systems

This unitary vision of risk management for the whole of each hydro-graphic basin strongly influenced following legislation, which approached landslides and floods in an integrated way. The work of the commission resulted in several new legislative acts. For example the act 996/1970 outlined the tasks of rescue services, established the Civil Protection Volunteer Service, and transferred the competence of these problems from the Minister of Public Works to the Minister of the Interior. In this way, the emergencies were no longer seen as simply technical problems but rather as problems of public order (Pellizzoni 1992).

The 1976 and 1980 earthquake events highlighted the problem of coordination between central and local authorities in emergency situations and led to a more flexible emergency response system that included national, regional and provincial authorities. Landslide research profited from these two earthquakes. In 1984, the National Group for Hydro-geologic Disasters' Defence (GNDCI) was established and went on to become a key actor in the history of landslide science. Scientific inputs combined with lessons learnt from disaster events resulted in the innovation of an integrated approach to land and water conservation problems.

Within Europe Italy has suffered the greatest human and economic losses due to landslides. In total 6.8% of the Italian territory is defined as highly at risk of landslides, which means that 1 million persons are exposed to landslides (APAT, 2007).

One of the key innovations catalysed by the 1966 Firenze flood and the work of the De Marchi Commission and the reports of the National water conference in 1972 is represented by the promulgation of the Law 183/1989 which established the River Basin Authorities. For the first time in Italy the framework of reference for these authorities was not administrative (e.g. region or province) but geographical, i.e. the river basin.

This new organizational structure also marked a change from a system of post-emergency intervention to a system including risk assessment, weather forecasting and measures for risk prevention. It is important to note that although an apparently linear relationship appears to exist between disaster events and policy shifts, in practice this interaction was mediated by complex interventions and transformations in scientific knowledge and governance frameworks.

During possibly the most crucial phase in terms of innovation and changes for landslide risk management, from 1992 to 2000, hazard assessment, risk and vulnerability mapping became a leading priority for risk management in Italy. In particular, it was the landslide that hit the municipality of Sarno in Southern Italy in 1998, that highlighted weaknesses in the Italian landslide risk management system. The 267/1998 law on risk zoning put more pressure on identifying areas prone to floods and landslides. It included a first order identification of the landslide risk areas classified in four classes (from R1, low risk, to high risk indicated by R4), a Hydrogeological Setting Plan, a program of urgent measures to mitigate the flood and landslide risk in R4 areas, and the development of a wide range of monitoring, forecasting and warning systems.

Through the years, in addition to the national River Basin Authorities established by the 1989 law, several interregional, regional and provincial River Basin Authorities have been appointed to take part in the integrated management of floods and landslides. Currently, the Italian landslide risk management displays a focus on risk governance. The notion of a single decision-making authority is being replaced by a multi-scale governance approach that recognizes the contribution of a large number of stakeholders. The process was kick-started by the implementation of the European Water Framework Directive which introduced a new organizational structure with hydrographic basins and districts. To secure joint administrative responsibility for streams, rivers and lakes, the River Basin Authorities were replaced with the District Basin Authorities. This shift, however, has proved both problematic and slow. In the year 2010the Hydrographic District Authorities were still not in place. As a result there are 40 river basin authorities: 6 national, 13 interregional, 19 regional, 2 provincial.

As identified by interview respondents, one of the levels at which risk zoning becomes more problematic in terms of its social, political and economic implications is the municipal level. More precisely, one of the key problems identified during the interviews with key informants was regarding the sometimes tense relationships between municipal and river basin authorities. While the municipal authorities most often ask to reduce the extension of areas characterized as high risk to allow socio-economic development, they may also at times ask the river basin authorities to extend the high risk areas to ask for more funding to monitor and control local hazards. For example, in Cetara, in the Campania region in South-Eastern Italy, the entire village is classified as a risk 4 area. This means that new constructions or buildings are not allowed unless new protection measures are built and cost by the owner. Municipal technical officers report that citizens and private investors often ask for a reduction of risk, by presenting a more detailed risk assessment prepared by private consultants. The situation causes conflicts at the local level as technical officers are faced by the importance of individual freedom and socio-economic development on the one hand, and public safety on the other.

Another problem identified in the Italian case relates to landslide victims and insurance schemes. The town of Nocera, which was hit by a landslide in 2005, has not yet received any reimbursement 5 years after the event because of bureaucratic problems. In Italy there is no private insurance available for landslides. In case of emergencies the Italian government intervenes directly by providing post financial aid and enacting ad hoc laws.

In Italy most people have access to risk data. The hazard and risk information are given to administrative bodies at regional, provincial and municipal level. In addition, risk and hazards maps are accessible by the public on the webpage of the River basin authorities and in the municipal technical offices. However, at the same time there are many different interests groups operating in the policy domain that are in conflict with public safety. Because building constraints often hinder urban, industrial and tourism development, there are continually negotiations about the validity of hazards and risk zones. In the Italian case it is also reported that technical officers at the local level not always agree with the risk zoning of the River Basin Plans and that they therefore are open for negotiations. Such local level actors are often put under pressure from private actors and lobbies to reduce the extension of areas designated as ‘high risk’ such that local plans may differ from requirements set in the basin plan.

Conflicts between national, regional and local authorities result in a lack of co-operation in terms of managing and developing landslide risk management. In Italy the obstacle preventing science from feeding into practice is related to two main problems. First, the responsibilities in Italian landslide risk legislation, policy and implementation are spread among several bodies at the same level and among different levels (i.e. national, regional, provincial or municipal). As a result, the current system has a quite complex structure and internal working mechanism, and many decisions have to be taken by agreement between a number of institutional bodies at different levels (Rossi and Ancarani, 2002).The overlapping responsibilities and cross scale conflicts between institutional structures have resulted in tensions between governing authorities over resource allocations and responsibilities. Perhaps as a step towards addressing such conflicts, the Ministry of Environment has recently funded a new research project aimed at building a national inventory of the structural risk mitigation measures already in place. More crucially, the project, called ReNDiS, also monitors the allocation of monetary resources used for soil defence, by updating the information provided by regional and River Basin Authorities. All these data are made available online “to favour transparency and disseminate information on actions undertaken to reduce the risk” (ISPRA 2010).

Second, the presence of strong interest groups and lobbies has resulted in conflict over risk mapping and risk zoning at the various scales. The political and economic implications of risk zoning at the local level create disagreement with the demands of risk maps, sometimes leading to illegal constructions in high-risk areas. Some interviewees maintain that municipal authorities aim at gaining or preserving citizen consensus and goodwill, rather than implementing risk zoning or promoting a culture of risk management which guarantees higher safety standards. However further research is needed to better understand the interplay of environmental, economic and political interests at the municipal level.

With regard to the issue of participation in risk governance as a result of the implementation of the EC Water and Flood Directives (respectively 2000/60/EC and 2007/70/EC), the River Basin Authorities are in charge of consulting all the relevant stakeholders before the finalisation of the river basin plan. Even if a systematic evaluation of these experiences is still not in place, it seems that the results of the participatory processes are very different e.g. with regard to the identification and selection of the stakeholders, the organisation and length of the process, the results achieved and their implementation, etc. This is also a consequence of the fragmented and decentralised structure of the Italian landslide risk system and of the lack of guidelines and methodologies for the implementation of these processes. To some extent this can be also explained as a problem related to how scientists and stakeholders assess, communicate and interpret risk. However, the constantly evolving nature of Italian risk management has led to the participation of a variety of technical and non-technical experts, and on-going efforts to improve coordination point to the possibility of improved systems of risk management for the future.

4.2 France

France has a long history of experiencing natural disasters, with documented events dating back to the middle-ages, with some events erasing entire cities and their populations. Thus, dealing with natural hazards has been on the agenda of authorities for over two centuries. Due to the centralised legal and political organisation of the country and a long tradition of codification, risk management policies have been addressed by several laws, codes and plans over the years.

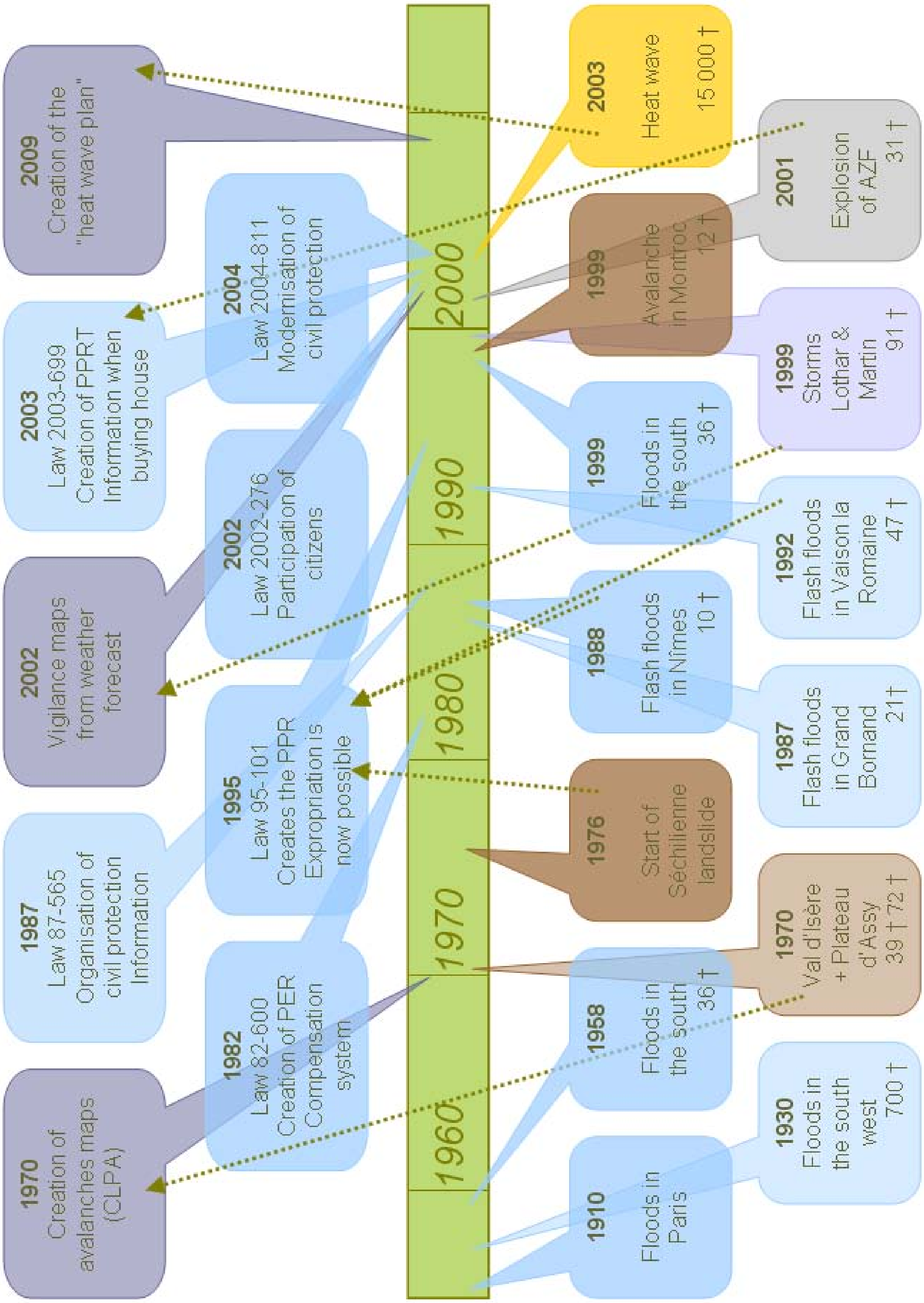
Some of the more recent developments in landslide legislation include the creation of the ANENA (Association for the study of snow and avalanches) in the 1970s, and the decision to map past avalanches in order to identify preferential paths (CLPA maps). In 1982, the law 82-600 mandated the creation of a national fund for the compensation of disaster victims. In France, the national insurance program is based on a public-private partnership characterized by a high degree of solidarity through cross-subsidized and non-segregated pricing. Damages are compensated when the government officially recognizes a disaster. Private insurers are required to offer catastrophe insurance in an all-hazards policy that is bundled with property and home contents insurance, covering both the residential and commercial sectors. Property insurance is not compulsory; yet if one chooses to purchase this insurance there is mandatory cover for disasters. This solves problems with adverse selection, and it is claimed that insurance penetration approaches 100 percent (Swiss Re. 1998). Private insurers can choose to reinsure through a public administered fund, the Caisse Centrale de Réassurance (CCR). If this fund proves insufficient, taxpayers will be called upon to contribute through an unlimited state guarantee.

The law 82-600 also legislated the creation of PER (exposure to risk plans), aimed at designating risk prone areas and producing protection and mitigation measures in those areas. Until then, only hazard maps existed, mainly for floods. It also clarified the role and responsibilities of civil protection, and the creation of emergency plans (ORSEC). Urban planning documents were obligated to take major risks into account and, more importantly, the law established a right to information about environmental risks.

Natural disasters in the early 1990s led to a revision of prevention and management systems. In 1995 PERs and other existing documents were replaced by a more flexible PPR (risk prevention plan). These new risk prevention plans could be single or multi hazard oriented. Like PER they were legally binding, but excluded retrospective application to existing buildings. Compulsory public consultations were enforced as a prerequisite to any environment related decision making. The compensation system funding was further clarified and, for the first time, it was possible for the authorities to expel residents from dangerous zones if deemed appropriate for risk management reasons.

In 2002, various changes to aspects of risk prevention and management system were undertaken. The role of public participation was emphasized, making it compulsory to establish precise frameworks for consultation in certain domains and states. Some responsibilities that were traditionally assigned to the State were re-allocated to local authorities. However, in 2003 the entire risk prevention system in France was completely overhauled. PPRs were extended to industrial hazards, and the interaction between different hazards now had to be considered in planning processes. Land use, information and consultation requirements were reinforced and this law also made it legally binding for sellers to inform buyers or new tenants of a residential building about the existing hazards (natural and industrial) that might impact the property. In 2004, civil protection and the coordination of the emergency services in crisis management were also reorganized.

Figure 4: Major events and evolution of legislative framework in France



In this way, the current legislative framework concerning natural hazards has been shaped by several additions and re-organisation in France. It is important to note that most of the laws and documents are not hazard specific. Some hazards are further addressed by specific agencies - in the case of landslides, for instance, the French geological survey (BRGM) provides information and maps for hazard monitoring and risk management policies.

In France, the role of the different authorities is clearly defined in terms of risk management structures. On the national level, two ministries are mainly in charge of addressing natural hazards. The Ministry for Ecology, Energy, Sustainable Development and Seas (MEEDMM) is responsible for prevention and protection, and the Ministry for Interior Affairs, Overseas Territories and Local Government (MIOMCT) is responsible for preparation and crisis management. Issues of insurance and compensation are addressed by the Ministry for Economy, Industry and Employment (MINEFE). Other ministries can be involved in prevention (e.g. Research, Agriculture, Health or Foreign Affairs). In addition to this, a specific orientation council for the prevention of major natural hazards (COPRNM) is established to give advice and create proposals concerning risk prevention.

At the local level, mayors are the main actor responsible for safety of their respective communes. Planning and land use policies are implemented at the communal level or in coordination with other communes when inter-communality exists. Therefore, mayors are in charge of informing their populations about natural hazards, and of organising crisis management. The prefects (representative of the State at the department level) are responsible for the local application of policies. They can also take over crisis management if a commune is overwhelmed. The prefect can prescribe the realisation of a PPR in a risk prone commune. Departments and regions can also contribute, mainly by financing equipment or mitigation measures.

In France, unlike Italy, laws can only be national and there are no regional laws. Therefore the legislative framework is supposed to be applied evenly across the entire territory. Due to their specificities, only some overseas territories can benefit from particular dispositions (either due to specific hazard, such as volcanoes, or because of a particular vulnerability due to their geographical location). The application of the same rules to different spaces leads to inequities. For example, urban areas are bound by the same laws as rural regions. National laws cannot be adapted to the variety of landscapes existing in France, where plains, mountains and littoral coexist. Therefore some laws are viewed as unfair or inadequate in their application (e.g. the requirement of a building-free strip of 50 meters behind a dam cannot be adapted to mountains with tight valleys).

Action against natural hazards focuses mainly on prevention (PPR) and compensation (from a state-fund) after a disaster. The PPR (risk prevention plan) is a legally binding urban planning document regulating land use and imposing construction rules in risk prone zones at the commune level. The territory of the commune is divided in zones: white zones (green in the latest version) are risk free, blue zones are prone to moderate risk, and red zones are prone to high risk. The PPR maps are not simply risk maps since they also take into account, for instance, the expected development of the communes. The maps are complemented by an urban planning document that states the rules to be applied on new buildings (and extension or works on existing buildings). Construction of any type of building is allowed in white zones. In the blue zones some restriction can be applied, either on the building methods (e.g. compliance to para-seismic codes, blind walls facing a mudslide path) or on the destination of the building (e.g. no habitation on ground floors in a flood prone area, or no vulnerable building such as school or hospital in a certain area). A PPR can be focused on one or several hazards, and can concern both natural and industrial hazards.

The online platform of the MEEDMM gives direct access to a significant amount of information, from the events database to the list of communes with a PPR. It also offers basic information about hazards and processes. On the field, risk managers are supported by practitioners, either from the private sectors or from public or semi-public bodies and agencies (e.g. BRGM, RTM & ONF).

The risk research and scientific community in France is composed of several different actors, including universities and academics, public bodies and agencies, research groups, centres or associations, and private sector companies. The main public agency dealing with landslide risk research is the French geological survey (BRGM), but other agencies such as CEMAGREF, CNRS, LCPC, INERIS, and ONF are also involved. The position of the BRGM is different from research laboratories. It is more focused on applied research. The BRGM assesses the results of fundamental research, defines the practical applications that can be derived from it (e.g. risk mapping or mitigation) and gives advices to ministries and State services. It has to keep a good scientific level and stay up to date on many topics. The organization takes part in reflection on the legislative framework. Its public service mission involves it in dialogue with ministries and local representation of State services. For instance, it can be consulted on expulsion decisions, or when defining a safety perimeter around a landslide. The BRGM also participates in the evolution of the legal framework by taking part in inter-ministerial commissions. It can feed back information (e.g. after the Xynthia storm on the Atlantic coast, or about seismic hazard). It contributes to the discussion as a knowledgeable body bringing scientific and technical expertise to the discussions, and does not take a position in the political debate. As such, the BRGM is a link between the political world and fundamental research.

The work of the BRGM work is complemented by university led research and independent research centres such as the CERG, OMIV, ANENA, etc. The community of landslides researchers is simultaneously diverse and limited - diverse in disciplines but limited in amount of unities. Most institutes deal with geology and geomorphology, and socio-economic aspects are not much addressed. There is a certain dichotomy; research is split in two communities. Traditionally, the "hard" scientists (geology, geomorphology, and hydrology) study the processes and hazards, while the "soft" scientists (social science, human geography) work on the interaction of physical processes with society and the questions of vulnerability and risk. This tends to change as there is more sharing of information between the groups, and as teams become more multidisciplinary - partly pushed by the recommendations of the European Commission, which considers interdisciplinarity as an added-value to project proposals. This new collaboration between researchers from different disciplines is especially visible in the Barcelonnette Basin and other landslide prone areas in France.

Overall, although the centralised nature of risk management in France bears a disproportionate impact on geographically and socially variegated regions, clear structures of responsibility in risk prevention and management provide a sound framework for landslide risk management in the country.

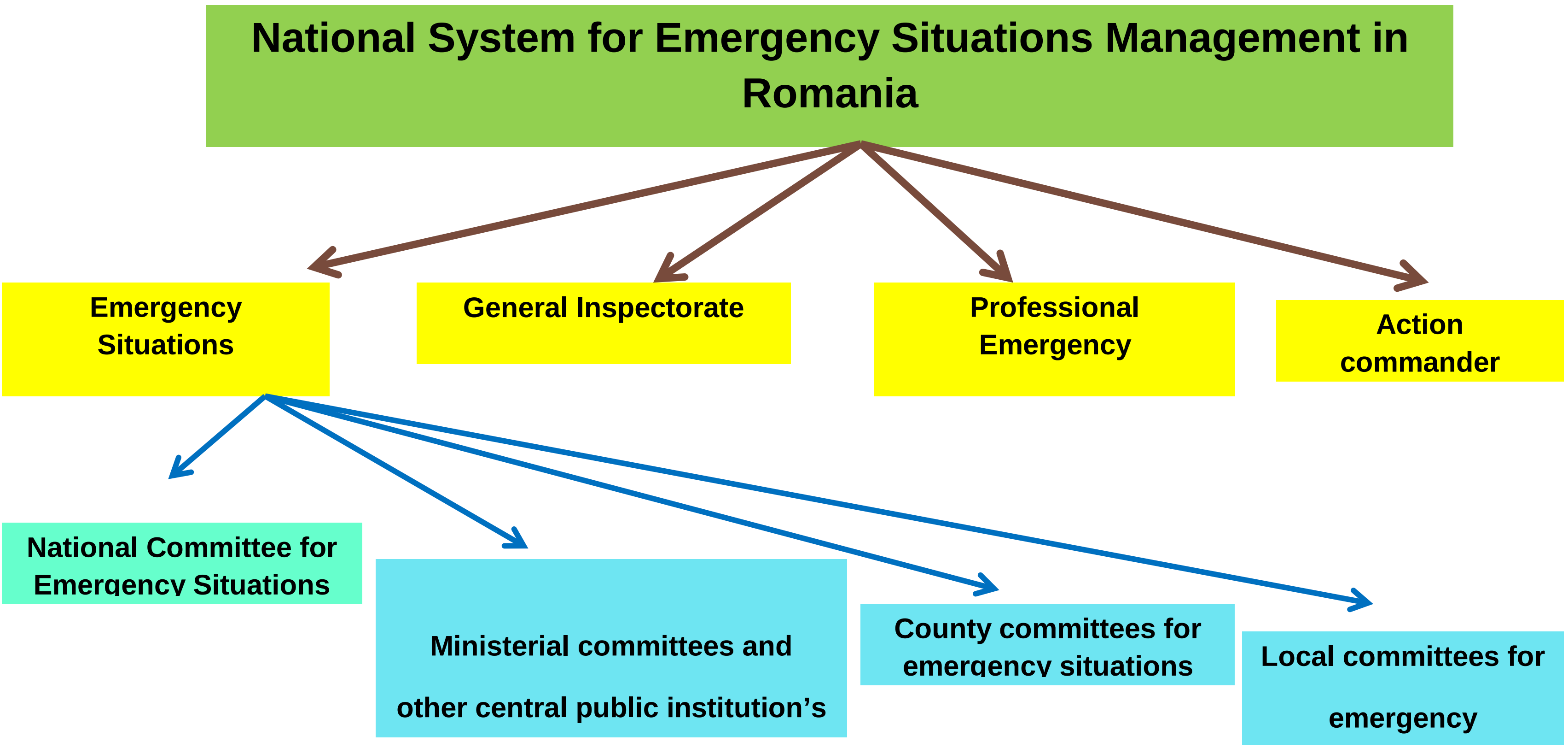
4.3 Romania

Romania encompasses a great variety of geological regions within its boundaries and is severely affected by different natural hazards, including earthquakes, floods, landslides, soil erosion, and drought. The most landslide-prone areas in the country are located in the alpine belt of the Carpathian Mountains and Transylvanian Alps, and in the Moldavian Plateau, which altogether cover two-thirds of the country's area. Susceptibility maps have classified over 37% of the country at moderate risk, while 13.4% is classified as 'high' and 'very high' risk (Bãlteau, Chendes, Sima, & Enciu, 2010). This makes Romania one of the most landslide prone countries in Europe.

In Romania, the history of landslide events is a long one. However, before 1989 there were no risk management systems in place. The Romanian national government was the sole authority responsible for recovery and rehabilitation after disaster events, which meant that response was based on ad-hoc solutions. The country, both during the post-war era of Soviet occupation, and under the dictatorship of Nicolae Ceauşescu after 1967, had a highly centralized and totalitarian structure of governance. Despite the exploitation of vast reserves of natural resources, the country experienced a range of economic problems throughout this period. The eventual need to service a very large foreign debt led to economic exhaustion, with no financial resources or interest allocated to mitigate landslide risk. During 1975-1988, independent scientific initiatives led to the production of hazard maps by the Institute of Geography of the Romanian Academy, but since there was a lack of interest on the part of the government in making these maps available for land-use planners, the maps were not integrated into land-use planning. As a result, regulation was not based on improved scientific evidence and new constructions were often built in high risk areas.

Ceausescu's overthrow, trial, and execution in December 1989 led to a dramatic shift in the political landscape of Romania, and marked the start of a slow transformation in regulation and risk management policies. In the 1990s, two legislative acts dealing with landslide risk management were introduced. The Governments Ordinance of 1994 secured better defence against disasters, while the Civil Protection Law of 1996 outlined directives on the creation of a National System for Emergency management. However, it was not before Traian Basescu became president in 2004, that the issue became a matter of high national priority. When Romania applied to join the European Union in 2004, it came under legal obligation to begin the implementation of EU directives aimed at the reduction and mitigation of climate change risk. As such, a shift in the statutory obligations of the national government brought about a transformation in the approach to risk management within the country.

The 2005 European floods that hit Romania and many other countries in Central and Eastern Europe became an important talking point for risk management policy change. Romania, which experienced the most powerful and widespread floods out of all the affected countries, suffered the highest number of human and economic loss. More than 30 individuals lost their lives during this time, and thousands were left homeless. Total damage was estimated to be around €1.5 billion. The floods revealed many weaknesses in the Romanian risk management system. In particular, they highlighted the need for more integrated policies on water and soil management, and exposed the need for better insurance provision systems. After internal and external pressure, the president had to provide post-relief to the many flood victims on behalf of the national government.


National System for Emergency Situations Management in Romania
Emergency Situations
General Inspectorate
Professional Emergency
Action commander
National Committee for Emergency Situations
Ministerial committees and other central public institution's
County committees for emergency situations
Local committees for emergency

Aside from significant transformations and shifts in government systems and the national legislative framework, the absence of relevant linkages and flows between science and practice in Romania is also related to the lack of coherence in investigating and monitoring landslides. In 1989, guidelines for the elaboration of landslide hazard and risk maps were developed by the Ministry of Local Public Administration. These guidelines, aimed at providing a common methodology for calculating landslide susceptibility, were not successfully implemented among the different institutions working in the field. As a consequence, even to this day there is no coordination or cohesion between the agendas of various research institutes and the government, aimed at systematically investigating and monitoring landslide affected areas at the national scale (Tudor, et al., 2010). Divergent risk zoning practices have led to an undermining of scientific work. Because risk zoning is expensive and private landowners and communities cannot afford to have their properties investigated, many people continue to build in areas exposed to landslide risk. At present, significant financial resources are required in order to systematically assess and address landslide risk on a national scale. However, the current economic crisis has resulted in decreased investment into research and implementation of geo-scientific investigations.

Specifically, problems with the inability of science to effectively influence practice are strongly related to the issue of trust and risk communication. For many years, risk knowledge was not available for land-use planners, contractors and other risk managers in Romania. The relevant data was often retained by the government, and the maps produced and made available to risk managers were often old or inadequate. At times, maps were manipulated by the authorities in order to promote socio-economic development in areas that were potentially prone to landslide risk. Evidence gathered through interviews suggests that corrupt bureaucrats were financially compensated to ignore hazard risk and granted building certificates to powerful interest groups. Romania’s particular political and economic history has resulted in the continuation of practices and norms from the past that make social learning and policy change difficult to implement. Today, most citizens have little trust in the system or policymakers. Too often risk maps have been faked and tampered with, and as a result people have mistrust in the experts and the knowledge produced. The government has historically had an authoritarian and controlling approach to risk management, and there is little or no evidence of dialogue or communication between national and regional authorities, scientific experts, and the public regarding risk management practices.

However, international pressure to change existing practices is growing. Gaining EU membership in 2007 provided a strong external driver for transition in risk management processes in Romania. However, the global economic crisis that began in 2009 resulted in a temporary suspension of this transformation process. Years of rapid economic growth and impressive gains in poverty reduction in Romania have been followed by stagnation, growing imbalances and economic vulnerabilities (Unicef, 2011). Efforts to improve governance, regulation and accountability have declined as priorities have shifted towards providing economic stabilization and recovery. For example, the requirement of the European Water Framework Directive for the implementation of participatory processes has proved difficult to enact in the Romanian context.

In this way, the financial crisis has exposed the continuing power imbalances and barriers to change that have been inherited by the Romanian people. These factors impede effective communication between science and policy, and make it difficult to establish a system of participation, inclusivity, transparency and trust. In terms of landslide risk management, the most problematic issues are linked to data availability and public trust in both scientific risk data and the implementing authorities. At present, there exists scant evidence of a culture of risk communication and participation, resulting in a fractured and largely ineffective regulatory system of national risk governance. However, independent actors such as the Romanian Red Cross are increasingly playing a proactive role in developing coherent risk management strategies to address local level vulnerability and disaster risk. Such efforts offer new hope for the creation of a system of risk management that is participatory and transparent, driven by actors that are seen to be more neutral and trustworthy than the existing state and scientific experts.

4.4 India

India represents one of the most landslide affected counties in the developing world. Landslides are among the major hydro-geological hazards that affect a substantial part of India. Fifteen percent of the Indian landmass, or 0.49 million sq. km, is prone to landslides (NDMA, 2009). The largest number of landslides takes place in the Himalayan region, followed by the Western Ghats and the Nilgiri hills in Peninsular India (Anbalagan et al, 2007). For example, according to Landslide Hazard Zonation Atlas prepared by Government of India, 70% of land in the state of Uttarakhand is designated as a high to severe risk area for landslide hazard. Although such unstable hill slopes are spread across 22 States and 2 Union Territories (UTs) to varying degrees, it is only in recent years that landslides have been considered a major national issue of concern.

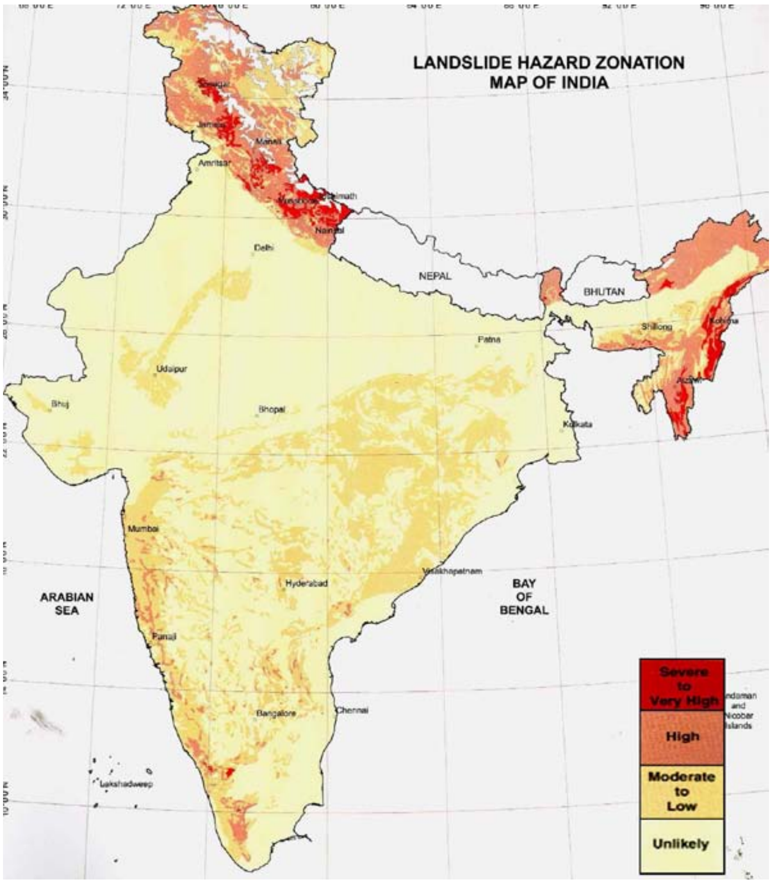


Figure 6: Landslide Hazard Zonation Map of India

Landslide hazard management has, like drought and floods, been characterized by post-disaster relief and ad-hoc solutions for site specific event. The Building Regulations given in 1960 and 1970 provided an important framework for regulating building activities in urban areas and setting technical schemes for constructions, but in particular the policies on landslide risk management has developed over the last two decades.

In India, the evolution of policy and legislation on landslides risk management has taken place in three phases. The first phase started in the 1990s due to an international focus on natural disaster mitigation. When the United Nations proclaimed 1990-2000 as the International Decade for Natural

Disaster Reduction, this new framework became an important trigger point for establishing a National Centre for Disaster Management in India and also at the state level disaster management cells were established in the Administrative Training Institutes of the most effected states. Though this phase did not see development of policies related to landslides in particular, this period set the stage for the shift in paradigm in approaching disaster management that would be seen in later years which would affect the policies and legislation related to landslides at a later stage.

The second phase in India's landslide risk management history was triggered by the 1998 Malpa landslide. The event, which occurred along the Kailash-Mansarovar route in the Kumaon Himalayan region, caused 205 (unofficial estimates consider this figure to be higher) fatalities. Although, there had been many other events the same size as the Malpa landslide, it became a watershed event in terms of landslide risk management because there were many pilgrims and wealthy, high-profile individuals among the victims. The Malpa landslide aroused a lot of media attention leading to many critical questions about Indian landslide disaster management. After the event important spoke persons took the opportunity to push for geotechnical investigations, landslide hazard zonation and mapping and land use zonation and regulations. The event became an important trigger for learning and change, and as a result the National Program on Landslide Hazard Mitigation was speeded up. For many years Indian scientists had been working in the field, but prior to this event landslide hazard management in India was characterized by ad-hoc, ex-post solutions for site specific problems. When the damage of Malpa unfolded in the media, the need for more systematic planning and science was quickly realised. In 2000 the Geological Survey of India (GSI) was identified as the nodal agency for landslide hazard zonation, Department of Science and Technology (DST) was identified as the nodal agency for geotechnical investigations, while the Ministry of Environment and Forest (MoEF) became the responsible authority for land use planning and regulation. Further, the turn of the century evidenced a shift towards a more holistic and integrated approach in landslide risk management. During August 1999, a High Power Committee (HPC) constituted with the approval of the Prime Minister to review the disaster management in the country. However, after the October 1999 Cyclone of Orissa and the 2001 Gujarat/Bhuj earthquake, which respectively caused 15,000 and 20,000 fatalities, some of the important recommendations of the High Power Committee included a draft of the disaster management act, establishment of National Disaster Management Authority and transferring the disaster management function from Ministry of Agriculture to

Ministry of Home Affairs. The commitment of the Government of India to the shift from post-disaster relief to a more proactive approach on disaster management was reflected in The Tenth Five Year Plan (and onwards) document which for the first time had a detailed chapter on Disaster Management and the Twelfth Finance Commission has been mandated to look at the requirements for mitigation and prevention apart from its existing mandate of looking at relief and rehabilitation.

The third phase in India's landslide policy came after the 2004 Indian Ocean Tsunami. The event, which today is known the deadliest natural disasters in recorded history, killed more than 230,000 people in Indonesia, Sir Lanka, India, Thailand and Maldives. The victims came from fourteen countries in total, and in the popular tourist resort of Phuket in Thailand, there was as many tourists as Thai nationals among the dead. The international nature of the many affected people and countries made this a global disaster. It prompted a worldwide response and an intensified focus on natural hazards and risk management. In India, the Disaster Management Act of 2005 and the establishment of the National Disaster management Authority (NDMA) soon followed the occurrence of the disaster. GSI being the nodal agency for Landslide Hazard Mitigation is mandated with assisting NDMA in drawing up the policies, plans and guidelines in case of landslide hazard and advise NDMA in technical matters. In 2009 the NDMA took the initiative to establish a national guideline on landslides to help authorities, district administration, agencies and organizations in preparation of both short-term and long-term planning. At present the Indian landslide Disaster Management policy at least on paper focuses on preparedness, prevention and mitigation, though in practice it still tends to be post-disaster response and rehabilitation.

Figure 7: Timeline of landslide policy and legislation in India

1989 - The General Assembly of the United Nations proclaimed the decade 1990-2000 as the International Decade for Natural Disaster Reduction .

1994 - Yokohama message emphasized that disaster prevention, mitigation and preparedness i.e. integrated disaster management

Phase 1 — International events that influenced national thinking on disaster management

1998 – The Malpa landslide - catalyzed the setting up of task forces by the Government of India for:
Landslide Hazard Zonation (GSI as nodal agency)
Geotechnical Investigations and
Land use Zonation and Regulation

1999 – *August* - a High Power Committee (HPC) constituted to review disaster management in the country
October - The Orissa Super-cyclone

2001 – *January* - The Gujarat Earthquake
October – HPC submitted its report and it recommended:

- Moving from disaster response to preparedness
- Preparing a disaster management act
- establishing NDMA

2002 – Disaster management function transferred from Ministry of Agriculture to Ministry of Home Affairs

2004 - *January* - GSI declared as nodal agency for landslides in the country
December – Indian Ocean Tsunami

Phase 2 — Disastrous events that led to paradigm shift and policy change for disaster management in the country

2005 – Disaster Management Act, 2005 and NDMA came in being; GSI as the Nodal Agency for landslides entrusted with additional responsibilities

2009 – NDMA's national guidelines on landslides and avalanches

Phase 3 — Beginning of Operationalization of the paradigm shift and in disaster management thinking & subsequent policy change

India has a federal system of government. For the administrative purpose, the country has been divided into 35 jurisdictions known as states and union territories. The states have elected legislatures and governments, which are fully autonomous in relation to the sphere of activities entrusted to them under the Constitution. Further, the 35 states and union territories are divided into about 693 districts. Each district is administrated by a Collector and District Magistrate.

Conventionally, relief and disaster management have been federal state concerns, with disaster management seen as the responsibility of local administration, under the supervision of the State Government and facilitated by the Government of India. At the national level, the Ministry of Home Affairs is the nodal Ministry for all matters concerning disaster management. The NDMA is now the apex body for disaster management in the country and is responsible and has the authority for laying down the policies, plans, and guidelines to be followed by Ministries and Departments of the Central Government for all types of disaster management. The NDMA's role is to coordinate the enforcement and implementation of the policies and plans for disaster management and arrange for, and oversee the provision of funds for mitigation measures, preparedness and response. At the State level, response, relief and rehabilitation are to be handled by the Departments of Disaster Management (the State Disaster Management Authority) with an enhanced area of responsibility to include mitigation and preparedness.

The district level is the key level for disaster management and relief activities. After the DM Act 2005, the District Coordination and Relief Committee are to be reconstituted/ re-designated into District Disaster Management Authorities (DDMA) with officers from relevant departments being added as members. At the sub-district level The Disaster Management Committee which draws up the DM plans consists of elected representatives at the village level, local authorities (which include Panchayati Raj Institutions (PRIs) or 'Institutions of self- government', Municipalities, District and Cantonment Boards, and Town Planning Authorities which control and manage civic services), government functionaries including doctors/paramedics of primary health centres located in the village, primary school teachers etc. The Disaster Management Teams at the village level will also include members of youth organisations and other nongovernmental organisations as well as able bodied volunteers from the village. There are various other institutional stakeholders involved in disaster management at multiple scales across the country. These include the police and paramilitary forces, civil defence and home-guards, fire services, ex-servicemen, nongovernment organisations (NGOs), public and private sector enterprises, and media and radio operators.

Building Regulations and bye-laws are state legislations as the State is considered competent to legislate and make laws on such subjects. Traditionally, the National Building Code prepared by the Bureau of Indian Standards in 1970 and subsequent revisions were advisory in nature and not mandatory. Due to lack of adequate or no land use restrictions in hazard prone areas in town and country planning laws, cities have expanded in all directions, occupying even the most vulnerable areas which has resulting in increased levels of risk to natural hazards. As a result, recent efforts have been made to establish comprehensive techno-legal regimes with appropriate provisions for safety against natural hazards. In theory, regulation for land use zoning is meant to have an overriding effect on any other regulation. However, in reality, implementation of such policies is weak and problematic.

Land slide science research has developed relatively independently from risk policy and legislation in India. The Geological Survey of India carried out the earliest landslide studies in India in 1880 and 1890, which included the study of the Nainital landslide by British geologists, Sir R.D. Oldham and C.S. Middlemiss. Most related research traditionally evolved in universities and centres located in the hilly, landslide prone terrain of the country, showing a close correspondence between emergence of relevant science and immediacy of the risk problems faced (hazard profile) in the area. In the last few decades, the scientific studies related to landslides in India have been conducted by a number of different national and sub-national research organizations and universities. Despite all these studies, only 10% of the landslide prone area of the country has been mapped. In 2004, the Geological Survey of India (GSI) was designated as the nodal agency for landslide hazard assessment in the country and by 2009 it had completed covering LHZ mapping at the macro[1] scale for about 49,000 sq km (10% of the total landslide hazard prone area) in India. While hazard zonation and inventory mapping had been undertaken in parts of the country by different institutes and researchers, there was no consolidated hazard mapping for the entire country till 2003. Though this

[1] *Macro scale* (1:50,000 to 1:25,000 scale appropriate for regional planning purposes); *Meso scale* (1:10,000 to 1:5,000 scale appropriate for town planning); *Micro scale* (1:1000 or larger scale appropriate for study of individual slope)

effort identifies the major areas in India prone to landslides, the scale of the map is too small for it to be useful for any regional or local level planning.

Interview data suggests that, in a way, hazard zonation maps exemplify the multitude of problems associated with landslide risk management practices in India. The relevance of any scientific research to a policy-making process depends on the potential of its results to affect policy choices. In India, the current state of scientific enterprise in risk mapping and hazard zoning and underlying uncertainties in the data make it difficult for policy makers to apply the scientific results in their policy practices with any confidence. Another issue which affects the relevance of the research for policy making is whether the scale (e.g. spatial or map scale in case of LHZ mapping) at which the scientific study has been done matches the scale at which the decisions need to be made by the policy makers. In India, a mismatch between hazard zonation mapping and policy needs has led to research outputs being incompatible with policy and practice processes. In addition, the maps and their associated research outputs are usually in a form that is not easily understood by practitioners, which also acts as a barrier to compatibility of research with policy process. In addition, in a number of cases scientists completes a research project and submit the report to the relevant funding agency. The scientist usually has no control over who uses the report and how the results are disseminated to the relevant users. Lack of accessibility of risk data, and a tendency towards compartmentalisation and lack of communication between departments results in the limited application of hazard zonation maps. In summary, the application of hazard zonation maps as a tool for overall risk management practices remains weak and disjointed in India, much like the general risk management framework at the national level.

In India, the shifts in policy and legislation can be seen as a result of abrupt change or shocks. Changes have either taken place after disastrous events, or have resulted out of incremental and more proactive changes in Indian landslide policy due to an increasing national and international focus on the relationship between natural hazards and climate change. The issue of political representation is also key to understanding the hitherto low priority received by landslides in India in contrast to other natural hazards such as flooding and drought. Proportional parliamentary representation means that states affected by landslide risk, usually small in size and population, have fewer seats in parliament than other regions. According to one estimate by Sharma (2010), the total number of seats held by the Uttarakhand (a landslide prone Himalayan state) is about 5 out of a national total of 540 members of parliament. In contrast, the state of Uttar Pradesh (which faces the problem of floods and droughts) alone has 80 representatives in parliament. This results in inequities in political representation and the prioritization of policy needs of the landslide prone smaller states.

The problem for science to feed into practice is related to several aspects. First of all, while scientists have produced many landslide and hazard maps, and a smaller number of risk maps, only 10 % of landslide prone territory the country has been investigated. Because India consists of 28 states and 3,000,000 sq. km, of which .49 million sq. km is landslide prone, it would take a lot of money and time to map the entire country. As a consequence, there are relatively few detailed maps available for risk managers in local communities.

Second, because there exist different ways of defining hazard and risk among the mapping authorities and scientists, there is no general consensus on how to make and understand hazard and risk maps. This is problematic since it would result in differentiated practices among planners and, in turn, loss of credibility in scientific enterprise. Facet based LHZ methodology (Anbalagan, 1992) that was initiated at the University of Roorkee (now the Indian Institute of Technology, Roorkee), after some modifications, was adopted as the Bureau of Indian Standards code for Landslide Hazard Zonation Mapping in India at the macro-scale (1:50000 to 25,000 scale) in 1998. The methodology provided by the Bureau of Indian Standards (BIS) through IS–14496 (Part 2): 1998 code has been followed to carry out landslide hazard zonation mapping in different parts of the country by the nodal agency GSI. After covering some areas following these BIS guidelines, it was felt that certain parameters need modification and these are currently under review. Most scientists felt that the Landslide Hazard Zonation Methodology is an evolving process and there was no consensus among the scientists about which is the most effective or best methodology for Landslide Hazard Zonation.

A third problem relates to risk managers' lack of access to risk data. Because the military has classified the Lower Himalayas as a region of national security, there is very little information about these areas that is made accessible to risk managers. Currently, time-consuming bureaucratic procedures have to be followed to get access to these hazard maps, and as a result most decisions are made without specific knowledge about hazards and risk. The Geological Survey of India plans to establish a web-portal which gives risk managers and others easy access to risk data, but at the moment this is very difficult to achieve because of the tense geopolitical situation between India and its neighbouring countries.

But even where landslide hazard / risk zoning is available, there may be poor implementation of such zoning. The high hazard or risk zones often imply building restrictions. Strong evidence emerged that these building restrictions were violated in Nainital, a town at the foothills of outer Himalayas, where many illegal constructions have arisen in no time. The town located at the shore of Naini Lake is a tourist hotspot and consequently there are many large scale interests involved in developing the area. The area has for a long while been known as high risk. In 1880 a landslide buried 151 people in Nainital, but instead of taking actions against illegal building activity responsible authorities have tended to turn a blind eye often in the name of economic and developmental interests. Because population pressures have increased in recent years and the number of poor people is high, many people have built houses on the unstable slopes as they can’t afford to build in safe zones and the opportunity cost (in terms of earnings) of relocating to another safe town nearby would be too high. In addition they felt that it is not as if these risky areas would remain empty – the opportunity forgone by them would be taken by somebody else. With regard to their safety, they adopted a fatalistic attitude that whatever happens to everybody on that risky slope would happen to them, they would not be alone in facing the impacts. There have been some successful attempts by the civil society to restrict such illegal construction, when one activist won the public interest litigation to demolish the illegal construction in high hazard zones. However, the scale of attempt, while commendable is still quite small compared to the scale of the problem.

In a country with a large population where most people live below the poverty line, the moral dilemma between allowing social-economic development and enforcing strict building regulations is the economic reality faced by the authorities. It seems that they often have little choice but to choose the first alternative. However, the country is slowly moving towards a more sustainable landslide risk management system. This is, in part, recognition of the fact that India is severely affected by climate change and it will have to work out better landslide risk management and mechanisms for reducing the impact of the landslide hazard and adapting to climate change.

4.5 Norway

Norway's topography and geological history makes it vulnerable to snow avalanches, quick-clays and rock falls causing tsunamis. Over the past 150 years, more than 2000 people have lost their lives due to landslides. In Norway, landslide risk management has largely been engaged by the Ministry of Local Government and Regional Development, the Ministry of the Environment and the Ministry of Agriculture and Food through *The Planning and Building Act* and *Act on Natural Damage*. These two Acts, which both came into force for the whole country in the 1960s, were triggered by some of the most disastrous landslide events in Norway's history; Verdal 1893; Loen 1905 and 1936, and Tafjord 1934.

The Acts appointed restrictions regarding building and constructions practices and obliged private landowners and municipalities to carry out protective measures against natural hazards. It also established people's right to compensation caused by natural perils. In order to ensure that the new legislation came into practice, the *National Fund for Natural Disaster Assistance* was established. Its function was to provide support for the investigation of hazard zones, to contribute to the investment of protective measures and to pay compensations for natural hazards. After 1980, the public fund for natural disaster damages (National Fund for Natural Disaster Assistance) was combined with the private natural disaster insurance scheme (The Norwegian Natural Perils Pool) to create a dual compensation system for natural disasters. Who replaces the damage depends on whether the object can be insured or not. Under the Natural Disasters Insurance scheme, all buildings and movable property insured against fire damage are automatically insured against natural disasters. The scheme is administered by the Norwegian Natural Perils Pool where all insurance companies in Norway are members. Everybody is charged the same premium rate in order to cover the risk of those who live in vulnerable areas. Damages are normally compensated in full unless the owner has s displayed gross negligence. (The Act on Natural Damage does not include damage on motor vehicles, boats, ships and some other objects. Compensation for these depends on a person's regular insurance coverage). Replacements of valuables that cannot by insured against fire are covered by the National Fund for Natural Disaster Assistance.

The legislative phase in Norwegian landslide risk management was followed by a phase with geo-scientific research and mapping. As a consequence of the quick-clay slide in Rissa in 1978, the

Government decided to start a National program for hazard mapping to be applied in land-use planning. The assignment to make hazard maps for quick clays, rock slides and snow avalanches, was given to *Geological Survey of Norway (NGU), the Norwegian Geotechnical Institute (NGI)* and the *Norwegian Mapping Authority.* In the 1985 revision of the Planning and Building Act, planners and contractors were requested to make use of these maps. However, because the mapping project was going slowly and there were few maps available for them, the maps were not made legally binding in the Act. In many communities new projects was approved on insufficient grounds.

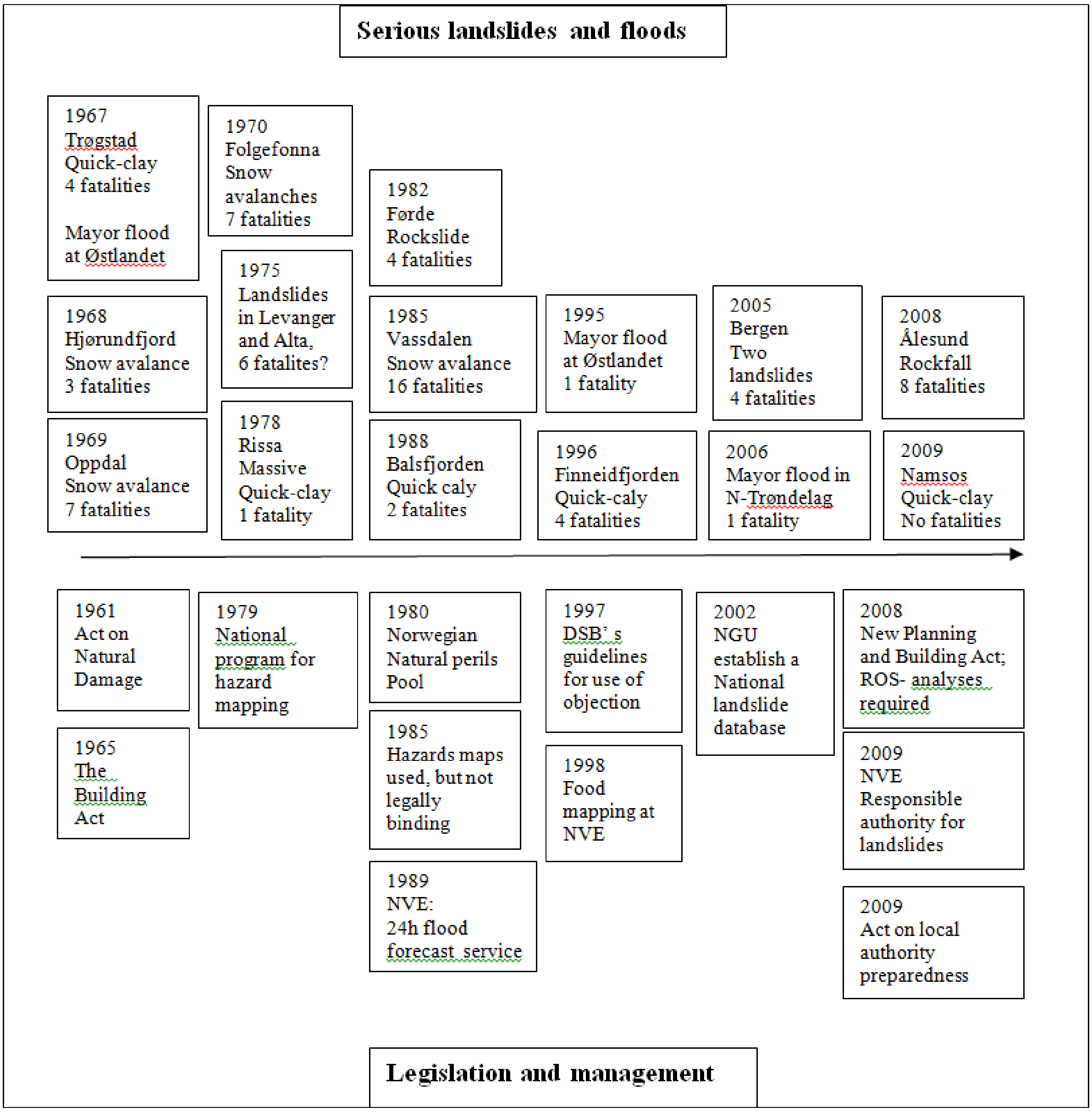
At the beginning of the century several serious landslides events demonstrated that the legislation and implementation of the Planning and Building Act was too weak. For instance, in 2008 a solid rock crashed into an apartment building in Aalesund. The event caused five fatalities and significant economic losses for the residents. The committee that was appointed after the accident concluded that the rock fall was directly linked to a weak building- and construction plan. The accident should, to a great extent, contribute to a review of the legislation and an intensified focus on community preparedness. *As a result,* risk and vulnerability analyses were made legally binding in the *Planning and Building Act of 2008.* Today, the building council of the municipalities must provide a proper geotechnical investigation before they can start to build. If building permissions are approved in an area known to be hazard prone, the local community will be responsible for any losses.

The Norwegian landslide risk policy has also to a great extend been changed due to the Aaknes/Tafjord project in Western Norway. In 2000 the County Governor in Møre and Romsdal County received warnings about an unstable rock slope at Aaknes. People living along the fjord feared that they were facing a new big rockslide which could result in a tsunami in the Storfjord region. Initial investigations of the fracture at Aaknes in the 1990s had concluded that there was no risk related to the site, but the fracture had extended noticeably since 1950s and local residents questioned the findings. Local pressure resulted in a second round of investigations. In 2003, the new scientific report concluded that the unstable rock slope at Aaknes was at high-risk and that a potential tsunami could affect 20.000 people living along the fjord. The result triggered an intense scientific push for the implementation of an early-warning system. In 2007, with financial support from the government, the local communities in the Storfjord region established the Aaknes Early-Warning Centre.

Another event that became a trigger point for policy change in Norway was the 2009 quick clay in Namsos. The slide was provoked by blasting in connection with road work. After the event an independent inquiry was initiated to examine whether the guidelines for road work had been followed, and to consider the need for change. The report revealed shortcomings in the mapping and assessment of the area's stability. Moreover, it revealed an unacceptable project culture among many contractors and developers with financial gains prioritised at the expense of safety (Nordal, et al., 2009). Consequently, in order to improve control routines and ensure the application of uniform standards in all development projects, a decision was made to introduce a third part control for areas prone to quick clays. In connection with the third part control, scientists worked out guidelines to be followed by all contractors.

In Norway, the Aaknes case has been important in terms of triggering a new landslide management system at both the local and national level. The case aroused enormous interest among other communities facing similar challenges, and resulted in an intense national, regional and local debate about the need to develop effective monitoring, warning and evacuation systems. However, it was the repeated and intense media interest, which included sensational talk of ‘monster waves’ in news, combined with the 2004 Indian Ocean tsunami that consolidated the focus on natural disasters and risk management. Without these two factors, the responsibility for risk management at Aaknes could potentially have been passed around the many different ministries working with landslide risk without any resolution. The Indian Ocean tsunami, in particular, led to increased attention towards monitoring and warning systems, and evacuation plans, and increased financial funding for emergency planning at Aaknes.

Figure 8: Timeline of landslide risk management in Norway



Further, the many bureaucratic problems experienced by those working with the Aaknes/Tafjord project at the local, regional and national level reveal the need for better coordination and organisation of landslide management in Norway. In 2009 the Norwegian Water Resources and Energy Directorate (NVE) was assigned as the responsible authority for both floods and landslides. This change signalled a shift towards a more holistic and integrated landslide risk management approach. As a result of the boost given by the Aaknes/Tafjord project, there also seems to be increased dialogue between authorities at the local, regional and national level, as well as a more open attitude towards the participation of civil society. The Aaknes case is not only interesting in terms of being a tipping point for political change, but also as a case study on the meaning of trust and trust building in landslide risk management. While risk had been downplayed in the 1980s and 1990s, it is possible to observe a shift in the approach of local and regional authorities at Aaknes after 2000. The undeniable widening of the fracture at an accelerating rate led to the initiation of an open dialog with local people. Local authorities and scientists arranged several public meetings on risk management and the proposed scientific solutions to mitigate this risk. This shift towards risk communication and participation to a great extent re-established public trust in the local authorities and knowledge producers, as well as increased trust in the technology used to monitor and alert people about the risk. Lars Harald Blikra, the scientific leader of the Aaknes/Tafjord project, said that:

> *At first many people felt unsafe, and all the publicity about worst-case scenarios made a bad worse, but then we started to organize public meetings where people learned more about the risk and how we were going to monitor it. When they understood that we could predict the rock fall in time to evacuate the area they calmed down. …. In the Aaknes case we have not been afraid of letting people know about the risk and in the long run this has shown to be a good strategy. It was in some way necessary to attract media interest and to let people know about the monster-wave, and I am sorry that this caused unnecessary fear, but the situation was precarious and we had to act fast to raise money for local disaster preparedness.*

There is reason to believe that there has been a shift from a top-down authoritative approach to a more inclusive tone in Norwegian landslide risk management. Today, scientists seem more willing to include people from the local community and inform them of the risk and steps recommended by the experts to deal with it. Because of a growing awareness about the risk of natural hazard it has also become more important for them to involve all parties, listen to their experiences and take their risk perception seriously.

What we see in Norway is that it has been different tipping points for policy change in landslide risk management. Change has occurred as a result of political pressure from policy entrepreneurs and the media, as a consequence of serious landslide events, and out of a compulsion to act on the problem. Further, the Norwegian case demonstrates that change has at times been driven from the bottom up by civil society and local and regional advocacy groups, or as a response to local people's fear about living in an area with a high-risk classification. Overall, the study reveals that the progress in Norwegian landslide risk management has been driven forward by major accidents and, in recent years, the risk of large rock falls. The changes in the policy domain can mostly be characterized as a reactive approach to risk, rather than a proactive engagement with risk. However, in recent years it is possible to observe changes calling for a more integrated approach to floods and landslides. Both the implementation of the Directive on the Assessment and Management of Flood Risks and the establishment of NVE as the Directorate for floods and landslides show that the authorities take the threat of climate change seriously and that they are more concerned about making better and more robust plans for the future. By signing the Water Framework Directive in 2007, the Norwegian government also agreed to a more concerted and coordinated management of flood risks.

Thus, the Norwegian landslide risk management system displays openness and flexibility, and a high level of preparedness for changing policy direction in order to overcome a problem, rather than resistance to change. As an egalitarian society with small power distances between the powerful and the less powerful, it is relatively easy to implement a system based on participation, transparency and trust in Norway. Obstacles in the way of science to feed into the practice domain relate to a lack of geotechnical competence in the communities. Today, land-use planners and risk managers have many technological tools and easy access to risk data that are helpful in the planning process. However, risk managers in the communities do not necessarily know enough about the technical aspects of natural hazards and the implementation of scientific data in the policy domain. It is also important to note that in many small communities it is difficult to follow the rules set out in the legislation, as these communities lack both competence and money to deal with landslide risk management in a safe way. Another problem for scientist to feed into practice relates to risk assessment practices. One big problem with today's mapping is that it is lacking a common methodology. The terminology used in risk and hazards mapping is not based on the same definitions, which means that there is no coherence in the mapping industry. This is most problematic as people are not treated the same way when they, for instance, have their building applications considered by the bureaucrats. To build trust in the institutions and the risk maps produced it is important to agree on the definitions to ensure same practices and equal treatment of the law. A similar problem with current state of mapping is that it is not of the appropriate spatial resolution. To secure better planning and reduce the number of conflicts between the authorities and the public, it is important to have more detailed risk maps, especially in areas that are under pressure. Currently, local residents often question the reliability of the hazard and risk maps because they go against local knowledge about risk. It is believed that better risk communication between the experts and the locals can contribute to better understanding for the risk zoning practices and that implementation of local knowledge can build greater understanding of where to draw the lines between moderate risk and high risk.

5. The cultures of learning and change

The five case studies provide insight into the differentiated forms and pathways of landslide risk management that evolved in separate policy contexts. Each empirical study, whether from within the EU or outside, reveals the significance of international directives, government change, and/or new economic situations on landslide risk policy. In one form or another, issues of trust, uncertainty, awareness and learning feature in each narrative as signifiers of the relationship between science and policy, and that of science and policy with the public. The myriad points of formal and informal interactions between experts, policy makers and the lay person were often found to be mediated by the influence of interest groups, media, public salience and technological innovation. Some of the more pronounced trends and commonalities that link the evolution of risk management practices in the five case countries are described below. These themes emerged from an investigation of both theory as well as the empirical data from the case studies. Although connected and interdependent, they can be differentiated into two categories: systemic risk dynamics and managerial risk dynamics.

5.1 Systemic dynamics

5.1.1 Role of Science and Scientists

The development of landslide risk science, and the engagement of scientists with policy makers were crucial in informing the dynamics of land slide risk perception and management in each national context. In France, the role of BRGM as a centre of technical expertise that advises but remains independent of policy systems points to a more traditional and linear understanding of scientific knowledge in the country. The division between expert and non-expert is maintained, and technical knowledge is assumed to be value-neutral. In this way, landslide risk science has developed in communication with policy, but the flow of information is largely one way and assumed to be value-neutral.

In Italy, the development of landslide risk management policies was directly impacted by the input of scientists and experts. The role of boundary organizations (see section 3.2) such as the De Marchi Commission, and later the National Group for Hydro-geologic Disasters' Defence (GNDCI), brought together for the first time experts in hydrology, engineering, geology, and planning. The interdisciplinary approach adopted in science transferred into the policy sphere, as the efforts of the commissions led to the creation of a comprehensive and multi-sector approach to water and soil management and local emergency preparedness in Italy for the first time. The scientist's recognition of the social determinants of risk also resulted in a shift in policy management of emergencies, with focus placed on public order rather than technical solutions alone. Scientific impact on risk legislation points to the relatively open channels of communication that existed between science and policy during this time. To a great extent, land use science and policy developed in conjunction with each other in Italy, pointing to the co-produced nature of landslide risk management in the country.

In contrast, until recently land risk science in India had developed independently from policy developments on landslide management. Initiatives to produce risk and hazards maps remained localised and fragmented, with poor access to information and scarce communication links between policy makers and research organizations. Only in the last decade, concerted efforts are being made to bridge the gap between policy and science domains related to landsldies in India. A greater focus on the improvement of scientific information on landslide risk has come about through a shift in policy priorities, highlighting the mutually reinforcing and co-production nature of science-policy construction in the country. In Romania, independent scientific initiative led to the production of hazard maps by the Institute of Geography of the Romanian Academy, but a lack of interest on the part of the government meant that the maps were never integrated into land-use planning. The lack of coordination or cohesion between the agendas of various research institutes and the government led to an undermining of scientific work, and provided yet another example of how political contexts impact the development of scientific knowledge construction.

As such, it is possible to generalise that publicly recognized scientific communities and knowledge, and open channels of communication between science and policy have led to better risk management systems in France, Norway and Italy. However, the effectiveness of these systems is still mediated by institutional structures and individuals agency. For example, despite good communication flows and exchange, a complicated system of risk governance and responsibility in Italy hinders the conversion of technical knowledge into practice.

5.1.2 Systems of Governance

Each case study reveals the contingent and discursive nature of policy development emerging in specific political contexts. For example, land risk policy underwent a long and protracted process of development in Italy. A decentralised system of government, with representation from national, regional, and local scales has resulted in a greater level of civil participation, along with input from technical experts and scientists. However, the complex division of administrative authority and structures of local governance have been critical in shaping the effectiveness of Italy's risk management regime. Multiple layers of authority have resulted in the creation of overlapping responsibilities and conflicting interests, which impede the effective implementation of risk management practices. In contrast, France has a highly centralized structure of governance with legislation led development and clear chains of responsibility. Although the uniform application of a singular risk management regime to a geographically and socially diverse territory has led to inflexibility, hierarchical division of authority has created accountability and transparency in the system. Similarly, risk policy development in Romania was deeply affected by the changing political regimes in the country. It developed from ad hoc response during communism and the Ceausescu years, towards an integrated and participatory risk management regime after Romania's entry into the EU. However, continuing power imbalances and barriers to change have been inherited by the new system limit the future development pathways of risk policies in the country.

In India, the representative parliamentary system of democracy has indirectly resulted in diminished prioritisation of landslide risk policy. Since the states at risk of landslide hazard represent a small demographic minority, their ability to influence policy developments is restricted. Therefore, although landslides pose a severe threat in parts of the country, the political system limits the policy options available for risk management. In this way, the political and social context of a place and the historical trajectories of policy development appear to affect the outcomes of its risk management regimes, and influence the availability of policy options for the future. As discussed in Section 3.4, the policy structures and political dynamics found in individual contexts produce differentiated cultures of risk management across national boundaries.

5.1.3 External Shifts and Shocks

The land slide management systems of all the five countries were affected by external shifts or shocks that transformed scientific and policy practice. The implementation of EU-directives and increased pressure from the European Union to develop comprehensive risk management strategies were important triggers for countries such as Romania, Italy and Norway. In India, developments in the international domain and UN bodies' emphasis on addressing climate change risk and develop disaster response strategies influenced the new national disaster management strategy. When the United Nations proclaimed 1990-2000 as the International Decade for Natural Disaster Reduction, the new framework became an important catalyst for reviewing the disaster management policies in the country establishing a National Centre for Disaster Management in India. Later, 1999 Orissa super cyclone, 2001 Bhuj earthquake and 2004 the Indian Ocean Tsunami sped up the passing of the Disaster Management Act, 2005, creation of NDMA and a Disaster Mitigation Fund and a Disaster Response Fund.

However, this policy reform in India is slow to translate into practical initiatives to address land slide risk. Local resistance and cultural opposition to risk reduction mechanisms imposed from above call into question the effectiveness of such transformations of risk policy. This demonstrates how although disaster events and external shocks appear to result in a direct change in landslide risk policy, thereby supporting the linear, disaster-driven model of policy change advocated by Birkland (see section 3.3), increased public salience and policy reform do not automatically produce long-term and sustained shifts in risk management. Instead, the data in the case studies reveals that the relationship between disaster shocks and policy shifts is additionally affected by a host of mediating factors, such as public resistance in the case of India, and short-term policy action does not necessarily translate into real transformations in the policy and science domains.

5.1.4 Access to Data and Trust

While land-use planners and risk managers have full access to risk data in Norway, Italy and France, there is a lack of trustworthy or accessible risk data in Romania and at times India (for example, in areas classified as sensitive for national security purposes by the military). In order to construct a suitable and effective landslide risk management it is essential to have comprehensive and reliable information that is available and easily accessible to all parties concerned. The study shows that landslide risk management and development suffer due to a lack of available information and transparent data. Cases in point include Romania and India where the government has in the past held back important risk information, and often uses outdated data in land use planning.

The Aaknes case in Norway has showed that participatory processes and open dialogue with the public are important in trust building and information flow, which ultimately increased local preparedness. Trust in scientific data is eroded if it contradicts local knowledge and local perceptions of risk. In Aaknes, scientific investigations in the 1990s concluded that there was no risk of landslides present in the area despite local protestations to the contrary. In 2003, a second scientific evaluation found the area to be high risk, resulting in contradictory information that undermined the overall credibility of scientific risk evaluations. The inclusion of local residents in risk evaluation led to improved knowledge and increased trust on both sides, highlighting the advantages of a more co-produced model of risk knowledge construction and management.

Also, in Romania and India, as well as Italy, governments have proved ineffective in controlling illegal building activity. They have failed to follow up on the lax implementation of building regulations, which in turn means that the public and contractors question the legitimacy of the legislative acts. This has resulted in a lack of trust in the efficacy and process of risk management in the country. Lack of dialogue and access to risk data can lead to fundamental mistrust of scientific experts and their technical knowledge. This, in turn, results in low enthusiasm for new policies, as well as poor communication between risk managers and the public.

5.2 Managerial dynamics

5.2.1 Landslide Risk Legislation

Legislation and its implementation are also practiced in different ways across countries. While laws are followed and to a great extent put into practice in Norway and France, the Romanians, Indians, and to some extent Italians, are more pragmatic in terms of allowing unregulated building activity in risky areas. The need for economic development, often in poor rural communities, has given entrepreneurs and developers a lot of power, and in many regions, and the irregular and selective application of laws, and corruption pose a serious threat to establishing a more robust and sustainable landslide risk management system. In India the authorities are perceived as being weak since they are not able to enforce land risk laws. However, economic trade -offs mean that many countries, especially those with limited financial reserves, are often forced to prioritise economic development in order ensure the welfare of their populations and to bring about social and economic development. This juxtaposition of priorities, of course, makes it rather hard to establish good practices for landslide risk management.

5.2.2 Risk Mapping and zoning regulations

An area that requires action in most countries for the improvement of landslide risk management is related to mapping. In most case study areas, existing mapping methodologies lacked uniformity and coherence, and differentiated applications of these maps undermined the credibility of risk data. Another major concern was the availability and access to reliable risk data (see section 5.1.4). A demand and supply mismatch of information in terms of scale relevance and content needs of policy makers and the public limited the useful application of such data. A lack of reliable data and tools that could help planners and risk managers to act responsibly and consistently was an issue in countries such as Romania and India.

The production, access and utility of risk maps in each of the case study areas provided a window into the construction of science, and the process of science-policy communication. Risk maps, fundamentally, are spatial representations of risk assessments. In Aaknes in Norway, until 2003 these were constructed independently of local consultation, relying solely on scientific 'expertise' for risk estimation. Such a technical and hierarchical approach of risk management led to the alienation of local stakeholders and general public mistrust in risk science. Engaging local communities in the process of risk assessment and evaluation has allowed for the construction of more accurate risk maps reflecting social as well as physical risk. In this way, participatory practices, smaller power distances, and decentralised construction of risk allows for increased resilience and public trust in risk science.

In India, risk maps are available for only a small percentage of the country. Disagreements over the definition of hazards and risks among mapping authorities and contractors has meant that there is not a general agreement about how to make and understand hazard and risk maps. This is problematic since it results in different practices among planners and, in turn, leads to a loss of credibility in scientific enterprise. Risk map science appears to be subjective and inconsistent, raising questions about the assumptions of scientific truth underpinning technical models. Instead, the process of risk estimation and risk science, as embodied by risk maps, reveals itself to be subjective and co-produced by social and political influences (Jasonoff 2004).

In Romania, lack of political accountability during the Cold War era and a culture of corrupt political practices have led to risk maps being viewed with distrust and suspicion. Large historical power distances between citizens and the state persist into the present (Hofstede 2001), and a general lack of trust in state regulation has undermined public belief in the scientific neutrality and accuracy of risk maps. Although pressure from the EU has resulted in efforts towards strengthening risk management and mapping processes in Romania, much of these policy changes to be limited to single loop learning (Argyris and Schon 1978). Second loop learning, or reflection on larger system failures, is not yet part of the policy reform process. The 1989 national guidelines for calculating landslide risk and producing risk maps have not resulted in a comprehensive and coherent system for risk estimation and regulation because there is no coordination or linkage between the institutional agendas of policy makers and scientific researchers.

Although risk maps exist for a large percentage of Italy, most of the mapping has been done without using formal tools of risk assessment. It is unclear whether the process of risk evaluation was based on expert judgement or local interventions. The lack of a consistent scientific methodology for constructing risk maps points to the absence of value-neutrality in risk estimation, and the locally contingent and non-linear nature of scientific knowledge.

In many ways, risk maps exemplify the problems of knowledge construction and risk communication between technical experts and the general public. The country case studies reflect the uncertainty implicit in risk maps, and the influence of politics, institutions and interests on risk mappers and scientists. As a visual representation of risk assessment, risk maps highlight the limitations of useable scientific information, and the co-production of science in landslide risk management.

Media and Public Salience

As evidenced in the Norway and India case studies, the media can play an instrumental role in altering the direction and speed of landslide risk management policies. In Norway, media stunts such as continuous coverage on the possibility of 'monster waves' in the news, and great level of media attention devoted to the 2004 Indian Ocean tsunami triggered a stronger reaction by the public. Without the media being focused on natural disasters and risk management, the hazard risk in Aakneset could easily have escaped the attention of mainstream discourse and politics. Similarly, in India most landslides remain outside the focus of national public opinion despite incurring large losses to human life. The Malpa landslide gained national attention because the fatalities included a number of prominent personalities and celebrities. This led to a high level of media focus, which in turn raised the public salience of landslide risk and management practices in the country.

Similar media coverage in Italy of landslides in a town neighbouring Nocera highlights the role of the media in affecting risk management and policy. Increased public salience resulting from media coverage in the news can focus attention on failures in policy, as advocated by Birkland (see section 3.3), thereby facilitating the creation of windows for policy change.

5.2.3 Finance

Economic pressures and the availability of funds are factors that affect the development of risk management policies. In Norway, for instance, the Aakens early warning system was an enormous financial strain on the municipal council budget. Even though there was a strong culture for risk management and change in Norway, landslide risk management were criticised because it was too expensive for the communities to carry out protection works and have their areas assessed, mapped and monitored. Similarly, in Romania risk zoning is expensive and since private landowners and communities cannot afford to have their properties investigated, many people continue to build in areas exposed to landslide risk. Significant financial resources would be required to systematically assess and address landslide risk and progress on this front has subsequently slowed down since the onset of the current economic crisis.

6 Insurance

The availability of insurance mechanisms played a major role in landslide risk management practices. France and Norway both have strong insurance systems integrated into risk management legislation. France has a public re-insurance system, and the national disaster compensation fund is drawn from contributions from this insurance scheme. This provides an economic buffer for policy makers and the public during disaster recovery and post-emergencies. Similarly in Norway, the public-private partnership on insurance provides a financial safety net for most disaster situations. In Italy there is no private insurance available for landslides. In case of emergencies, the Italian government intervenes directly by providing post-disaster financial aid and enacting ad hoc laws for recovery. However, as demonstrated in the L'Aquila disaster where compensations were huge, all too often this means that the government does not have sufficient funds for disaster relief and recovery. In the case of earthquakes, Italian legislation actually requires significant (100%) compensation to victims. This is a very strong safety net but is a heavy burden on state finances. As a result, in Nocera compensation has been promised but not paid, which reduces the effectiveness of this public safety net.

Overall, these themes offer only a starting point into uncovering the structures and dynamics that mediate the relationship between landslide science and policy, and the factors that lead to techno-sociological transformations in different cultural and political contexts. Further investigations into the role of the media or insurance, for example, need to be undertaken to better analyse the development of landslide risk policy. The differentiated experiences in each country context point to the importance of socio-political dynamics in affecting the outcome of scientific and technical solutions to landslide risk. Although the five case studies successfully demonstrate the role of culture in shaping risk management, greater and more in-depth empirical work is necessary for understanding the specific contextual conditions that result in the precedence of one policy outcome over another in any given location.

7 Conclusion

This study has investigated the social and cultural contexts that shape landslide risk management. By examining science policy interaction and communication, an attempt has been made to understand the process of engagement whereby science impacts policy and vice versa. Models of knowledge construction, pathways of policy change, and the impact of policy structures on trust and learning can be applied with varying degrees of success to the different country contexts used to illustrate the empirical experience of landslide policy across Europe and India. Differences in social, political, and scientific cultures have resulted in varied and diverse landslide risk management practices in each country. Undertaken by five locally embedded researchers, the individual case study reports have served to highlight the role of mediating influences that affect the development of scientific and policy measures for addressing landslide risk in different political and social contexts. Together, they provide an interesting – and first of its kind - initiative for building a comparative analysis of landslide risk management practices both in the scientific and policy realms of five different national contexts.

Several key triggers and dimensions of change and learning in risk management policy have been outlined in the preceding section. These discussions offer an entry point into understanding the processes of coproduction between science and policy, and are in no way comprehensive or complete. Although linear and technical understandings of science and policy continue to be prevalent in risk management discourses, and attempt has been made to better understand the drivers of change in risk policy, the complex negotiations and tensions that underscore the multi-nodal relationship between science, policy makers and the public, and the manner in which socio-political structures and the agency of individuals impacts the outcomes of risk communication and management. Moving beyond the concept of value-neutral science and linear, disaster-led policy change allows for a more accurate construction of social and technical risk, and pulls in locally relevant and diverse sources of risk knowledge that are vital for the implementation of international standards of risk management practices that filter down to the local level adaptive practices and resilience of communities.

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Annex I

Each case study faced particular challenges and opportunities for gaining access to interviewees from research, policy development and management communities at national and local levels (and sometimes also intervening regional levels of science and governance). The lists presented in this annex were derived from the Italy case study and are intended to be illustrative of the range of stakeholders whose views and experiences have formed the basis of this report and underlying analysis.

SAMPLE LIST OF INTERVIEWEES (ITALY CASE STUDY)

National level		
Prof. Paolo Urbani	Professore Ordinario di Diritto Amministrativo e Diritto Urbanistico, Universita' LUISS- Roma, Università di Chieti "G. D'Annunzio", Università di Roma	Professor of Law (administrative issues and urban planning), University of Roma and Chieti
Prof. Leonardo Cascini	Professore Ordinario di Geotecnica, Universita' di Salerno	Professor of Geotechnical Engineering, University of Salerno
Prof. Michele Zazzi	Professore associato di Pianificazione urbanistica e territoriale e Coordinatore del gruppo 183 (Associazione Onlus per la difesa delle risorse idriche)	Professor of Urban Planning and coordinator of the Group 183 (NGO for hydro-geological resources defence)
Dott. Renato Villalta	Segretario Generale dell'Autorita' di Bacino della regione Friuli Venezia Giulia	General Secretary of the Basin Authority of the region Friuli Venezia Giulia
Dott. Francesco Puma	Segretario Generale (*a seguito di delega conferita dal Ministro dell'Ambiente)* dell'Autorità di Bacino Nazionale del fiume Po	General Secretary of the river Po National Basin Authority

Prof. Massimo Veltri	Presidente del Comitato paritetico per l'indagine conoscitiva sulla difesa del suolo in qualita' di Senatore della Repubblica	Head of the Enquiry Parliamentary Commission on Soil Defense, Senator of the Italian Republic
Prof. Mauro Renna	Professore Ordinario di Diritto Amministrativo, Università degli Studi dell'Insubria	Professor of Law (administrative issues), University of Insubria
Prof. Paolo Canuti	Gruppo nazionale per la difesa dale catastrofi idrogeologiche (GNDCI) – gia' direttore della linea di ricerca 'Prevenzione e previsione di eventi franosi a grande rischio'	National group for hydro geological disaster defense (previous Head of the research unit dealing with prevention and forecasting of landslides)
Prof. Leonello Serva	Direttore del Dipartimento Difesa del Suolo/Servizio geologico d'Italia dell'Istituto Superiore per la protezione e la Ricerca Ambientale (ISPRA), Roma	Director of the Soil Defense Department, Italian Geological Service of the National Institute for Environmental Protection and Research, Roma
Avv. Francesco Lettera	Avvocatura Generale dello Stato, Roma	Lawyer representing the Italian State in case of controversies over hydro-geological risk, Roma
Regional Level		
Ing. Fabio Trezzini	Ministero dell'Ambiente, Dipartimento di Difesa del suolo, Roma	Soil Defence Unit- Environment Ministry, Roma
Dott. Raffaele Pignone	Presidente Comitato di Coordinamento geologico Stato- Regioni	Head of the Geological Regions-State Coordination Committee
Dott.ssa Vera Corbelli	Segretario Generale per il Distretto Idrografico dell'Appennino Meridionale,	General Secretary of the Southern Apennines' Hydrographic District,

	Caserta	Caserta
Dott. Giuseppe Gavioli	Membro del Comitato esecutivo con delega all'area tematica Rapporti istituzionali del "Gruppo *183*"	Member of the Executive Committee of the Group 183 (Association for the defence of hydro-geological resources)
Dott. Alessandro Pasuto	Dirigente di ricerca presso l' Istituto di Ricerca per la Protezione Idrogeologica (IRPI) del Consiglio Nazionale delle Ricerche (CNR), U.O.S. Padova	Head of the Padova Unit of the National Research Institute for Hydro-geological Protection
Dott.ssa Federica Marchetto	Esperto della segreteria tecnica per la tutela del territorio del Ministero dell'Ambiente, Roma	Expert of the technical commission for environmental protection at the Environment Ministry, Roma
Ing. Demetrio Egidi	Direttore Protezione Civile della regione Emilia Romagna, Bologna	Director of the Civil Protection, region Emilia Romagna, Bologna
Arch. Adriana Galderisi	Ricercatrice e Professore a contratto in tecnica urbanistica presso il dipartimento di pianificazione e scienza del territorio presso la Facoltà di Ingegneria dell'Università Federico II di Napoli	Professor of Urban planning, University of Napoli
Local level - Campania Region		
Prof. Luigi Stefano Sorvino, Dott. *Crescenzo Minotta*, Ing. Gerardo Lombardi	Autorità di bacino Destra Sele, Napoli	Destra Sele River Basin Authority, Napoli
Ing. *Raffaele Doto*, Ing. Massimo Verrone, Ing.	Autorità di bacino Sinistra Sele, Salerno	Sinistra Sele River Basin Authority, Salerno

Manlio Mingiorni		
Dott.ssa Vera Corbelli, Dott. *Gennaro Capasso*, Ing. Raffaele Velardo	Autorità di bacino nazionale del Liri-Garigliano, Caserta	Liri-Garigliano National River Basin Authority, Caserta
Dott.ssa Fiorella Galluccio, Dott. Giuseppe Esposito, Dott. *Raffaele Bordo*	Dipartimento Difesa del suolo, Regione Campania	Soil Defence Department, Region Campania
Alfonso Pirone	Dirigente del settore risorse idriche, salvaguardia e difesa del suolo, Provincia di Caserta	Hydric resources and Soil Defence Department, Province of Caserta
Dott. Giovanni Romano	Assessore Ambiente, Infrastrutture, Protezione Civile, Risorse Mare, Provincia di Salerno	Environmental, Infrastructure, Civil Protection, Marine Resources Councilor, Province of Salerno
Dott. Domenico Ranesi	Dirigente per i settori di agricoltura e foreste, attivita' produttive e mercato del lavoro, innovazione tecnologica e informatizzazione, protezione civile, Provincia di Salerno	Director of the sectors of Agriculture and Forests, Productive Activities, Technological Innovation, Civil Protection, Province of Salerno
Arch. Francesco Guida, Dott.ssa Valeria Palo	Settore Protezione Civile, Provincia di Salerno	Civil Protection Sector, Province of Salerno
Ing. Luca Pucci	Assessore all'ambiente, Comune di Nocera Inferiore	Environmental Councilor, Municipality of Nocera Inferiore

Mario Prisco	Responsabile Protezione Civile, Comune di Nocera Inferiore	Head of the Civil Protection Unit, Municipality of Nocera Inferiore
Alfonso Mazzariello	Comitato vittime frana, Comune di Nocera Inferiore	Landslide victims' Committee, Municipality of Nocera Inferiore
Ing. Antonio Di Lauro	Responsabile ufficio tecnico, Comune di Nocera Inferiore	Head of the technical office, Municipality of Nocera Inferiore
Antonio Cesarano	Vicesindaco, Comune di Nocera Inferiore	Vice-mayor, Municipality of Nocera Inferiore
Dott. Alfonso Schiavo	Medical Doctor, Comune di Nocera Inferiore	Medical Doctor, Municipality of Nocera Inferiore
Dott. Secondo Squizzato	Sindaco, Comune di Cetara	Mayor, Municipality of Cetara
Francesco Pappalardo	Assessore ai lavori pubblici, Comune di Cetara	Public Works Councilor, Municipality of Cetara
Ing. Pietro Avallone	Responsabile Ufficio tecnico, Comune di Cetara	Head of the technical office, Municipality of Cetara
Francesco Crescenzo, Francesco Vitale	Protezione Civile, Comune di Cetara	Civil Protection, Municipality of Cetara

Annex II

The 'London' meeting was used to work through conceptual frames and methodologies for data collection and analysis and to introduce each case study and case study lead researcher to the group. The agenda is presented below as a record of this meeting. As would be anticipated this was only the start of the development and revision of methodological tools and analytical targets which unfolded over the coming months as data was collected and analysed by the researchers. Communication relied on telephone and email discussions and was helped by the Norwegian case study lead (and first report synthesis author), and the second synthesis lead author being based in London with the PI, and also by participation in meetings as part of ongoing Safeland coordination activities.

AGENDA FOR LONDON MEETING

Work Package 5.2 – Stakeholder process for choosing an appropriate set of mitigation and prevention measures

Task 1. Scoping studies of the risk/policy issues for selected case studies

Agenda and Logistics for Methods Meeting
22 January 2010
King's College London
Mark Pelling, King's College London

AGENDA

09.00 – 09.30	Tea, informal welcome and completion of financial claim forms.
9.30 – 10.00	Formal welcome, introductions and statement of meeting aims and expectations.
10.00 – 10.45	Science and policy communication: a comparative study of flood modelling in Europe; Reflections on key findings, data collection and analysis: Sebastien Nobert (KCL).
10.45 – 11.00	Tea break
	Initial Case Study Descriptions
11.00 – 11.30	Romania: Raluca-Mihaela Maftei and Elena Tudor
11.30 – 12.00	Norway: Linda Bye
12.00 – 12.30	Italy: Anna Scolobig

12.30 – 13.00	India: Upasna Sharma
13.00 – 14.00	LUNCH
14.00 – 14.30	Common research focus and framework: Mark Pelling
14.30 – 17.00	Open discussion of focus and framework
19.00	Meeting dinner at Sofra Restaurant, 36 Tavistock Street, WC2E 7PB.

Annex III

Each case study developed its own customised interview protocols so that each differer in elements of structure and question emphasis depending on the cultural/political/professional environment within which landslide risk management was embedded and upon the range of interviewers for which access was anticipated. This said the use of scaled interview guides, core thematic, and many individual questions were the same. The protocols presented here as an illustration were developed as part of the Italy case study.

INTERVIEW PROTOCOLS AND QUESTIONS

Introduction by the interviewer

Introduction to the SafeLand project and the overall research theme (multi-partner, multi-country, funded by the EC). Ask permission for audio recording and explain the restricted use that will be made of it. Assure the use for the researches' purposes and anonymity. Illustrative general purpose of the questions, the procedure rules [interviewees are free to express their opinions, that these matter and clarify there are no right (or wrong answers)] and time setting. Explain the procedure for interviewees' consensus on the interviewee transcript.

The protocols reported below have been used as a background/frame of reference. We focused on different questions, depending on the experience and knowledge of the interviewees about landslide risk management, legislation, scientific issues, etc.

PROTOCOL 1 - INTERVIEWS AT THE NATIONAL LEVEL

General objectives

- Describe the historical evolution of landslide risk management in science, legislation, policy and implementation;
- reveal the critical factors driving and constraining change in landslide risk management;
- analyze the interfaces between science and policy in landslide risk management.

General questions

- In your opinion, how serious is the landslide risk in Italy? With what would you compare it? Is it getting worse? Why?

- Have you observed any trend in landslide hazards (e.g. they may be getting more or less frequent with greater / lesser impact)? If yes, what do you think are the factors responsible for this trend? (Also see whether climate change figures in the list of reasons mentioned)

- What needs to be done? Who should do it? Who should pay?
- What are the opportunities, and what stands in the way of managing landslide risk?
- What do you feel are the major unresolved issues?

***Dedicated questions – landslide risk management*:**

Changing paradigms

1. What is the current status of landslide risk management in Italy? What is done as preventive measures i.e. what measures are taken to avoid or mitigate the risk posed by landslides? What is done once a landslide takes place? Are there any warning systems in place?

2. How has national legislation and policy evolved with respect to landslide risk – what have been the major events that triggered policy response to landslide risks? Who have been the main actors responsible for shaping the national level policy and legislation related to landslides?

***Dedicated questions - legislation*:**

Law design

1. “The Italian legislation on landslides/soil defense has always been dependent upon the legislation on floods/water conservation”: do you agree with this statement?
2. “The main changes in the Italian legislation on landslides occurred in: 1989 (law 183/89: establishment of River Basin Authorities and basin plans); 1998 (law 256/98: watershed management plans and risk zoning procedures); 2006 (law 152/06 and implementation of the directive 2000/60/CE): do you agree? Do you think there were others ‘paradigmatic’ changes? Which ones?

3. What was the role played by technical or inter-parliamentary commissions (e.g. De Marchi Commission in 1966; Cutrera Commission in 1997; Veltri Commission in 1998) in the elaboration of the legislation?

4. Are there some ‘expert’ communities (e.g. hydrologists, geologists, …) which influenced the path of the legislation? Are there any (pre-existing) synergies or stable relationships? How is the recipients’ (i.e. municipal and regional authorities) feedback included and taken into account in the design of a law?

5. [In case the interviewee has been involved in the design of a law] Could you briefly describe your experience with regard to the design of the law x;y;z? Could you describe communication between legislators, political leaders, and technical experts at the national and regional level? Are there any examples of friction or tension that you could describe? What was the most difficult decision you had to make?

<u>Law implementation</u>

6. Why the basin plans (piani di bacino) foreseen by the law 183/1989 did not work in practice and had to be fulfilled few years later with the watershed management plans (piani stralcio, l. 256/98)?

7. With regard to the elaboration of the new basin district plans (d.l. 152/06):

    - Are there some problematic aspects related to responsibility allocation among the different actors involved?
    - Is there coordination/overlapping among basin plans, urban plans, economic development plans and emergency plans? How does this influence the plans’ design and implementation at the local level?
    - How does the update and monitoring of the plans work?

8. What do you think about the implementation of the 2000/60/EC Directive?

<u>Future trends</u>

9. Do you think the actual Italian legislation on landslides is effective, ie. do you think landslide risk will be less in 5 years because of the plans?

10. Is there anything that you feel should be improved? What do you think will be the main trends/patterns in the future (e.g. focus on centralization vs. decentralization)?

11. In what way have the new reforms reduced the risk of landslides?

12. How successful is the current legislation to deal with the growing threat of landslides?

***Dedicated questions-science*:**

Risk assessment and methodologies

1. **What would you say characterizes the history of landslides in Italy – and how has scientific researchers dealt with landslides and risks over the past years? What has been the scientific focus and in what ways has it changed?**

2. What kind of knowledge is asked for and produced? What areas are given priority? What is the major scientific trend today? A movement from descriptive to probabilistic landslide modelling?

3. Are there standardized and shared methodologies for the identification and mapping of landslide processes? Which are the main elements of scientific uncertainty?

4. Is there a shared opinion in the scientific community about the most effective methodologies for risk assessment? [if possible report some concrete examples]

5. What kind of risk data is available today - and how are you working to develop good risk data? What challenges are to be taken into account using this data? To what extent is Italian research a world leader or follower?

6. How does the "transfer" of new knowledge work (new methodologies and their implementation at the basin authorities' level)? Which is the role played by technical or inter-parliamentary commissions (as the De Marchi Commission in 1966 and the Cutrera Commission in 1997) in influencing the transfer of knowledge from the scientific field to legislation and policy?

Interactions between experts' communities

7. How has the interaction between scientist and policy been over the years? To what extent and in what ways has the national research influenced/changed national policy on landslides?

8. How would you describe the level of competence and communication between the various research institutions? How is the communication and competitive relationship between

departments, universities and various disciplines? What would you say is the purpose of educating new scientists and produce new knowledge?

Risk maps

9. What role would you say risk maps play in science and policy of landslide risk management? How important are they compared to other tools for visualising risk? Is this relative importance changing?

10. What kinds of risk maps are accessible (scale) and what are their contributions to risk management? In what ways are the data/maps adapted to the end users and how is the dialogue with the end users? How do you think that the maps are understood and used in local risk management? Are there any exchange of information and experiences?

11. What are the most important strengths and weaknesses of the current maps? Does climate change or demographic change alter these strengths and weaknesses?

Research and funding

12. Where does the research money come from and how does it affect research priorities? (Locally, nationally, internationally? Do you think that scientific research is taken place on the relevant issues today, or do you feel that the research is pulled in another direction in order to survive financially? Would you say that research on landslides are concentrated on a few hands or spread well beyond?

Future trends

13. What are your thoughts about the future development of landslide research? How successful is the current research to deal with the growing threat of landslides as a result of climate change/ demographic change?

Do you know of anyone else that it would be important to interview?

PROTOCOL 2 - INTERVIEWS AT LOCAL LEVEL

Objectives:

- Identify local priorities and practices for risk identification, communication and management;
- Identify the extent to which they interact with top-down national/regional landslide risk planning and management legislation and actions, to include risk preparedness, hazard mitigation and disaster response.

General questions

- In your opinion, how serious is the landslide risk in _____? With what would you compare it? Is it getting worse? Why?
- Have you observed any trend in landslide hazards (e.g. they may be getting more or less frequent with greater / lesser impact)? If yes, what do you think are the factors responsible for this trend? (Also see whether climate change figures in the list of reasons mentioned)
- What needs to be done? Who should do it? Who should pay?
- What are the opportunities, and what stands in the way of managing landslide risk?
- What do you feel are the major unresolved issues?

<u>Landslide risk management</u>

1. What is the history of landslides and risk management in _____? When did it start and why?

2. How are you dealing with the risks of landslides in ________? What kinds of prevention and mitigation measures are at place? What kinds of precautions have been taken to ensure people and buildings – and what kinds of security and alert plans are operative? What has been the number one concern and priority in risk management?

3. Does the local administration have the capacity to deal with landslide risk in ______? How could this capacity be improved? What do you think are the current constraints in managing landslide risk?

4. Are there national / regional guidelines for landslide risk management? Do you have access to them? Do you apply them? What are your views on the support received from regional and national levels for risk identification, communication and management? Is it adequate? If not then what more needs to be done?

5. Is other kind of information available for assessing landslide risk?

Risk mapping

6. How are the basin plans and the watershed plans implemented in practice?

7. What, in your opinion, is the main purpose of mapping landslide risk? How will the maps translate into policy? What scale is appropriate for what kinds of uses?

8. Who will make most use of the maps, and what problems might arise?

9. What do you think about the availability of these data/services? How easy are they to use/understand? What challenges/problems do you encounter in the use of the maps?

10. How will the public in high-risk areas access the maps? How do you think they will react? Might the maps influence property values?

Risk awareness, citizens' involvement and participation

11. How do you think the locals respond to the risk – has it changed over the years? In what way has it changed your practice and sense of risk? Do you think that you have a good information and training on how to deal with the danger of landslides?

12. In your opinion, is the public aware of landslide risk? Do you think they trust the public authorities to protect them against this risk? Are there environmental groups or citizen groups that advocate for more protection? What is the role of the political parties? What kinds of conflicts among the stakeholders have arisen?

13. Are citizens responsible for any aspects of risk mitigation? Should they be? How do they participate in the decision making process?

Do you know of anyone else that it would be important to interview?