Policy and Institutional Framework for Landslide Mitigation and Risk Reduction

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Abstract. A global review on the current status of Institutional and Legislative Systems for landslide mitigation and risk reduction management has revealed that countries go through time-consuming processes to create and update policies, legislations and strategies. As such, the concept of a template for policy and institutional framework, as well as subsequent transformation to a National Slope Master Plan has been recommended. The template will serve as a blueprint to generate political commitment, which will enable the allocation of resources from the main stakeholders both in terms of manpower and budget. This will then facilitate the setting-up of a lead organisation or agency to ensure good governance to champion landslide mitigation and risk reduction. With a proper budget for the lead organisation, they can recruit the best candidates with attractive remuneration and sustainable career path for the efficient implementation of the National Slope Master Plan.

In addition, the template for this Master Plan will streamline the preparation of a local legal and regulatory framework, etc. to secure resources and provide best practices from lessons learned locally and internationally. The involvement and technical support of international agencies like ICL will expedite the development of reference knowledge kits and guidelines for adoption and adaptation. This will also assist other countries in need of support, especially those from developing and under-developed countries.

Keywords. Policy, Institutional Framework, Partnership, Guideline, Template, National Slope Master Plan

1. Current Status Of Global Disaster Reduction

A global review (UNDP 2005) on the current status of Institutional and Legislative Systems for Disaster Risk Reduction Management has revealed that countries go through time-consuming processes to create and update policies, legislations and strategies for better management of Disaster Reduction. This review has discovered that the formation of a legal and regulatory framework is only a baby huddle in the entire process of Disaster Reduction Management and Implementation. Fig. 1 has summarised the challenges in Disaster Reduction Management worldwide.

Political commitment is also the make or break factor in the effectiveness of disaster reduction. This phenomenon is particularly prominent in a developing country where "short-lived" political commitment is often encountered, partly due to constraint in resources and change in political priority. Such a situation often leads to the implementation of disaster reduction only on an ad-hoc basis and focuses more on emergency response and recovery during or after disaster, rather than on a systematic long-term risk mitigation and reduction. Low commitment and priority have also translated into limited allocation of resources, lack of local participation and weak follow-up action during policy implementation. Such a discouraging global scenario has resulted in low public awareness on the inherent risk of landslides as only restricted information is are made known to the public.

Poor institutional coordination on landslide mitigation and reduction, as well as the lack of capacity and capability have been identified as the key challenges faced. This is manifested in the slow build-up of competency at both national and local levels, the lack of capability in quality assessment on susceptibility, hazard, risk and vulnerability, the concentration of R&D on hazard assessment rather than risk management, etc. These are some of the challenges encountered during Landslide Risk Mitigation and Reduction Management.

The establishment of Disaster Management Legislation in Indonesia in 2007 is one example of strong Government Policy for mitigation and disasater risk management, despite the challenges for implementation (Pujiono, 2008). This national legislation has been further developed by establishing several National Regulations for multi-disaster management in Indonesia.

Meanwhile, Indonesia has also established a National Board for Disaster Management as the coordinator agency, and one of the national agenda of the agency in 2008 is to develop the National Guidelines for Multi-Disaster (including landslide) Risk Analysis. Risk analysis is the key to further developemnt of national and local master plans for landslide mitigation and risk reduction.

2. Aim Of Policy And Institutional Framework Template

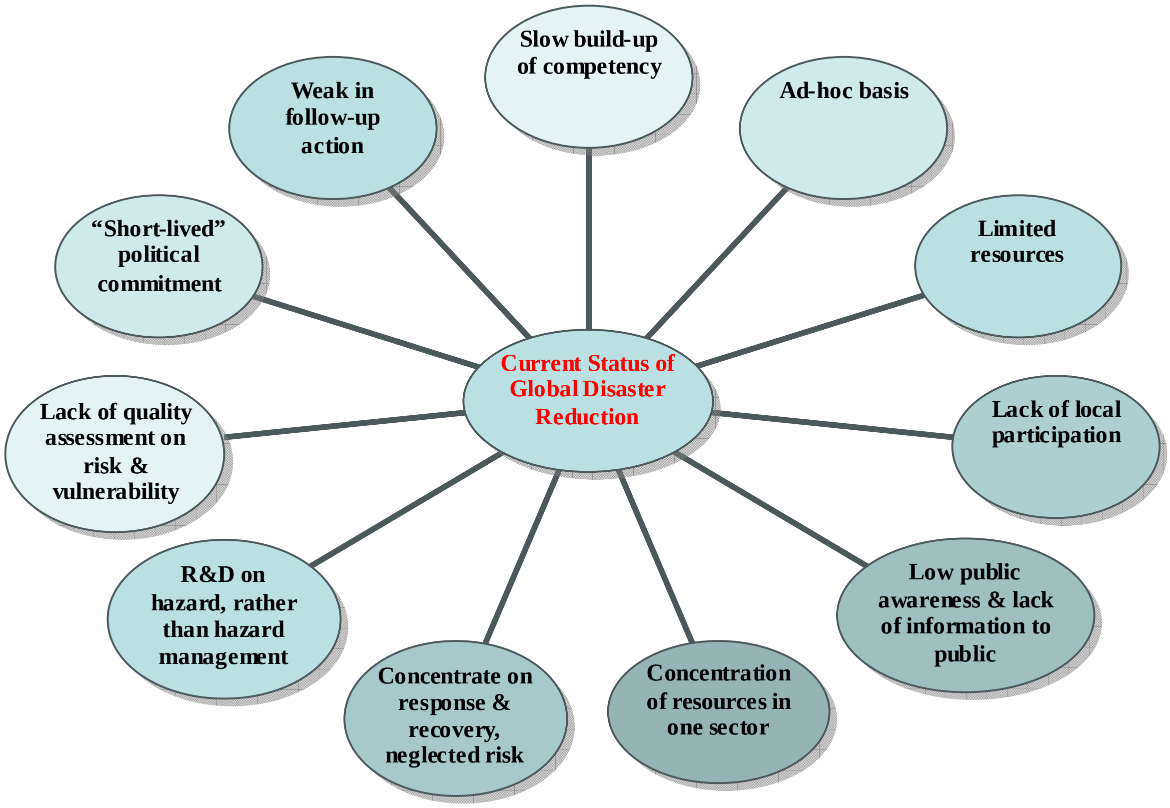

Fig.1 Current status of Global Disaster Reduction (UNDP, 2005)

With the known shortcomings of disaster reduction management from a global perspective, an effective way of reducing loss of lives and properties during disasters is to formulate a general Policy and Institutional Framework leading to a template National Slope Master Plan, with contribution from international Centre-of-Excellences (COEs) like UNDP, International Strategy for Disaster Reduction (ISDR), and International Consortium on Landslides (ICL). A similar concept of a National Slope Master Plan (NSMP) on landslide management and risk reduction has been formulated in a number of countries, such as the United States of America by U.S. Geological Survey (USGS) (Spiker and Gori, 2003), Malaysia by Public Works Department (Public Works Department, 2008), Hong Kong by Geotechnical Engineering Office (GEO) (Chan, 2007).

The summary need statement for such a template is illustrated in Fig. 2. The "template" NSMP aims at establishing a sustainable landslide mitigation and risk reduction system which can be adopted or adapted to local conditions while serving as a blueprint to obtain political consensus, generating political commitment and elevating priority of landslide mitigation and disaster reduction. Such a template will be able to streamline the preparation of a local legal and regulatory framework, secure human and financial resources, and provide best practices and knowledge management, especially from lessons learned. In addition, the engagement and cooperation from international centres of excellence will expedite and facilitate the development of knowledge kits and guidelines for sharing knowledge and obtaining financial support for emergency rescue aid via organisations like IDA.

It is also common knowledge that landslides do not occur as one singular disaster, but may be induced by other disasters such as earthquakes and volcanic eruptions. Furthermore, landslides can also trigger other disasters such as flood, debris flood and tsunami. Therefore, mitigation of other disasters related to landslides should also be integrated in the template of the National Slope Master Plan.

3. Overview Of Template Policy And Institutional Framework

The creation of a strong and resilient national landslide mitigation and disaster risk management framework has been identified as the key to a safer environment. Seven crucial factors to the success of good governance derived from international experience [Hong Kong (Chan, 2007), Malaysia (PWD, 2008), Italy (Casale and Margottini, 1999)] are illustrated in Fig. 3. Firstly, a specific yet flexible legal and regulatory framework should be established, including policies and legislation on landslide mitigation and risk reduction management, mechanisms and processes in ensuring legal accountability, mechanisms for effective implementation, enforcement etc. In the aspect of development planning, the relevant policy should cut-across

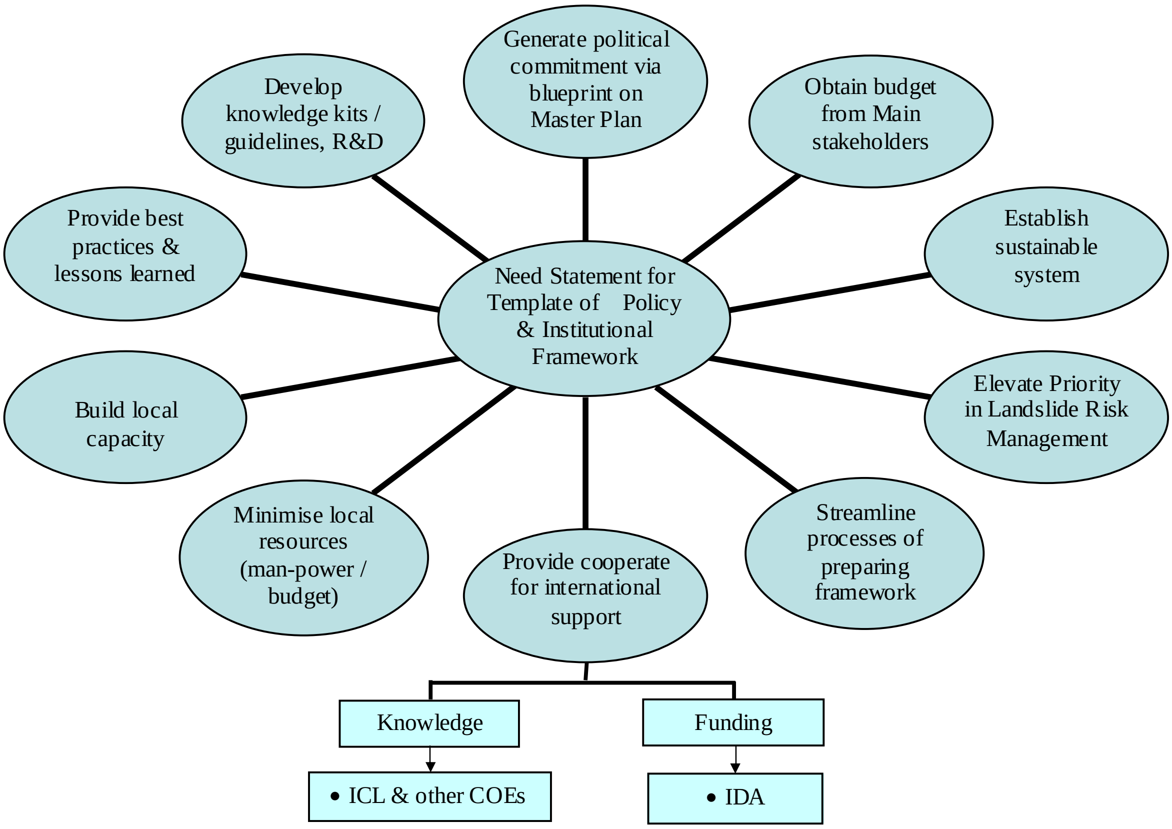

Fig.2 The Need Statement for Template of Policy & Institutional Framework

development in both urban and rural areas for housing, infrastructure, agricultural, forestry, farming, mining, etc. Procedures and guidelines on planning implementation should incorporate an effective risk assessment and mitigation system with attention to possible environmental impact and sustainability. Legal and regulatory framework and development planning used or proposed by Hong Kong (Chan, 2007), Malaysia (Public Works Department, 2008), Italy (Casale and Margottini, 1999), etc, could be utilized as a typical model.

The proposed policy and institutional framework leading to the template National Slope Master Plan form a blueprint to generate political commitment, hence attaining resources from main stakeholders and providing short and long term budgets for successful implementation. Such allocation of resources should consider the needs at both federal and local levels as landslide mitigation and risk reduction should be an inter-agency and inter-disciplinary affair.

The low competency level of mainstream stakeholders is a common constraint in the good governance of policy and institutional framework. Hence, the template NSMP will constitute a model for adoption or adaptation. It contains knowledge kits providing best practices and lesson learned, training schemes for stakeholders and practitioners, platforms for knowledge management and information sharing, etc. Furthermore, a mechanism for continuous capacity building should also be in-place through research and development activities by local universities or research institutions, as well as dissemination of knowledge in landslide mitigation and risk awareness to the primary and secondary educational system.

The governance of such a Master Plan should be undertaken by a main agency or a ministry responsible for local government. As landslide mitigation and risk reduction is a combined effort of many ministries, the lead agency should be under the Prime Minister's Office or a ministry that supports all the relevant agencies or stakeholders responsible across ministries and agencies that serve them best. This is to harmonise ministries and agencies involved and prevent rivalry for resources.

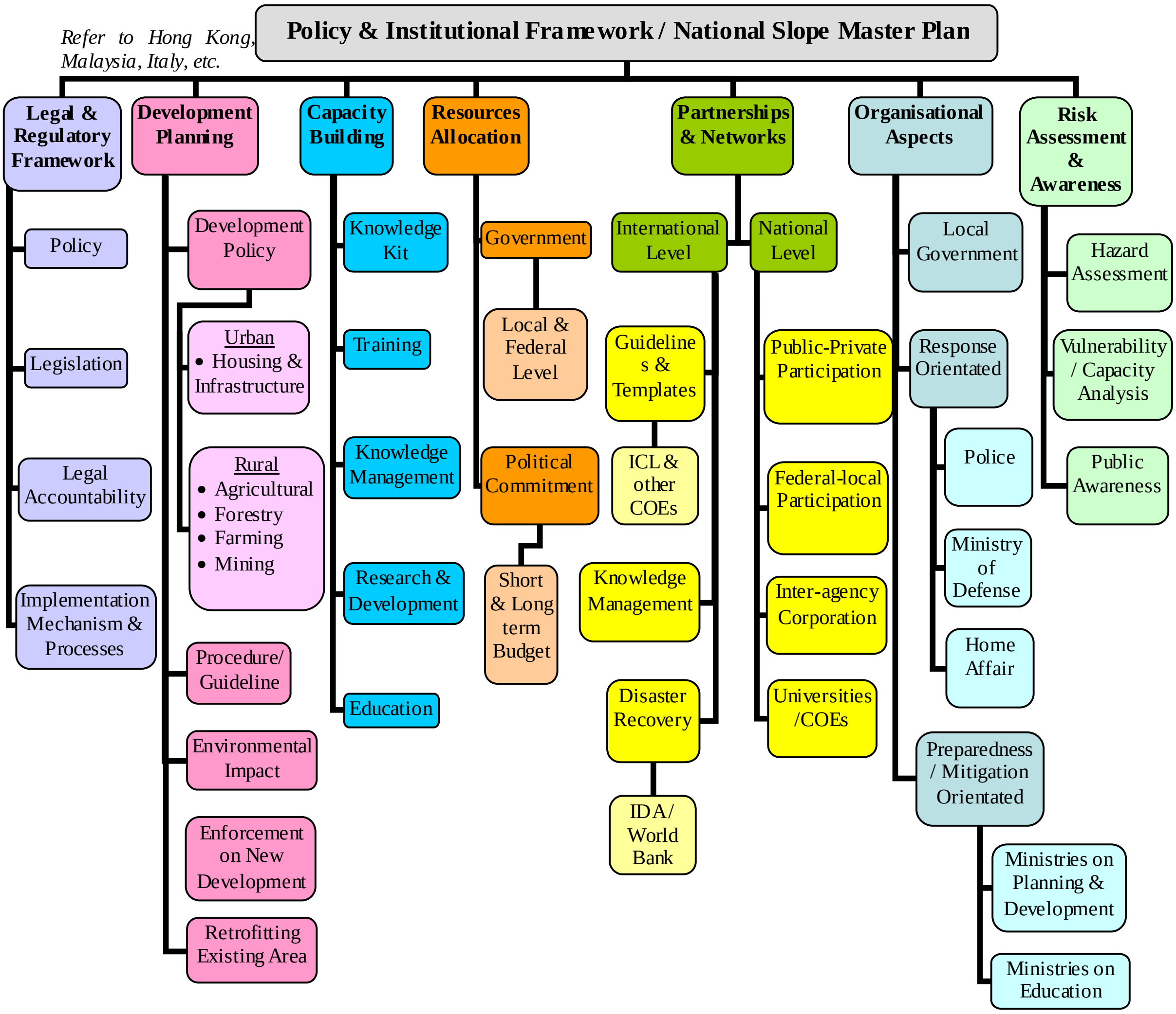

Fig.3 Overview of Template Policy and Institutional Framework

Under the lead agency or ministry, the operation of landslide mitigation and risk reduction may be divided into two major functional groups, one in response to landslide and the other in mitigation aspect. From the response perspective, it may be led by a response- oriented department like police, Ministry of Defence or Ministry of Home Affairs. Landslide mitigation should be under the leadership of preparedness and mitigation-orientated agencies in charge of planning, development, implementation, and enforcement as well as education. Therefore, depending on the local political interest and organisational structure, the template Master Plan may be adapted or adopted for different needs.

A summary of the possible contributing and triggering factors of landslides are shown in Figs 4 and 5, respectively. Comprehensive strategies and action plans could then be implemented once the Master Plan is endorsed with commitment and budget.

Notwithstanding the above, the Master Plan will incorporate the elements of partnership and cooperation at both international and national levels, ensuring the involvement of relevant target groups. Support from expert organisations like ICL and other COEs should be called upon to expedite the development of the reference guidelines and methodology in knowledge management on landslide mitigation and risk reduction. Meanwhile, the mechanisms and processes on disaster response and recovery may be advocated by international rescue units and IDA. At the national level, participation from all sectors should be encouraged in order to ensure interaction between public and private sectors at federal and local levels. These should be further enhanced by contribution from universities and research institutions.

The entire implementation procedure should be entrenched with a "check and review" benchmarking system for continuous policy refinement. With that, the formulated template of a National Slope Master Plan may become a flagship programme, serving as a blueprint for a structured and systematic implementation plan.

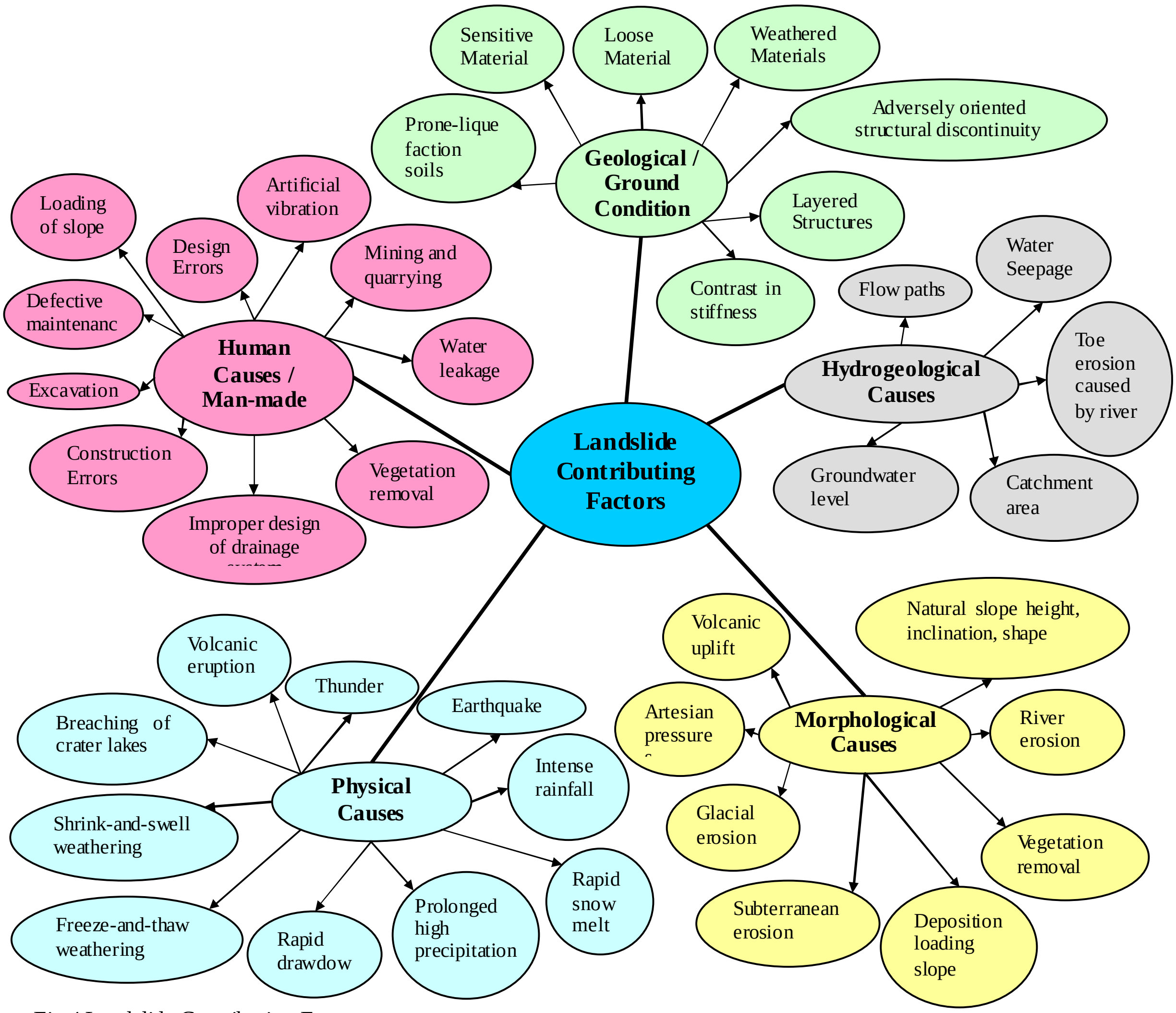

Fig.4 Landslide Contributing Factors

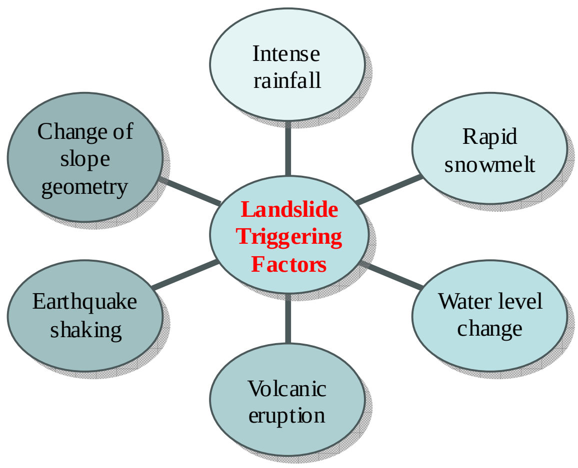

Fig.5 Landslide Triggering Factors

4. Components Of National Slope Master Plan

The followings are the components of the National Slope Master Plan. They were adapted from Malaysia (PWD, 2008) and USGS (**2003**):

1) Policy and Institutional Framework
2) Agricultural Development *(agricultural)*
3) Forestry Policy & Activity *(forestry)*
4) Hazard Mapping and Risk Assessments
5) Early Warning System and Real Time Monitoring
6) Loss Assessment
7) Information Collection, Interpretation, Dissemination and Archiving
8) Public Awareness and Education
9) Loss Reduction Measures
10) Training
11) Emergency Preparedness, Response and Recovery
12) Research and Development

The twelve components should be the functional groups under the lead agency. The lead agency should be the implementer of each component whereby the agency may take a coordination role or be involved in the actual operation. Such decision are dependent on the resources available for the agency and the intended organization structure within its agency.

5. Main Stakeholders

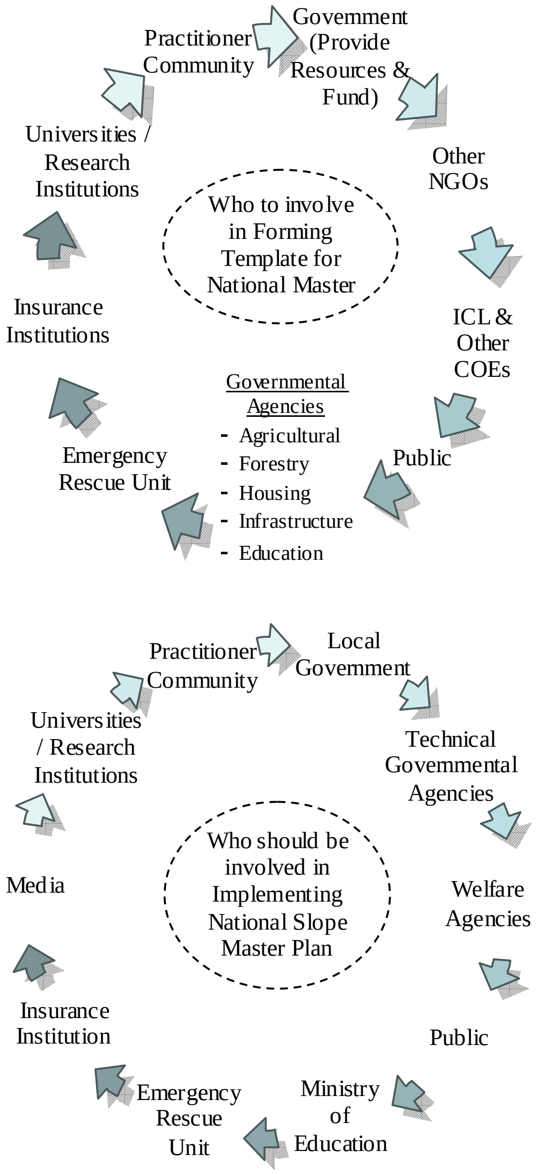

Fig.6 Formation and Implementation of a National Slope Master Plan

For successful implementation of a NSMP, personnel involved in two stages, namely the preparation stage (i.e. to develop Master Plan) and the implementation stage (i.e. to adopt/adapt such a framework as local landslide mitigation and risk reduction system). A detailed diagram on parties involved has been illustrated in Fig. 6. The main stakeholders contributing to the formation of a template Master Plan should be the local expert organisations and international organisations like ICL and COEs.

The remaining stakeholders are mostly common between the two stages, namely local government, governmental agencies, universities and research institutions, practitioner community, insurance institutions, emergency rescue units, public welfare agencies and the general public. Participation from relevant development planning agencies in various disciplines are vital to attain a shared and representative overview of the Master Plan for sectors like agricultural and forestry, housing and infrastructure, education, etc. In addition, media coverage may act as a catalyst to the implementation programme of landslide risk reduction as it highlights political commitment and promotes public awareness. Therefore, it has been included as one of the key parties involved in the implementation stage of the Master Plan.

6. The Stages Of Master Plan Implementation

In order to achieve profound improvements in landslide mitigation and risk reduction, success at the implementation stage is vital. As such, four different stages of implementation are identified before, during and after a landslide event. A summary of the components involved at various stages is elaborated in Fig. 7. The four major stages are preparedness stage, mitigation stage, response stage and recovery stage.

In the preparedness stage, the Master Plan should be in-placed either by adopting it as a whole or by adapting it to local conditions. As such, the appropriate laws and regulations, implementation and enforcement policies and guidelines for development planning, training scheme for stakeholders and promotion scheme for community awareness should be geared towards effective disaster reduction management.

In the mitigation stage, significant resource allocation from the main stakeholders is essential as it consist of planning and enforcement of good practices in new development, retrofitting of existing areas at risk, research and development and exploring advancement in technology and methodology. A similar approach has been adopted in Hong Kong where landslide mitigation and risk reduction have been incorporated into two (2) components, first in planning control of new development, and subsequently in retrofitting existing slopes at risk (Chan, 2007). Such policies have contributed significantly to landslide mitigation and risk reduction in Hong Kong with tremendous impact and benefits to Hong Kong residents. Hazard and risk assessment should also be included with the setting-up of an early warning system and landslide prediction model for slopes that are not feasible to improve and strengthen.

In the response and recovery stage, the National Slope Master Plan should facilitate efficient response mechanisms with the appropriate standard operating and evacuation procedures. During the disaster recovery stage in particular, mechanisms for financial allocation in terms of food and shelter, hygiene and health care, housing reconstruction, slope rectification, etc, shall be in-placed to minimize loss and impact to the community.

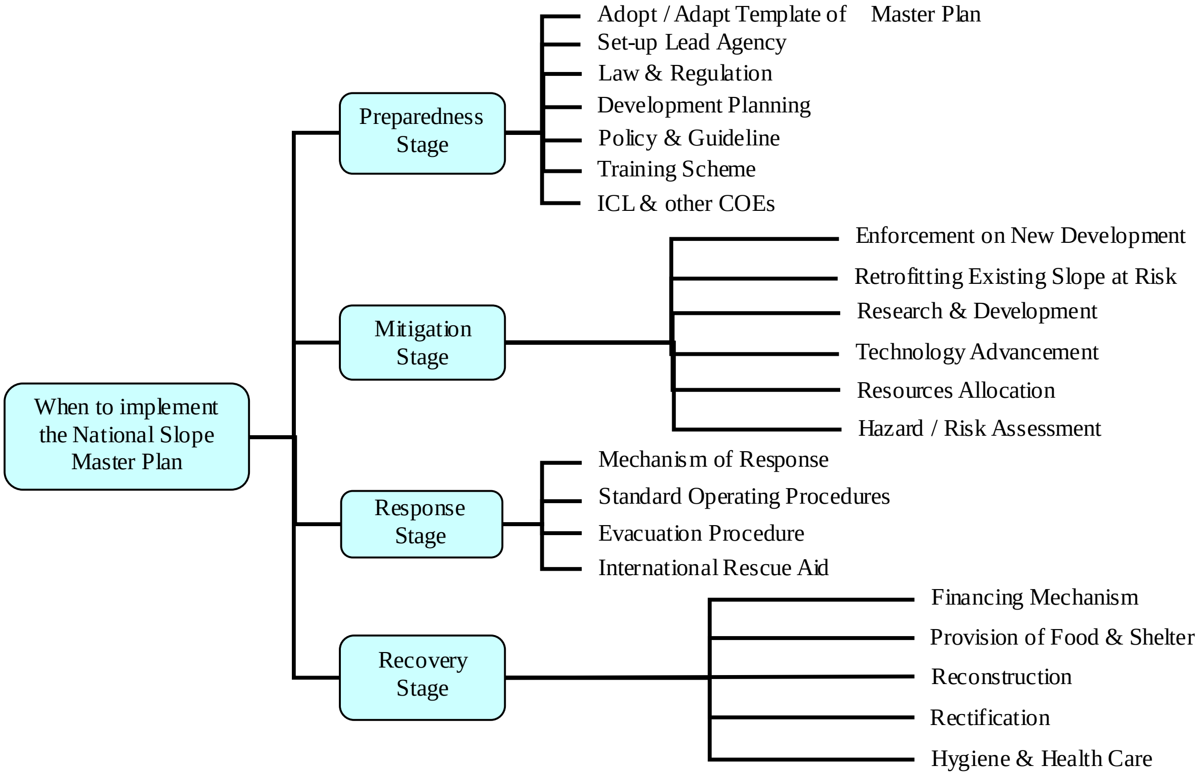

Fig.7 Implementation Stages of National Slope Master Plan

The stages of implementation shown in Fig. 8 summarises the implementation flow highlighting the elements to monitor, venues for publication, target groups for knowledge transfer and more importantly, feedback and review system for audit and improvement. Among the listed components, the core items for monitoring should be the status of political commitment (to ensure continuous resources allocation), building-up of competency among local stakeholders and practitioners, feedback on training schemes and quality of research and development by local COEs. International COEs can coordinate information from lessons learned by individual countries through their implementation processes, facilitating subsequent improvement in the configuration of template Master Plan.

All progresses and best practices derived from the implementation of Master Plan should be shared through conferences, forums, seminars and workshops. Subsequently, distilled knowledge on best practices and lessons learned should be transferred to local COEs in the form of knowledge kits and guidelines.

7. Invited Presentations

7.1 Disaster Management Legislation In Indonesia: Challenges For Implementation

Pujiono, P. (Indonesian Society for Disaster Management, Indonesia)

Indonesia is one of the largest countries in the world with strategically situated and vast geographical spread with complex topo-geological features that constitute tremendous natural hazards. Socio economic make up and political complexity of the country, meanwhile, embodies the population's vulnerability to disasters. On the other hand, Indonesia's capacities to mitigate, respond and recover from disaster events leave so much room for improvement.

Impetus and driver of the Disaster Management Legislation could be traced to civil society movement in the field of disaster management all the way back in early 2003. The Indian Ocean tsunami propelled the tremendous momentum for proper political discourse towards legislating disaster management. After stalling, another major disaster, the Yogyakarta earthquake, provided the opportunity to recommence the debate and finally following another bout of procrastination the instrument was enacted into Legislation.

The disaster management legislation of Indonesia is one among the most progressive and comprehensive laws of disaster management. It calls for addressing multitude of hazards, to be implemented at all time, and involving all stakeholders. It directly links the country's constitutional mandate to the prevailing global disaster risk reduction regimes and the national institutional arrangements.

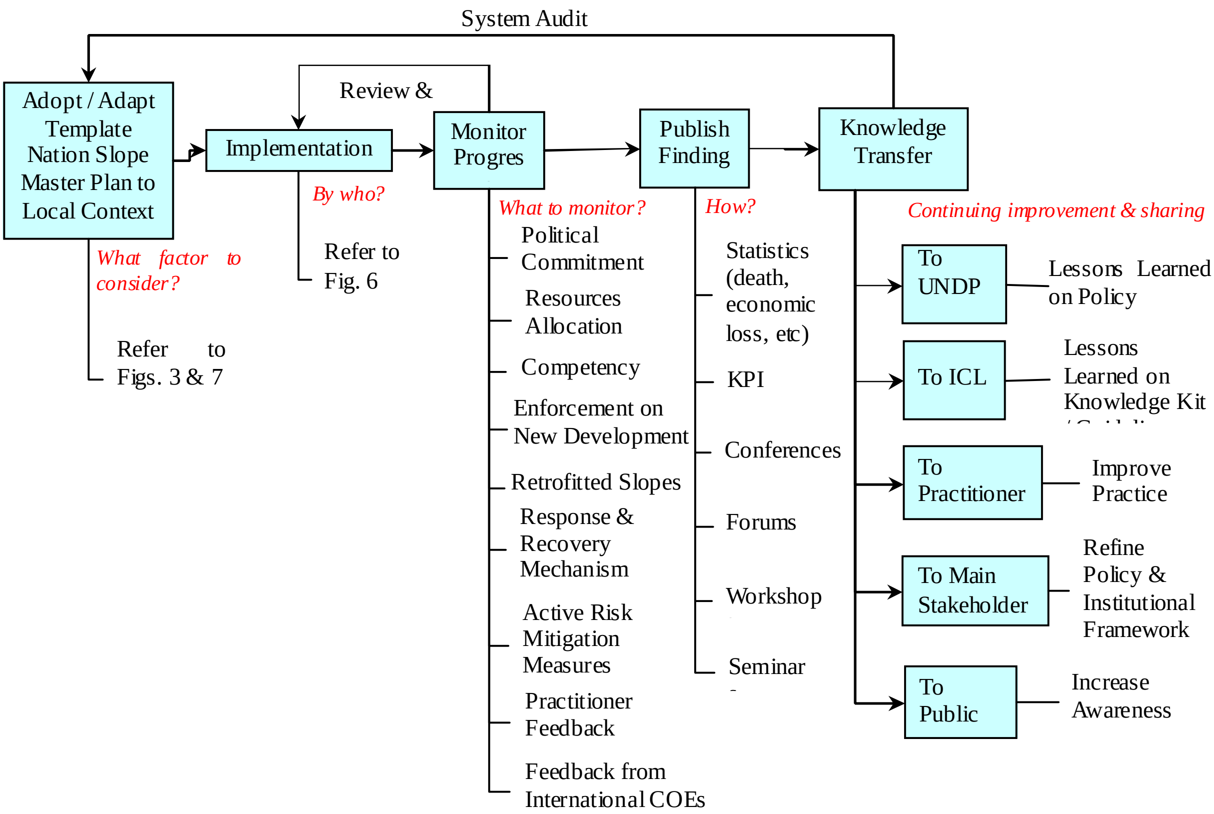

Fig.8 Flow Chart of Implementation Process for a National Slope Master Plan

The law makers and government concurred to have the legislation implemented immediately following the ratification. Parties were designated to execute the legislation in accordance to an equally explicit timetable. Allegedly, however, the same features that make the legislation so outstanding are the very same factors that may have prevented its full implementation. Analysis on the determining factors could reveal the ideological and political environment, governance issues, as well as other pragmatic considerations that may have stall the implementation.

The legislation provides most of the required policy environment, institutional setup, and pragmatic provisions to address landslide risks in Indonesia. Therefore, a prospect of further delay on the implementation of the legislation may ultimately be detrimental to people's vulnerability to landslides. Conversely, there is now opportunity presents for the landslide discipline to formulate authoritative arguments towards the immediate and fuller implementation of the legislation.

7.2 Natural Hazard Legislation And Professional Landslide Guidelines In British Columbia, Canada

VanDine, D. F. (VanDine Geological Engineering Limited, Canada)

For more than 30 years in British Columbia (BC), Canada, for new residential development in areas with a potential landslide hazard, several provincial acts have required a Professional Engineer (PEng) or a Professional Geoscientist (PGeo) to write landslide assessment reports with the statement "the land is safe for the use intended". Those acts are the:

- BC Land Title Act (Section 86) – Subdivision Approvals
- BC Local Government Act (Sections 919.1 and 920) – Development Approvals
- BC Local Government Act (Section 910) – Flood Plain Bylaw Variances or Exemptions
- BC Local Government Act (Section 692(d) Provincial Regulation M268) – Geotechnical Slope Stability (Seismic) Regulation, and
- BC Community Charter (Section 56) –Building Permits.

Other pieces of provincial legislation for proposed residential development exist in BC in which a PEng or PGeo may be involved, but there is no legislated requirement for the involvement of a PEng or PGeo.

Although landslide assessments are also frequently carried out for proposed non-residential development such as institutional, commercial, industrial and infrastructure, for emergency response, and for existing residential development, there is no associated provincial legislation. Besides the fact that there is no provincial legislation for proposed non-residential development or for existing residential development, there are several other shortcomings of the pieces of legislation listed above. These shortcomings include:

- the perceived required use of the terms "certify" or "certified"
- the inconsistency as to which professional can carry out the work
- the various descriptions of experience required by the PEng and PGeo, and
- the undefined terms "safe", "safely" or "used safely for the use intended".

The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) is a licensing and regulatory body for PEngs and PGeos. It was constituted by provincial legislation in 1921 to protect the BC public from unqualified and non-licensed practitioners.

In 2006, the Association of Professional engineers and Geoscientists of British Columbia (APEGBC) published Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia in an effort to address the aforementioned shortcomings, and to assist its members who carry out such work. These Guidelines outline what a PEng or PGeo should do when carrying out a landslide assessment with respect to proposed residential development associated with the above pieces of legislation. How to carry out such an assessment is left to the practitioner.

In April 2008, the Guidelines were revised to incorporate earthquake-induced landslides as required by changes to the 2005 National Building Code of Canada and the 2006 BC Building Code. This presentation reviews the relevant pieces of provincial legislation, further describes the shortcomings of the legislation and describes how the APEGBC Guidelines address the shortcomings.

7.3. Slope Safety System And Landslide Risk Management In Hong Kong

Chan, R. K. S. & Lau, T. M. F. (Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong SAR Government)

The year 2007 marked the 30^{th} anniversary of the implementation of the Slope Safety Management System by the Geotechnical Engineering Office (GEO) in Hong Kong. The GEO (formerly known as the Geotechnical Control Office) was established in 1977 by the Hong Kong Government to regulate geotechnical engineering and slope safety, in the aftermath of several serious landslides with multiple fatalities in the 1970s.

The unique slope safety problem in Hong Kong is largely the result of dense urban development on steep hilly terrain, the legacy of a large number of substandard man-made slopes mostly formed before the 1970s without adequate geotechnical input, and high seasonal rainfall. Over the last 30 years, the GEO has developed a comprehensive and holistic slope safety management regime to combat landslide disasters and reduce landslide risk to the community.

Under the comprehensive Slope Safety Management System, the Government has been taking a proactive approach to reduce the landslide risk through exercising geotechnical control of new works, systematically rectifying existing substandard man-made slopes under the Landslip Preventive Measures Programme, managing natural terrain landslide risk, maintaining all Government man-made slopes, setting safety standards for slope engineering practice, promoting public awareness and response in slope safety through public education, and providing landslide emergency services.

One of the principal duties of the GEO is to exercise geotechnical control on new works, through checking design submissions and auditing the adequacy of construction supervision of geotechnical works. The GEO was vested with the responsibility of checking private geotechnical submissions under the ambit of the Buildings Ordinance. Whereas the mandate for the geotechnical control of public works is derived from the administrative instruction issued by the policy bureau. Over the years, the GEO has initiated many legislative amendments and improvements to administrative instructions to enhance the slope safety management for the private and public sectors respectively.

Since 1976, the GEO has embarked on a long-term slope retrofitting programme, known as the Landslip Preventive Measures (LPM) Programme, to deal with the sizeable substandard government and private man-made slopes that were formed before the establishment of the GEO, in a risk-based priority ranking order. Under this Programme, all the high-risk substandard government slopes affecting developments and major roads will be upgraded to the required safety standard by 2010. In the last 30 years, significant improvements have been made on the output and robustness of the LPM works to meet the changing needs of the general public.

In order to facilitate the effective execution of geotechnical control and landslip preventive works functions, the GEO sets slope safety standards which are tailor-made to suit local geological and climatic settings of Hong Kong. Since 1979, the GEO has produced a number of technical guidance documents on slope engineering through research and development work. These publications provide recommended standards of good practice and are considered consensus documents of the geotechnical profession as the draft documents were circulated for comments widely throughout both the public and private sectors of the local profession, academic institutions and contractors, as well as overseas specialists in the respective fields. The systematic landslide investigation initiative, which was introduced in 1997 and became a part of the LPM Programme in 2000, has played a key role in advancing the state of knowledge on slope performance and better understanding of causes and mechanism of slope failures.

Since the early 1990s, the GEO has been carrying out systematic research and development work on natural terrain landslide hazards in Hong Kong. Studies of significant natural terrain landslides and the associated research have provided the basis for rationalizing the technical approach to deal with natural terrain hazards. In the last decade or so, significant progress has been made in the following areas: improved understanding of the mechanism and causes of natural terrain landslides through landslide studies, identification of natural terrain landslides and compilation of a historical landslide inventory, insights from landslide susceptibility analysis, improved understanding of rainfall-natural terrain landslide correlation, improved capability in debris mobility numerical modeling and promulgation of guidance on design of landslide debris-resisting barriers.

In recent years, notable advances have been made by the GEO in the novel application of digital technology and information technology to enhance the capability and efficiency on geotechnical development work. These include digital photogrammetry, Geographic Information System (GIS), Interferometric Synthetic Aperture Radar (InSAR) and Light Detection and Ranging (LiDAR). With the use of these technologies, the GEO was among the first in the world to apply quantitative risk assessment in geotechnical engineering for landslide risk management.

The efforts for continuous technical development and improved standards for landslide risk management are driven by the change culture instilled in the GEO through the setting up of the Steering Committee on Continuous Improvement (SCCI) in 1995, to steer and manage the change and continuous improvement programme. Strategic Plans, comprising 6 principal goals, were developed for implementation. These goals focused on staff development, improvement to the productivity and quality of the slope upgrading programme, technical advancement in landslide risk management, enhancement of geotechnical control and technical standards, and development of the GEO's Slope Information System.

When the current phase of the LPMP is completed in 2010, the overall landslide risk from man-made slopes will be substantially reduced to less than 25% of the 1977 level. To continue the efforts to manage the landslide risks in Hong Kong, a Landslip Prevention and Mitigation Programme (LPMitP) has been launched in late 2007 to dovetail with the LPMP which is due for completion in 2010 in order to deal with the remaining landslide risks. The LPMitP will be implemented on a rolling and risk management basis and it aims to tackle man-made slopes with moderate risk as well as vulnerable natural hillside catchments with known hazards.

This paper presents an overview of the Slope Safety Management System developed and managed by the GEO, the framework for continuous improvement in technical standards to enhance slope engineering practice, and legislation improvements in mitigating landslide hazards and risk reduction in Hong Kong. Some recent novel applications of digital technology to natural terrain risk management in the GEO and the newly launched LPMitP will be introduced.

7.4 A New Sustainable Landslide Risk Reduction Methodology For Communities In Lower Income Countries

Anderson, M. G. & Holcombe, L. (University of Bristol, United Kingdom)

Unplanned housing developments in vulnerable communities on steep tropical and sub-tropical hillslopes in many developing countries pose major problems for the residents themselves; for Governments, in terms of potential relocation costs; for engineers in determining the precise nature of the hazard and risk; and for donor agencies, such as the World Bank, in establishing the form of disaster mitigation policies that should be promoted. Some of these communities have, in the past, had to be relocated, at costs of millions of dollars, because of major slides triggered by tropical storm rainfall. Even so, evidence shows that: (1) risk reduction is a marginal activity; (2) there has been minimal uptake of hazard maps and vulnerability assessments and (3) there is little on-the-ground delivery of construction for risk reduction.

This paper directly addresses these issues by presenting a new low-cost, community-based approach to landslide risk reduction in such a context. It is founded on the vision that there is often sufficient capacity within Governments to address such landslide issues without needing to incur significant additional costs by employing non-Government specialist staff. Such expenditure adds to debt and only sub optimally builds within-country capacity.

The approach we present develops a cross-ministry Government management team, implements a community-based approach to landslide risk assessment, develops low-cost interventions and builds capacity through community knowledge transfer. We report on the successful pilot undertaken in St Lucia, West Indies and on the uptake of the methodology by regional organisations and international donors within the Caribbean region. Importantly, the implementation of this new methodology within communities, is demonstrated to reduce landslide risk, bring economic benefit to vulnerable communities and deliver some 90% of the total expenditure on-the-ground (i.e. management overheads of only 10%).

7.5 Malaysian Slope Master Plan

Abdullah, C. H., Mohamed, A. and Pandi, A. R. (Public Works Department, Malaysia)

Since 1993, Malaysia has experienced many landslides that have caused considerable numbers of death, destruction to properties and immense direct and indirect economic losses. The 1993 Highland Towers landslide incident near Kuala Lumpur is considered to be the landmark landslide that creates public awareness about the peril of landslides. In this incident, a tower block toppled over due to undermining of its foundation triggered by a landslide. No concrete actions were taken by the government or the private sector to address the landslide issues following the incident. In 2003, as a result of a massive rock slope failure that cut-off a toll highway that leads to Kuala Lumpur from the north for more than 6 months, the Malaysian Government decided to establish a branch within the Public Works Department of Malaysia to ensure that slopes in Malaysia are properly and systematically managed. The first major task assigned to the new branch is to produce a comprehensive National Slope Master Plan (NSMP) for Malaysia. The goal of the NSMP study is to provide a comprehensive and effective national policy, strategy and action plan for reducing loses from landslides nationwide. This paper highlights the key objectives, the scope, the methodology and the output of the NSMP study. The issues and problems faced by the study team to come up with a relevant Master Plan are also discussed.

The NSMP is divided into 10 components that cover all the topics pertaining to slope management. The components and their main objectives are as follows: 1) Policy and Institutional Framework – provide effective policy to minimize landslides in slopes nationwide; 2) Hazard

Mapping and Assessments – develop a framework for establishing an inventory of hazard and risk maps for planning and decision making; 3) Early Warning System and Real Time Monitoring - establish a system for monitoring landslides that pose substantial risk ; 4) Loss Assessment - compile and evaluate information on the social-economic impacts of landslide hazards; 5) Information Collection, Interpretation, Dissemination and Archiving - establish an effective system for landslide data collection and hazards information transfer ; 6) Public Awareness and Education - develop awareness programmes of landslide risk to general public, developers, engineers, decision makers and others; 7) Loss Reduction Measures - develop a plan for appropriate mitigation measures. ; 8) Training - develop programmes for guidelines, training, and education for engineers, scientists, decision-makers; 9) Emergency Preparedness, Response and Recovery - improve the nation ability to respond and recover from landslide disaster; and 10) Research and Development - develop a predictive understanding of landslide processes, threshold and triggering mechanisms. The NSMP will provide an assessment of the status, needs and associated costs for a national landslide hazards mitigation strategic programme for first, second and third phases. Each phase represent a period of 5 years. With these objectives in mind, the methodology adopted were literature review, study of works carried out by others for example Geotechnical Engineering Office of Hong Kong, United States Geological Survey and Ministry of Land, Infrastructure and Transport.

The NSMP study encountered a number of problems during the course of the study especially on the database for landslides and the incurred cost of repairs. The reasons for this problem are poor record keeping, and even if the records are present; they are not in 'palatable' form which can be immediately digested and utilized. The information are also scattered among the government agencies, universities, contractors and consultants. Some of the documents are secret either due to their sensitive nature or due to the trade secrets employed by some of the companies. Other problems include the difficulty in getting feedbacks from stakeholders on questionnaires that were sent. On the matters pertaining to public awareness, Malaysia being a multiracial country with a diverse ethnicity, language and culture; a public awareness campaign and education will have to take these issues into consideration.

The NSMP will be tabled to the Malaysian Government for their endorsement, following which; it would then be implemented in phases. One of the major recommendations is to set up a dedicated engineering agency that would oversee all matters pertaining to slope management.

The success of the NSMP very much depends upon the political will of the Government, the setting up of the relevant agency, the fund provided and the collaboration among the stakeholders and the cooperation from the public.

7.6 Landslide Management in the UK – is it working?

Gibson, A. D., Culshaw, M. G. and Foster, C. (British Geological Survey, England)

As a country with limited experience of significant natural disasters, the UK has not developed a sophisticated legal and regulatory framework for the mitigation of landslide hazards. The 1966 Aberfan disaster stimulated academic research into landslide mechanisms but even a number of high-profile events in the late 20th Century, and a series of 'near-misses' since then, have had short-lived impact upon social awareness, limiting political motivation to develop policy to manage landslide hazards.

In the UK, landslide events tend to be managed locally, with limited national coordination or communication of best practice. Government efforts in the 1980s and 1990s to make national assessments of geohazards (including landslides) and to provide generic guidance to land-use planning authorities had some success but, due to limited resources and political support, ultimately failed to develop into an effective, integrated, national response to landslides.

This paper examines how landslides are dealt with by UK government, partly through the devolved governments in Scotland, Wales and Northern Ireland. The existing system relies on a combination of planning guidance, which varies between the devolved governments, and building regulations. However, crucially, the system offers no framework for the legal or financial responsibilities for hazard management. As a result, landslide management in the UK has been influenced more by planning and political structure than actual risks to the population and, as a consequence, does not provide sufficient safeguard to the population. Examples are presented that show how this framework has affected the investigation and mitigation of different types of landslide. The paper will also show how exploitation of recent events in the UK and elsewhere, a greater awareness of climate change amongst the population and improved communication by the scientific community may lead to a long term change in policy and greater protection for the population.

7.7 Reducing Landslide Hazards through Federal, State, and Local Government Cooperation: The Seattle, Washington, Experience

Gori, P. L. (U.S. Geological Survey, USA) and Preuss, J. (PlanWest Partners, Inc, USA)

In the winters of 1995/96 and 1996/1997, the Pacific Northwest in the United States experienced a series of devastating floods and landslides. After the winter storms of 1996/1997, the City of Seattle, Washington, initiated a major effort to reduce losses from landslides. By coincidence, at the time the storms occurred, the U.S. Geological Survey (USGS) was supporting a multi-hazards research project in the region. The USGS Landslide Hazards Programme continued its scientific investigations in the region until 2006. The USGS research complemented and was coordinated with the City of Seattle's efforts. This paper documents the convergence of the City of Seattle, the State of Washington, and the USGS decisions to understand the landslide hazards facing the Seattle area and to implement policies that reduce damage from landslides.

This paper draws on a study by Planwest Partners, Inc and the U.S. Geological Survey (USGS) that evaluated the use by local government of recent USGS research on landslide hazards in Seattle. The methodology of the study includes a review of the research by USGS and the City of Seattle and its contractor concerning landslide hazards of the region, and it includes extensive interviews with Seattle public officials and others that are instrumental in landslide hazard reduction policy. In addition, two roundtable discussions, were organized, the first with the representatives of agencies involved with setting landslide hazard reduction policies and the second with USGS researchers. The initial interviews and roundtable discussion with city officials and agency representatives led to a review of Washington State and Seattle regulations and laws that encouraged passage and enforcement of landslide hazard reduction policies.

The United States relies on different levels of government to enact and enforce land-use decisions, which are the basis of numerous landslide hazard mitigation and reduction policies. Land-use and development decisions are for the most part made at the local level. They include density and type of land-use permitted, how buildings are sited, and the location of public improvements such as roads, parks, schools, and other public amenities. State governments enact general requirements that may facilitate the local policies. At the national level, federal government agencies such as the USGS have a minimal role in land-use planning and enforcement for the most part, but do provide information that may be of use to local governments as they implement land-use and hazard reduction policies.

Each level of government brought different capabilities to the task of reducing Seattle's exposure to future damage from landslides. When Seattle experienced the impact of two successive rain seasons of abnormally high rainfall, officials decided more stringent approaches to reduce the landslide hazard were needed. A key foundation of the new landslide hazard reduction approach was a scientific one—to understand the landslide hazards and to formulate remedial measures to combat it. Seattle commissioned the consulting firm of Shannon & Wilson to undertake an inventory and landslide characterization study.

Prior to the 1995/96 and 1996/97 rainfall seasons, Seattle had among the most comprehensive, historical records of landslides in the U.S. The database representing 1,326 landslide events over 100 years was categorized and plotted using GIS. Shannon and Wilson's study characterized four key landslide types and their locations: 1) high bluff peeloff, 2) groundwater blowout, 3) deep-seated landslides, and 4) shallow colluvial (skin slides). The City of Seattle also commissioned the production of landslide hazard and seismic hazard maps from the USGS and the University of Washington. Seattle completed a comprehensive GIS application, adding the landslide inventory and the hazard maps to their existing municipal information.

The USGS contributed five key products that were used by Seattle to reduce its landslide damage and losses. These are:) Shallow Landslide Hazard Map of Seattle, Edwin L. Harp, John A. Michael, and William T. Laprade, Open File Report 2006-1139, 2) Report and Map showing Landslide Susceptibility Estimated from LIDAR Mapping and Historical Landslide Records, Seattle Washington, William Schulz, Open File report 2005-1405), 3) Preliminary map showing landslide densities, recurrence intervals and annual exceedance, probabilities as determined from historic records, Seattle, Washington by J.A. Coe, J.A. Mitchael, R.A. Crovelli, and W.Z. Savage. Open File Report 00-303. 4) Modeling 3-D Slope Stability of Coastal Bluffs Using 3-D Groundwater Flow, Southwestern Seattle, Washington, by Dianne L. Brien and Mark E. Reid, U.S. Geological Survey Scientific Investigations Report 2007-5092, 5) Rainfall Thresholds for Forecasting Landslides in the Seattle, Washington, Area–Exceedance and Probability by Alan F. Chleborard, Rex L. Baum, and Jonathan W. Godt Open File Report 2006-106. The scientific studies by USGS scientists were also made available to the general public in the form of non-technical fact sheets which included information about how the USGS prepared these products and how to use them.

Interviews conducted with representatives of the City of Seattle revealed that the products developed by the USGS Seattle Landslide Project were integrated into numerous venues for decision making and policy implementation. These uses include rigorous consideration of the potential landslide hazards in relation to decisions on siting and maintaining public facilities such as roads and schools, and implementation of the City's Drainage Plan and Critical Area Regulations. These maps and information are also used in conjunction with environmental review on public and private projects as well as strategic planning for response readiness.

The State of Washington contributed to the success of the adoption of landslide hazard reduction policies through the Growth Management Act (GMA) that requires all local jurisdictions, such as Seattle, to identify and regulate geologically hazardous areas. This statewide law establishes the "demand" for scientifically based products. The State of Washington monitors and enforces local compliance with GMA and has the authority to withhold state funds from communities that do not comply. The State also has ultimate authority to evaluate consequences and potential impacts of projects that go through the State Environmental Policy Act (SEPA) an act that mandates environmental review including identifying the consequences of new construction grading.

In the case of Seattle, three levels of government converged on the problem of landslide hazards. New information about the landslide hazards was made available by the USGS and Seattle and its contractor Shannon and Wilson. Existing State of Washington regulations that required loss reduction policies at the local level reinforced Seattle's desire to implement new land-use policies, new interagency coordination of emergency response, and new sources and methods of allocating funds for new public facilities. Also, the new funding mechanism that authorized the collection of drainage management fees gave Seattle a new revenue source to implement landslide hazard mitigation.

7.8. Seismic Hazard Mapping Act of 1990 and Mapping of Landslides in California

Anderson, R. L. and McCarthy, R. J. (Alfred E. Alquist Seismic Safety Commission, United States of America)

California's topography and geology is directly related to it's scenic beauty. Low hazard potential undeveloped land is at a premium in California as more and more development occurs. This tends to push development into areas that may be prone to a natural hazard such as flooding, naturally occurring asbestos, wildfires, fault rupture landslides, liquefaction, collapsing soils or tsunamis. In addition some development is purposely done in areas of known or potential hazards in order to take advantage of views from the properties. After World War II, residential development along and on hillsides began in earnest in Southern California. Landslide assessment and mitigation in California started in earnest after rain induced landslides occurred in 1952 and were followed later on with seismically induced landslides after the 1971 San Fernando and 1989 Loma Prieta earthquakes. Local laws and ordinances were used to require that landslide hazards be dealt with.

After the Loma Prieta earthquake of 1989 the State Legislature recognized that action needed to be taken to help citizens recognize seismically induced landslide hazards by providing a legal frame work requiring that the California Geological Survey conduct regional landslide mapping and requiring that development have a detailed landslide hazard assessment conducted. The law that required the mapping is known as the Seismic Hazards Mapping Act.

There are four basic types of landslide maps produced in California: A) landslide inventory maps, B) landslide hazard maps, C) landslide risk maps, and D) Landslide zone maps. The Seismic Hazard Mapping Act requires that the California Geological Survey map seismic hazards of liquefaction and landslides. This paper focuses only on the landslide hazard (a modified version of the type B landslide map) element of the Seismic Hazard map. The seismic hazard zones map includes depicts areas that the California Geological Survey has identified that would require further investigation under the Seismic Hazard Mapping Act should they be developed. The seismic hazard zones map focuses only on areas susceptible to liquefaction or landslides or that have been observed to have either hazard occur in the past. The maps are produced at a scale of 1:24,000 and are registered to be used with United States Geological Survey 7.5 minute quadrangle topographic maps as a base map. The areas with the highest priority are those facing urbanization, redevelopment or areas that have high populations that may be subject to seismic hazards that would threaten public health and safety during an earthquake. These maps are incorporated into the safety elements to city and county general plans.

Prior to obtaining a permit in an area that has been identified by the State as an area requiring further investigation for a seismic hazard, the developer must conduct a site specific investigation to have a landslide or a liquefaction hazard assessment conducted in conjunction with a geotechnical report for the property to be permitted.

Should the site be prone to landslides, then a site specific mitigation scheme must be developed and approved by the lead reviewing agency. Once the landslide mitigation measure has been approved and all other appropriate issues from the development project have been addressed to the satisfaction of the lead agency then the project may be approved for development.

In order to help increase the quality and consistency of seismic hazard assessment the California Geological Survey developed the “Guidelines for Evaluating and Mitigating Seismic Hazards in California” and the “Recommended Criteria for Delineating Seismic Hazard Zones in California”. The “Guidelines for Evaluating and Mitigating Seismic Hazards in California” provides background information to the Seismic Hazards Mapping Act, as well as overviews for investigating seismic hazards including estimating strong ground motion, analyzing and mitigating landslides and reviewing site investigation reports. The “Recommended Criteria for Delineating Seismic Hazard Zones in California” assists California Geological Survey staff in mapping expected strong ground motion using a probabilistically based seismic hazard assessment approach and then uses the results in determines zones of liquefaction or earthquake induced landslide potential.

In addition to the guidelines, the American Society of Civil Engineers and the Association of Engineering Geologists along with the California Geological Survey and the Southern California Earthquake Center have provided training on the guidelines and the Seismic Hazards Mapping Act for practitioners as well as building officials.

7.9 Prevention Policies For The Protection Against Hydrogeological Disasters In Italy

Margottini, C. (Italian Ministry of Environment)

The Italian territory, for its morphological and geologic conformation, as well as for its geographical and climatic position, has always been affected by floods and landslide of high intensity and risk.

As an example it can be mentioned that in Between 1279 and 2002, the AVI catalogue (CNR-IRPI) filler 4521 events with damages, of which 2366 related to landslides (52.3%), 2070 to floodings (45.8%), and 85 to avalanches (1.9%). In the same period 13,8 victims for year in occasion of landslide phenomena and 49,6 for year for those alluvial have been reported. In last the 50 years victims to hydraulic phenomena are decreasing (31 victims year), but with an exponential increasing of the associated economic costs (APAT, 2007).

Surveying carried out from the River Basin Authorities has highlight the presence, in Italy, of approximately 13.000 individual areas ranging from high to very high risk for floods, landslides and avalanches (Fig. 9). These areas correspond to 29.517 Kmq and represent the 9,8% of the whole national territory (4.1% floods; 5,2% landslides; 0,5% avalanches), being involved 6,352 Italian municipalities (81,9% of the total), with city centers and important productive infrastructures and areas (Source Ministry of Environment).

The economic and social costs supported from the Italian State in order to supply the damages to the natural hazards are still little clear: in period 1968 to the 1992 they have been estimated in 75 Billions €, with medium value of a 3 Billions €/year (source Official Gazette of the Senate, 1992; costs brought up-to-date to 1992). Limitedly to the alluvial phenomena, the Yearbook of the Statistical Data of the APAT filler a total of 16 Billions € in period 1951-2005, with average value to 0,293 Billions €/year, that become 0,773 Billions €/year in period 1990 - 2005. Still less clear is the costs for the prevention: the distribution of the public works in Italy, period 2000 - 2005, evidences as the N04 Category (protection of the environment, hydrogeological

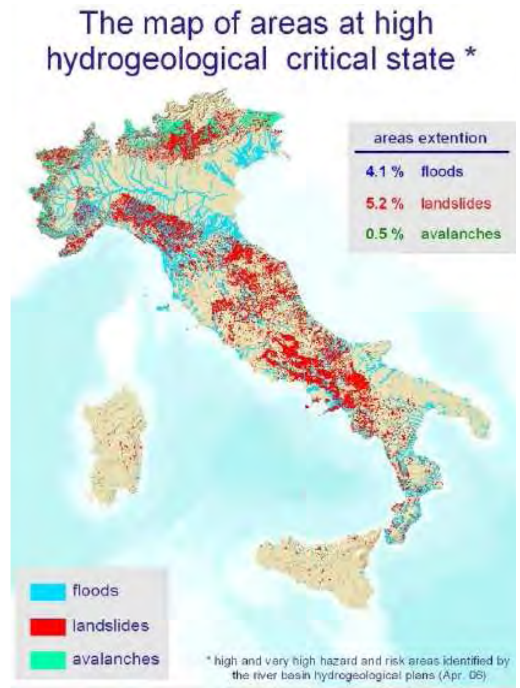

Fig. 9 The map of high and very high risk areas in Italy (Source Italian Ministry of Environment)

disasters and water resources) shows public investments for € 9.338.928.387, 00, second category only after road construction (source Authority for the Vigilance on Contracts Publics). Limitedly to the relative laws of financing to works for the reorganization of idrogeologico dissesto (D.L. 180/98 and s.m.i and L. 179/02) and managed from the Ministry of the Atmosphere and Tutela of the Territory, is evidenced, in period 1998-2005, equal appropriations to € 1.491.538.585, 00 relative to 1959 participations (Source APAT, project RENDIS).

Without considering civil protection activities, the main prevention policies and related laws were generally promulgated as the answer of the State to occurred catastrophes. As an examples it can be mentioned the main law 183/89, creating the River Basin Authorities in Italy, developed after the Polesine flooding in Northern Italy of 1951 and the Florence flooding in 1966. This law remained largely not functioning until the Sarno mud slide of May 1998. After that, a new law was promulgated (law 267/98), aiming at implementing the knowledge of risk areas in Italy and posing financial resources on prevention policies. This legislation had a further implementation after the flash flood of Soverato (South Italy) in 2000, with additional prescriptions, mainly for protection from flooding and flash flood. In recent year some modification were introduced, adding complexity to the whole legislation.

At the state of the art, in the Italian Ministry of Environment, the hydrogeological protection, in its wider meaning, prefigure the overcoming of the separation between the single intervention on the territory and environment. This behind the knowledge of the complexity and the interdependences between natural processes, use of the territory, urban and territorial planning; this last also in presence of demographic dynamics that, in the general reduction of the anthropic pressure in Italy, tend to concentrate the population in few important centres; such interconnections are dramatically evident in occasion of the great catastrophic events. In fact, during the last few years, also as a result of the climatic variations and to the modifications of land use planning and management, the frequency and the gravity of the extreme events, flood and drought, it seems to increase from which it arises the necessity of new policies protect in more effective way the populations and the territory. Main milestones of this new policies are:

1. the restoration of fluvial environments, cliff and coasts, recovering, anywhere possible, their own characteristics of naturalness, by means of land use changing also at the level of river basin, the restructure of natural water flow, the recovery of sediment transportation to the coasts and the realization of intervention with low environmental impact;
2. the reduction of degree of exposure to risks, relocating the infrastructures and only applying passive defense works in case of real necessity;
3. the safeguard the water resources assuring the corrected destination and priorities, the correctness of effective requirements with respect to economic and environmental terms;
4. the establishment of short and medium term shared scale of priorities, concentrating on them the available financial resources;
5. the realization of an inter-institutional collaboration, activating, in the respect of roles and responsibilities, all the possible and valid synergies to the aims of a correct territorial occupancy.

The above items should receive adequate financial support in order to fulfill the requirement of security of population, e.g prevention policy, before the occurrence of an extreme event and not as response and recovery after a disaster.

7.10. Landslide Mitigation and Risk Reduction Practice in Korea

Lee, S. G. (University of Seoul, Korea) and Hencher, S. (Halcrow China Ltd.; University of Leeds, UK)

Korea is a peninsula located in the middle part of eastern Asia and situated between China and Japan, covering an area of 221,000 km^2. In general, the peninsular is mountainous (about 70% of the total area) but rarely exceeding 1,200m in altitude. The climate of Korea has four distinct seasons. The mean annual temperature is 10°C with a maximum of 30°C in summer and minimum of -15°C in winter. The average annual rainfall is about 1,200mm, 60% of which generally falls during the summer period from June to August. The geology of Korea if complex and includes a wide variety of rock types including igneous, metamorphic and sedimentary. Regardless of rock type, the depth of weathering is generally limited to a few metres.

Slope failures, including natural and man-made cut slopes failures are one of the major hazards encountered in Korea, resulting in an average annual loss of 60 lives and property valued at 60~100 million U.S. dollars; the scale of damage has been rapidly growing with the booming of the construction industry. Most slope failures in Korea are triggered by rainstorms during the three month period from July to September.

Natural slope failures include debris flows and debris avalanches and these are typically initiated as shallow landslides along the boundary between thin saprolite and stronger rock on locally steep ground surfaces of between $35^{\circ} \sim 44^{\circ}$. Landslides have been studied over recent decades by Korean government organizations such as the Korea Forest Research Institute (KFRI) and the Korea Institute of Geosciences and Mineral Resources (KIGAM), however these studies are at an early stage for developing a good understanding of landslide mechanisms in Korea such that the consequences may be properly mitigated.

Since 1998 road cut slopes have been investigated by government organizations under the auspices of the Ministry of Construction and Transportation (MOCT). In particular the Korea Expressway Corporation (KEC) has investigated 4,800 cut slopes along express ways and the Korea Infrastructure Safety and Technology Corporation (KISTC) together with the Korea Institute of Construction Technology (KICT) has investigated 12,650 cut slopes along other national roads. Finally 299 slope sites along railway routes have been investigated by the Korea Railroad Research Institute (KRRI).

These investigations were conducted generally to prioritize remedial works on the basis of perceived stability using simple data-sheets or tables but without geological face mapping. The data sheets, tables and methodologies deployed are distinct to each organization and as such, they are not interchangeable. Furthermore attention has been focused only on the stability of the cut-slopes themselves with little or no consideration given to the stability of the terrain above and adjacent to the cut-slopes.

It is estimated that there are more than 700,000 cut slopes along roads and in housing areas in the urban and rural regions of South Korea. The responsibility for the management and maintenance of these cut slopes belongs to local government and private entities but the system has not been properly controlled by the government, partly due to a lack of regulations with respect to the stability of cut slopes. The government does not currently have detailed information on the distribution and stability condition of cut slopes throughout the country.

Many cut slopes, both public and private, fail during and after construction with consequent injuries, loss of life and economic loss. It is important therefore that the main factors causing slope failure are investigated and measures taken to reduce the incidence of slope failure. There needs to be better consideration of cut slopes through from design to construction and to maintenance following construction.
In an attempt to reduce the casualties and loss from slope failures, the National Emergency Management Agency (NEMA), an organization under the Ministry of Government Administration and Home Affairs, commenced a 5-year Research and Development project in September 2006 entitled 'Technological Development in Estimation and Countermeasure of Slope Collapse'. It is intended to review methods for site investigation of slopes, soil and rock testing, determination of geotechnical parameters, design methods, landslide preventive measures, cut slope data basing, rating techniques and, finally, to develop a real-time streaming-based slope disaster information forecasting system.

In July 2007, the Korean government introduced a new "Steep-Slope Law". It is a step towards allowing the Korean government to examine and control, systematically, the stability of cut slopes across the nation according to unified investigation techniques.

7.11. Institutional Frame Work for Community Empowerment towards Landslide Mitigation and Risk Reduction in Indonesia.

Andyani, B., Karnawati, D. and Pramumijoyo, S. (Gadjah Mada University, Indonesia)

The author's experiences as a volunteer in Aceh's tsunami December 2004 and Yogyakarta earthquake May 2006 (Andayani B and Koentjoro, 2008; in Karnawati et al, 2008) had taught some lessons which are necessary to be addressed in the National Plan for Disaster Risk Reduction. First, the need to improve community resilience against any potential disaster (such as landslide) has not yet been institutionally addressed in the existing disaster management effort. Second, the invlovement of social scientist or social disciplines needs to be further elaborated in the disaster mitigation and risk reduction. In fact, people's psychological aspect had never been touched by disaster management system (Karnawati et al, 2008).

Admittedly, there have been quite intensive efforts to mitigate various natural disasters such as landslides, earthquake, tsunami and volcanic eruption. Most of the mitigation efforts covered hazard mapping, risk analysis, development of appropriate technology for landslide early warning and countermeasures, and those are usulally provided mainly based on the technical approach. Yet, there is still minimum consideration on soicio-cultural aspect. Accordingly, most of the hazard map, analysis, early warning system and technology, as well as the countermeasure facilities cannot be effectively implemented and operated by the community and the local authority, especially in the developing countries.

Therefore, it is suggested to establish more systematical approach and mechanism to include socio-cultural and economical considerations in the process of developing institutional frame work for disaster risk reduction. Indeed, research for social investigation and mapping needs to be formally established in parallel with the technical research for disaster mitigation and risk reduction.

One success story in incorporating the socio-cultural considerations in landslide mitigtion is the application of community-based landslide early warning system in Banjarnegara Regency, Central Java (Fatahani TF and Karnawati D, 2007). In early 2007, the Indonesian Ministry of Development for Disadvantage Region committed to improve the community resilience in landside prone area by providing a pilot programme for community based landslide early warning system in one selected area in Banjarnegara, Central Java. This warning system was developed in coordination with the Local Government of Banjarnegara Regency and Gadjah Mada University. During the development process, community participation for landslide preparedness and the empowerement training for implementation of early warning system were intensively carried out. Stake holders consisting of schools, women organisation, village community, local red cross, local team of Search and Rescue, local police and NGO actively participated during the empowerment training and evacuation drill (Fig. 10). After installment of this early warning system, on November 7, 2007, the early warning alarm was on, and this alarm successfully made the local community living in the vulnerable site immediately leave the site and moved to the safer area. Then about 4 hours later, the landslide occurred without any victim. In fact, this become very good lesson learned which can save about 40 families living in the vulnerable site. The success of this community based early warning system encouraged the local government to further develope similar system to be applied in several other vulnerable sites in Banjarnegara Regency. This also stimulated the National Board for Disaster Management to develope further similar early warning in several different vulnerable Provinces in Indonesia.

The success of this community-based early warning system was due to an appropriate investigation on socio-cultural characteristics of the community. Therefore, in the next effort for landslide and seismic hazard mapping in Bantul Regency at Yogyakarta Province, similar investigation is also carried out in order to gurantee the effective implementation of the produced hazard map. From the investigation and mapping on social characteristics, it was identified that the main obstacles in the implementation of hazard mapping is the poor knowledge and understanding on geohazard phenomena (including landslide), which then results in serious public anxiety and poor community's capability for disaster preparedness. In such situation, the introduction of any hazard map to the community accordingly will create more anxiety and socio-economical problems related to the land ownership and worse economical development and investment in the hazard prone area. To avoid such problems, in parallel with technical efforts for hazard mapping, continues public education is carried out thorugh the establishment of a motivation team in village or district level. This team consist of elements form school teachers, woman organisation, youth organisation, difable group and supported by the key persons in the village. The main mission of this team is to continuesly disseminate practical information about the cause of landslide hazard, how to prevent and how to prepare or to anticipate the hazard. Such information can be disseminate informally through the community radio, informal community meeting, traditional attractions, and other informal and popular media. Continues monitoring of activities and empowerment for the motivation team should be done under the responsibility of the local government and supported by the local university or NGO.

Fig. 10. Public education and evacuation drill in Kalitelaga Village, Banjarnegara Regency, Java, Indonesia (Fathani TF and Karnawati D, 2007)

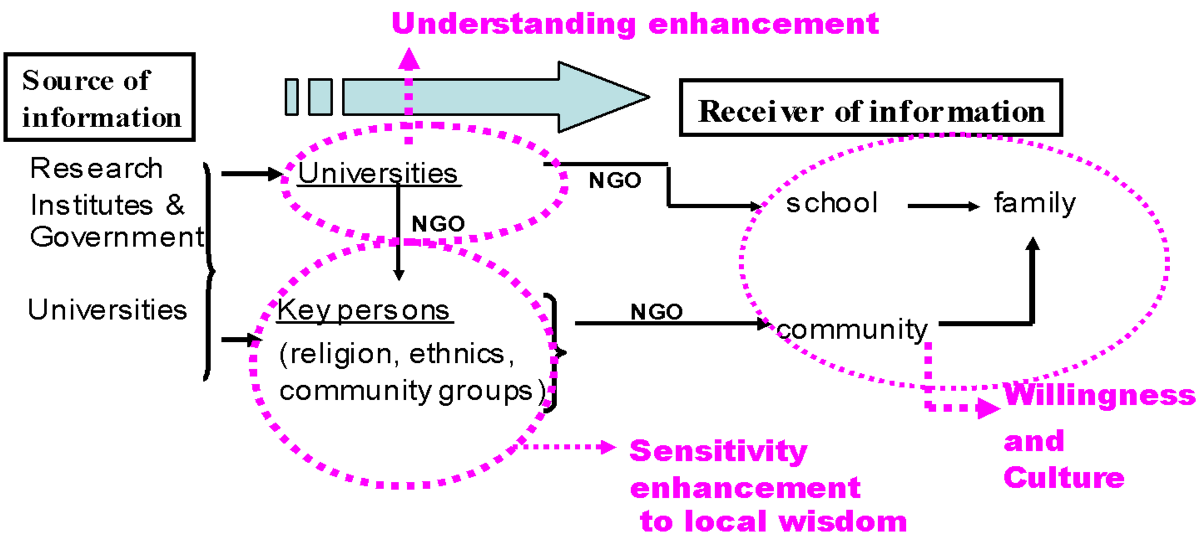

Fig. 11. Suggested institutional framework to support the development of community willingness and culture for landslide mitigation and risk reduction (Karnawati, et al 2005).

Learning from above case experiences, it is obvious that socio-cultural aspect should be appropriately considered to improve the community resilience with respect to disaster mitigation and risk reduction. The role of social and psychological disciplines is crucial to support the technical efforts in disaster mitigation. Cross-cutting coordination among research insitutions/ universities or technical departments (offices) as the source of information for disaster mitigation and the receiver organization/ institutions which are responsible for community preparedness is proposed by Karnawati et al (2005) as illustrated in Fig. 11. The main goal of this institutional frame work for community empowerment is to develop cultural willingness and preparedness for disaster (including landslide) mitigation and risk reduction.

8. List Of Presentations

Disaster Management Legislation In Indonesia: Challenges For Implementation.
Pujiono, P. (Indonesian Society for Disaster Management, Indonesia)

Natural Hazard Legislation And Professional Landslide Guidelines In British Columbia, Canada
VanDine, D. F. (VanDine Geological Engineering Limited, Canada)

Slope Safety System And Landslide Risk Management In Hong Kong
Chan, R. K. S. & Lau, T. M. F. (Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong SAR Government)

A New Sustainable Landslide Risk Reduction Methodology For Communities In Lower Income Countries
Anderson, M. G. & Holcombe, L. (University of Bristol, United Kingdom)

Malaysian Slope Master Plan
Abdullah, C. H., Mohamed, A. and Pandi, A. R. (Public Works Department, Malaysia)

Landslide Management in the UK – is it working?
Gibson, A.D., Culshaw, M. G. and Foster, C. (British Geological Survey, England)

Reducing Landslide Hazards through Federal, State, and Local Government Cooperation: The Seattle, Washington, Experience
Gori, P. L. (U.S. Geological Survey, USA) and Preuss, J. (PlanWest Partners, Inc, USA)

Seismic Hazard Mapping Act of 1990 and Mapping of Landslides in California
Anderson, R. L. and McCarthy, R. J. (Alfred E. Alquist Seismic Safety Commission, USA)

Prevention Policies For The Protection Against Hydrogeological Disasters In Italy
Margottini, C. (Italian Ministry of Environment)

Landslide Mitigation and Risk Reduction Practice in Korea
Lee, S. G. (University of Seoul, Korea), Hencher, S. (Halcrow China Ltd.; University of Leeds, UK)

Institutional Frame Work for Community Empowerment towards Landslide Mitigation and Risk Reduction in Indonesia.
Andyani, B., Karnawati, D. and Pramumijoyo, S. (Gadjah Mada University, Indonesia)

Conclusions

The concept of a policy and institutional framework, as well as the subsequent transformation to a template National Slope Master Plan which includes many components to successfully implement Landslide Mitigation and Risk Reduction have been introduced in this chapter.

The main advantages of the formation of such template are summarised as follows:

National Level

1. To serve as a blueprint to generate political commitment, which will enable the allocation of resources from the main stakeholders both in terms of manpower and budget. This will facilitate the setting-up of a lead organisation or agency to ensure good governance and to champion landslide mitigation and risk reduction. With the Master Plan budget, the lead organisation could recruit the best candidates with attractive remuneration and sustainable career path for efficient implementation of the Master Plan.
2. To setup a lead agency for landslide mitigation and risk reduction at national level, ideally under the Prime Minister's Office or a Ministry that supports all the relevant agencies or stakeholders responsible across ministries and agencies that serve them best. This is to harmonise general directives and to prevent competition for resources.
3. To streamline the preparation of a local legal and regulatory framework, securing resources and providing best practices from lessons learned.
4. To implement landslide mitigation and risk reduction in two thrusts, first on planning control of new development, and second on retrofitting existing slopes. This is to ensure enforcement of good practices in new development, retrofitting of existing areas at risk, research and development and exploring advancement in technology and methodology.
5. To effectively set up institutional coordination for addressing the socio-cultural dimension in landslide mitigation and risk reduction.

International Level

1. To seek engagement and cooperation of stakeholders from international organisations such as ICL and its network of centres of excellence, to collate the experience and practices in the world on policies and legislations, etc. and develop a template on National Slope Master Plan, knowledge kits and guidelines as references for nations in need of help especially underdeveloped and developing countries. This will save cost and time in the development phase.

2. To provide financial support for emergency rescue aid via international aid organisations.

With these templates in place and continuous sharing of experience and resources, landslide mitigation and risk reduction can be more successful.

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