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REPORT

SURVEYING PERCEPTION OF LANDSLIDE RISK MANAGEMENT

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Surveying perception of landslide risk management
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KLIMA 2050

Surveying perception of landslide risk management

Preface

This report presents the methodology and results of an opinion survey on perceptions of landslide risk management in Norway. The project is part of the Work Package (WP) 3.5 Management of landslide risk of Klima 2050.

Klima 2050 - Risk reduction through climate adaptation of buildings and infrastructure is a Centre for Research-based Innovation (SFI) financed by the Research Council of Norway and the consortium partners. The SFI status enables long-term research in close collaboration with private and public sector, as well as other research partners aiming to strengthen Norway's innovation ability and competitiveness within climate adaptation. The composition of the consortium is vital in order to being able to reduce the societal risks associated with climate change.

The Centre will strengthen companies' innovation capacity through a focus on long-term research. It is also a clear objective to facilitate close cooperation between R&D-performing companies and prominent research groups. Emphasis will be placed on development of moisture-resilient buildings, stormwater management, blue-green solutions, measures for prevention of water-triggered landslides, socio-economic incentives and decision-making processes. Both extreme weather and gradual changes in the climate will be addressed.

The host institution for SFI Klima 2050 is SINTEF, and the Centre is directed in cooperation with NTNU. The other research partners are BI Norwegian Business School, Norwegian Geotechnical Institute (NGI), and Norwegian Meteorological Institute (MET Norway).

The business partners represent important parts of Norwegian building industry; consultants, entrepreneurs and producers of construction materials: Skanska Norway, Multiconsult AS, Mesterhus/Unikus, Norgeshus AS, Saint-Gobain Byggevarer AS and Isola AS. The Centre also includes important public builders and property developers: Statsbygg, Statens vegvesen, Jernbaneverket and Avinor AS. Key actors are also The Norwegian Water Resources and Energy Directorate (NVE) and Finance Norway.

We would like to thank all the participants of the survey for their valuable time to provide opinions and feedback, and contact persons of various Klima 2050 partners and the County Governors for their help and support.

Trondheim, May 2016

Berit Time
Centre Director
SINTEF Byggforsk

Summary

Aim of work
Enhanced precipitation due to climate changes leads to increase in both frequency and intensity of landslides in Norway. A proactive approach to risk management is therefore required to significantly reduce the losses associated with landslides. Opinions and perceptions from practitioners on performance of landslide risk management are expected to provide insights on areas for improvement in landslide risk management activities in Norway. They are also useful reference for prioritising future work plans in Klima 2050.

How to survey and assess perceptions on landslide risk management?
A well-established indicator for performance is the Risk Management Index (RMI) proposed by Cardona et al. (2004). The methodology for calculating this index is based on a survey to technical staff, decision-makers, and stakeholders involved in all stages of risk reduction strategies. The RMI is thus an innovative and useful procedure for measuring perceptions holistically from selected actors.

The indicator was first used to measure perceptions of landslide risk management in Norway by Chiu (2015). The present study adopts a similar methodology as Chiu (2015) to obtain more survey results as well as opinions that can also provide insights to the future activities of Klima 2050. Perceptions are surveyed for two time periods: 2015 and 2050 and based on national, county, and municipality levels. Relevant data from Chiu (2015) are also analysed together with the survey data in the present study.

Risk Management Index (RMI)
The RMI is a composite index that consists of four public policies, which are represented by indices, namely Risk Identification index (RMI_{RI}), Risk Reduction index (RMI_{RR}), Disaster Management index (RMI_{DM}), and Governance and Financial Protection index (RMI_{FP}). The RMI is calculated as the mean of the four public policy indices. Each policy index can take a value from 0 to 100. Therefore, RMI also varies from 0 to 100, where the lowest and highest values correspond to the poorest and best performance of risk management (i.e. RMI and policy indices increase as the performance of risk management improves). Based on the obtained score, the resulting RMI (or its subindices) is subdivided into 5 levels with corresponding verbal description 1: Low, 2: Incipient, 3: Significant, 4: Outstanding and 5: Optimal

The survey
For the present study, a survey on landslide risk management perceptions in Norway was conducted between mid September and late October, 2015. A total of 28 responses were received.

Key observations of the survey results are summarised in the following:

1. RMI at any administrative level in 2015 ranges from 30 to 42, correspondent to performance at level 3: Significant. In 2050, the RMI values increase and ranges from 46 to 66, correspondent to performance level 3: Significant to 4: Outstanding.
2. Policy indices are higher for the national level than sub-national administrative levels.
3. RMI_{RI} at national level is the highest among all policy indices in both years, especially in 2050.
4. Within the RR and DM public policies, indicators associated with upgrading, retrofitting, and reconstruction of assets have the lowest performance levels in both years but a large number of answers of 'not relevant' and 'not able to answer'.
5. RMI_{FP} is the lowest among all policy indices in any year, especially at the municipality and county levels.
6. The indicators considered to be most critical are indicators considered important for the landslide risk management, but within which the performance is considered as low.

Technically this would be indicators with relatively low performance levels combined with high relative weights. This combination was identified for the three indicators: *RI3. Hazard evaluation and mapping* (relatively low rating at municipality level)*, RR4. Housing improvement and relocation from prone-areas*, and *DM5. Rehabilitation and reconstruction training*.

7. At the end of the survey, the respondents were requested to identify and provide brief explanations on the factors they had predominantly considered when evaluating the change in landslide risk performance from 2015 to 2050. The most frequent considered factors in this connection were factors related to knowledge and technology, climate, risk perception, and anthropogenic activities.

Conclusions

Based on the survey results and the comments from respondents, it is concluded that several aspects of landslide risk management in Norway can be improved. For example, landslide hazard evaluation and mapping should be prioritised in Norway. Upgrading, retrofitting, and reconstruction of assets may also be included in the landslide risk reduction strategies in Norway. In addition, there should be more focus on inter-institutional organisation as well as allocation and use of financial resources for dealing with landslides at municipality level.

Comparing the results for 2015 and 2050, the respondents show an optimistic view of the landslide risk management in the future. In spite that climate change and expanded development are considered to pose greater landslide hazards in the future, landslide risk management in Norway is perceived to improve in the long term. At all the administrative levels, the scores for the majority of indicators showed an improvement from 2015 to 2050. The reason may be related to respondents' belief that better knowledge and technology (e.g. more advanced monitoring and warning systems), increased risk awareness, and appropriate planning and mitigations in the future are powerful enough to adapt to climate change and development.

The results can be used in the development of innovations in the landslide risk management in Norway and they are regarded as useful reference for the future work in Klima 2050. However, using the results, extra care should be taken as they are associated with uncertainties related to the limited number of response, subjective nature of perceptions, and limited knowledge of respondents.

Further work

It is our opinion that the present method can be adapted to and applied in other types of natural hazards in Norway, such as floods, also. However, generally, the questions in the survey should be further simplified or reformulated to make them more understandable. It is suggested to consult practitioners in municipalities about the appropriate terms that should be used in the questions. It is further recommended to expand the present approach of surveying perceptions on landslide risk management to obtain perceptions also from the public, since a more comprehensive evaluation of the effectiveness of landslide risk management can be obtained by comparing between perceptions by experts and the public.

Content

1 Introduction

1.1 Objectives and scope

Enhanced precipitation due to climate changes leads to increase in both frequency and intensity of landslides in Norway. A proactive approach to risk management is required to significantly reduce the losses associated with landslides.

Work Package (WP) 3.5 Management of landslide risk of Klima 2050 aims at developing innovative measures and adequate procedures to improve the management of landslide risk at different levels (municipality, regional) in Norway. Risk management refers to the identification, reduction and controlling of risk, as well as strengthening of a society's capacity to withstand hazard impacts through a systematic process of organizational, development, operational, capacity, and institutional actions (van Westen et al. 2011; Carreño et al. 2007). Adequate procedures for the management of landslide risk help to ensure that risk mitigation measures are optimally integrated in practice in the building/construction/transportation sectors. Mitigation strategies for landslides can be divided into two types: structural and non-structural (Dai et al. 2002). Structural mitigation strategies refer to physical measures to reduce the probability of landsliding and/or the spatial impact of a landslide (e.g. slope stabilisation and retaining structures), as well as designing and constructing buildings to withstand slide forces. Non-structural mitigation strategies include land use planning, monitoring and warning system, and acceptance strategies. They can reduce the societal consequences of landslides.

Opinions and perceptions from practitioners on performance of landslide risk management are expected to provide insights on areas for improvement in landslide risk management activities in Norway. The surveyed opinions can thus be useful reference for prioritising future work plans in Klima 2050. The Risk Management Index (RMI) proposed by Cardona et al. (2004) is a well-established method for measuring perceptions of risk management holistically from selected actors. The RMI index is measured based on opinion questionnaires to technical staff, decision-makers and stakeholders involved in all stages of risk reduction strategies. The present study adopts and modifies Cardona's RMI method (to fit with Norwegian conditions) to conduct a survey on perceptions of landslide risk management in Norway. The RMI method considers a wide variety of strategies to manage the landslide risk including structural and non-structural measures, acceptance strategies, disaster management and risk transfer.

The present report aims at presenting the survey results on perception of landslide risk management in Norway.

Due to limited time for collecting survey data, survey response is deemed limited. Therefore, readers should bear in mind that the obtained results are associated with large uncertainties.

1.2 Background

1.2.1 Previous work

The RMI method was first proposed by Cardona et al. (2004) and later modified and applied by Cardona et al. (2005) and Carreño et al. (2007) to assess risk management performance of natural disasters in countries in Latin America and the Caribbean (LAC). The index is included as an output in the project on disaster risk management indicators under the Inter-American Development Bank/Institute of Environmental studies of the National University of Colombia (IADB/IDEA) program. To date, the index is updated to 2008 for 17 countries of the LAC region (Cãrdona & Carreño 2011).

Lahidji (2009) also proposed a system of component indicators to evaluate and compare coping capacity of countries against the impact of natural disasters. The system consists of ten components, each of which is benchmarked against five levels of achievement. Such system and the classified components resembles those of the RMI method.

Chiu (2015) implemented the RMI method to perform a comparative study of perceptions of landslide risk management in Norway and Hong Kong. An opinion survey was conducted in early 2015 in Norway to study the perceptions on landslide risk management at county and national levels for years 2004, 2014 and 2024. A total of nine responses from Norway were received. The respondents are from NGI, Norwegian Water Resources and Energy Directorate (NVE), County Governors, Norwegian Directorate for Civil Protection (DSB) and the Norwegian University of Science and Technology (NTNU). Survey data from Chiu (2015) are collaborated with the data obtained via the survey conducted during the present study.

1.2.2 Modifications of questionnaires in Chiu (2015)

The present study modifies the questionnaires of Chiu (2015) in order to obtain more responses. Key modifications include:

1. Translating the questionnaire (originally only in English) to Norwegian, since it is expected that most participants' working language is Norwegian.
2. Simplifying and reformulating some of the questions in order to make them more answerable and applicable to Norway. The work by Lahidji (2009) is also taken as reference. Details of the reformulation of questions are given in Appendix A.
3. Including municipality level.
4. Adding 'Not relevant' and 'not able to answer' as options in the answers. The former can help evaluate the relevance of the questions. The latter can provide insights on the knowledge level of respondents.
5. Redesigning the structure of the questionnaire to facilitate participates to understand the scope of the questions and evaluation criteria.
6. Including open questions to allow participants to freely express their opinions on the topic as well as the questionnaire.

Details of the questionnaires are described in Section 2.5.

1.2.3 Overview of landslide risk management in Norway

The aim of landslide risk management in Norway is to offer all citizens an 'as low as reasonably practicable' (ALARP) risk level (Lacasse & Nadim 2007), i.e. to perform a cost-effective risk reduction. Landslide risk management in Norway is mainly engaged by several ministries, through the Planning and Building Act, Natural Perils Act (Act on Natural Damage) and Civil Protection Act. The first two acts came into force for the whole of Norway in the 1960s, triggered by catastrophic landslide events (Pelling et al. 2011). These acts decree restrictions regarding building and construction practices, actions of private landowners and municipalities to carry out safety measures against natural hazards, and establish citizens' rights to compensation for natural disasters (Pelling et al. 2011). On the other hand, the Civil Protection Act puts forward local authorities' preparedness for landslide disasters.

A more holistic and integrated approach in landslide risk management in the country was observed when the Norwegian Water Resources and Energy Directorate (NVE) was assigned as the operative authority for landslides in Norway in 2009 (Pelling et al. 2011; DSB 2013). The directorate is responsible for inter-ministerial coordination on landslide prevention (Lacasse & Nadim 2007). In addition, it issues national landslide warnings and provides professional help to municipalities and society to manage landslide risks through hazard mapping, guidance on land use planning, implementation of protective measures, monitoring and warning, as well as assistance during events (DSB 2013; Saunders et al. 2015).

At the national level, the Norwegian Directorate for Civil Protection (DSB) conducts national risk assessment for landslides every year since 2010 (Saunders et al. 2015). Since 2008, risk and vulnerability analysis (ROS-analysis) is legally bound in the Planning and Building Act in connection to land use planning and new area developments (Pelling et al. 2011). As a result, at the local level, municipalities are required to run a comprehensive ROS analysis to establish the existence of landslide hazards and potential consequences before the regulation plan can be approved by the county authorities (Lacasse & Nadim 2007). For landslides there are explicit safety requirements for buildings, prohibiting building in areas where the annual probability of landsliding exceed a certain annual probability. This probability depends on the type and importance of the buildings to be constructed, e.g. 1/1000 per year for residential buildings with less than 10 persons. For the building requests to be approved, municipalities also need to provide a proper geotechnical investigation (Pelling et al. 2011) and consider safety or mitigation measures (Lacasse & Nadim 2007). Municipalities are also required to prepare and update a contingency plan based on the ROS-analysis. In addition to the required analyses prior to development of new areas, the municipalities have a duty to carry out a holistic risk and vulnerability analysis (ROS-analysis) for already developed areas. The purpose of the analysis is to identify and evaluate the likelihood of adverse events that can occur in the municipality and assess how these may affect the municipality. Such analyses are to be repeated every 4th year.

Since 1980, any damage caused by natural hazards can normally be fully compensated (Lacasse & Nadim 2007). This is achieved through a combined insurance system of the private natural disaster insurance scheme (managed by the Norwegian Natural Perils Pool) and the National Fund for Natural Disaster Assistance (Pelling et al. 2011). Under the system, any objects that are insured against fire are normally also insured against natural disasters, whereas other valuables that cannot be insured against fire are covered by the public fund (Pelling et al. 2011).

2 Methodology

2.1 Background of Risk Management Index (RMI)

To assess risk management, criteria involving incommensurable units and information which can only be evaluated by linguistic estimates are often involved (Cardona et al. 2005; Carreño et al. 2007). To handle these criteria simultaneously so as to give a quantitative measure of effectiveness of risk management, Cardona et al. (2004) suggested combining the 'multi-attribute technique' and fuzzy sets theory.

The multi-attribute technique agrees with ISDR draft framework (ISDR 2003) for guiding and monitoring disaster risk reduction. This outlines various thematic areas, components, and tentative performance evaluation criteria in disaster risk management. By adopting such a systematic and generally agreed upon framework of multiple disaster reduction initiatives, risk reduction approaches and trends can be analysed and compared (ISDR 2003).

On the other hand, fuzzy sets theory gives flexibility to modelling which uses linguistic or qualitative expressions for management performance levels, e.g. 'low', 'significant', 'optimal' etc. (Cardona et al. 2004, 2005; Carreño et al. 2007). These linguistic values are the same as a fuzzy set of bell-shaped and sigmoidal-shaped membership functions (Cardona 2001; Carreño 2001; Cardona et al. 2004, 2005; Carreño et al. 2007), as shown in Figure 2.2a.

2.2 RMI as a system of 'composite indicators'

Under the multi-attribute technique, following the draft framework compiled by ISDR (2003) and considering public policy makers as users, Cardona et al. (2004) constructed the RMI as a system of four 'composite indicators' (hereinafter ‘policy indices’), each of which represents a public policy and comprises of several indicators. The structure of the RMI system used in the present study is illustrated in Figure 2.1.

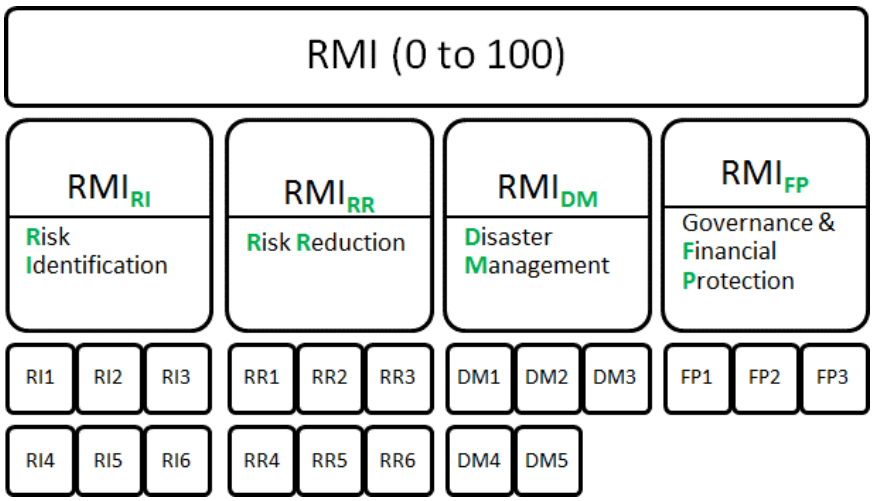


Figure 2.1 The Risk Management Index (RMI) system.

The four public policies include Risk Identification (RI), Risk Reduction (RR), Disaster Management (DM), and Governance and Financial Protection (Loss Transfer) (FP). In the present study, context of the public policies is modified to be implemented in landslide hazards as summarised in Table 2.1, whereas indicators of each public policy are listed in Table 2.2.

Each policy index takes a scale from 0 to 100. The RMI, which is defined as the average value of the four policy indices, thus also varies from 0 to 100:

$$RMI = \frac{RMI_{RI} + RMI_{RR} + RMI_{DM} + RMI_{FP}}{4} \quad (2.1)$$

The four policy indices as well as the RMI are referred as landslide risk management indices.

Procedures of how the RMI of a country is obtained are schematically presented in Figure 2.2. Each policy index is quantified by the weighed values of its indicators. The weighed values are based on performance levels and relative weights, which are attributed to the indicator via separate questionnaires (see Section 2.5). The principle of obtaining the relative weights of indicators and subsequently the policy indices are described in Sections 2.3 and 2.4, respectively.

Table 2.1 Public policies considered in landslide risk management (adopted from Cardona et al. 2005; Carreño et al. 2007).

Public policy/ Composite indicator	**Policy index**	**Description**
Risk Identification	RMI_{RI}	Individual and social risk awareness of landslide hazards and methodological approaches in landslide hazard assessment
Risk Reduction	RMI_{RR}	Prevention and mitigation measures against landslides
Disaster Management	RMI_{DM}	Response and recovery following a disaster
Governance and Financial Protection (Loss Transfer)	RMI_{FP}	Allocation and use of financial resources for dealing with disaster

Table 2.2 Public policies and their corresponding indicators for the RMI in the present study (modified from Cardona et al. 2005; Carreño et al. 2007; Lahidji 2009)

Public Policy (policy index)	**Indicators**
Risk Identification (RMI_{RI})	RI1. Systematic disaster and loss inventory
	RI2. Hazard monitoring and forecasting
	RI3. Hazard evaluation and mapping
	RI4. Vulnerability and risk assessment
	RI5. Public information and community participation
	RI6. Training and education in risk management
Risk Reduction (RMI_{RR})	RR1. Land use and urban planning
	RR2. Hydrographic basin intervention and environmental protection
	RR3. Implementation of hazard-event control and protection techniques
	RR4. Housing improvement and relocation from prone-areas
	RR5. Updating of safety standards and construction codes
	RR6. Reinforcement and retrofitting of public and private assets
Disaster Management (RMI_{DM})	DM1. Emergency preparedness and continuity planning
	DM2. Information and warning systems
	DM3. Emergency response
	DM4. Community preparedness and training
	DM5. Rehabilitation and reconstruction planning
Governance and Financial Protection (Loss Transfer) (RMI_{FP})	FP1. Inter-institutional organisation and strengthening
	FP2. Budget allocation and mobilisation
	FP3. Insurance and disaster funds

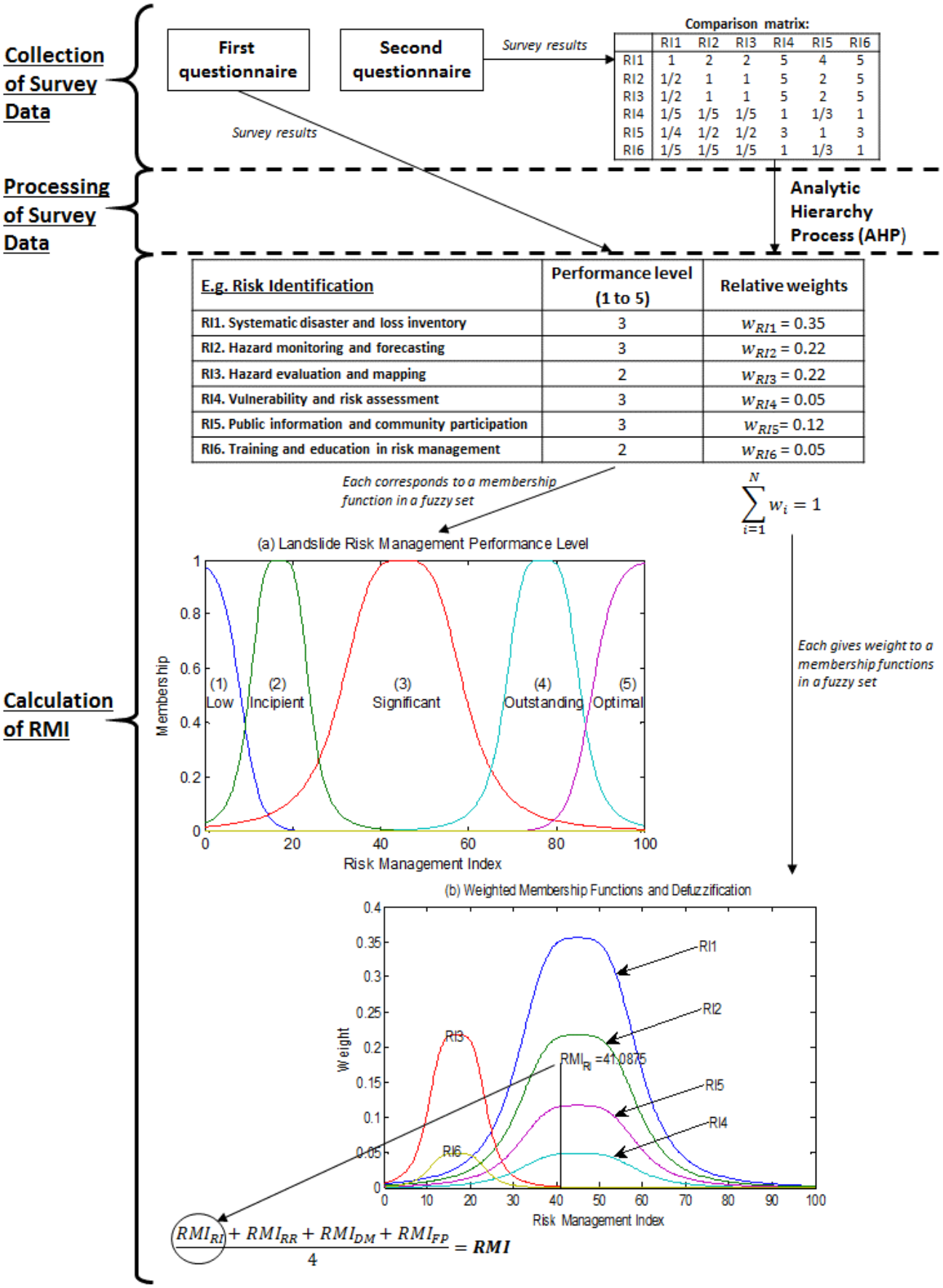


Figure 2.2 Procedures to obtain RMI of a territory, exemplified by the public policy of RI (modified from Chiu (2015)).

2.3 Assignment of weights to indicators, the Analytic Hierarchy Process (AHP)

For each indicator within a public policy, a weight is allocated to represent the relative importance of the indicator within the public policy. The process of allocating the weights follows the Analytic Hierarchy Process (AHP).

AHP is widely used in decision making for multiple attributes (Saaty 1980, 1987; Saaty and Vargas 1991; Cardona et al. 2005; Carreño et al. 2007). It enables a decision making problem to be decomposed into hierarchy, such that the problem can be evaluated based on both qualitative and quantitative aspects. The basic idea of AHP is that attributes (indicators in this study) are compared pairwise. For each pair of indicators, comparisons are made via two steps by perception: (1) 'Which of the two indicators is perceived as more important?' and (2) 'In which degree?' Also, the degree of preference between each pair of indicators is rated within the same order of magnitude from 1 to 9. A degree of 1 represents that both indicators are equally important, whereas a degree of 9 represents that one indicator is 9 times more important than the other one.

Results of each comparison are tabulated to form a comparison matrix (see example in Figure 2.2). Relative weights are then calculated using an eigenvector technique. While calculating relative weights, the eigenvalue (λ_{max}), which is the largest positive eigenvalue, and the principal eigenvector of a comparison matrix are obtained. Consistency across the comparisons is also checked with respect to the eigenvalues:

$$\text{Consistency Index (CI)} = \frac{\lambda_{max} - n}{n - 1} \tag{2.2}$$

$$\text{Consistency Ratio (CR)} = \frac{CI}{CI_{random}} \leq 0.1 \tag{2.3}$$

It is suggested that if CR exceeds 0.1, the elements of the pairwise comparison matrix have to be re-examined (Saaty 1987) and modified (Carreño et al. 2007).

Within an acceptable consistency, the corresponding principal eigenvector is then standardised by having a value sum of 1. The standardised vector is called the priority vector.

The calculation of relative weights is undertaken by Matlab, using the script provided by Chiu (2015). An example showing the results of relative weights calculated from a comparison matrix is shown in Figure 2.2 ('Processing of Survey Data').

2.4 Fuzzy set of risk management performance levels

Each of the management performance levels used in the valuation of indicators represents the membership function of a fuzzy set, as shown in Figure 2.2a. A membership value of 1 represents total membership, whereas 0 represents non-membership. For the five fuzzy sets (i.e. five performance levels), two types of membership functions are involved:
Performance levels 1 and 5 are represented by a bell-shaped function:

$$bell(x; a, b, c) = \frac{1}{1 + \left|\frac{x - c}{a}\right|^{2b}} \tag{2.4}$$

Performance levels 2, 3 and 4 are represented by a sigmoidal function:

$$sigmoidal(x; a, b, c) = \frac{1}{1 + exp[-a(x - c)]} \tag{2.5}$$

The relative weights determined by AHP for each indicator (standardised to a sum of 1) give the height to the membership function of each fuzzy set (Figure 2.2b). A weighted fuzzy set thus contains $w_1 \times \mu_C(C_1)$, ..., $w_n \times \mu_C(C_n)$, where w_1 to w_n are the weights assigned to the indicators $\mu_C(C_1)$ to $\mu_C(C_n)$.

Defuzzification is carried out next using the method of centroid of area, which estimates the area and the centroid of a fuzzy set and determines a concentrated value, X, by the division of the sum of the product by the sum of the areas (see also Figure 2.2b). The policy index of a public policy, RMI_p is thus obtained by:

$$RMI_p = \frac{\int_X \mu_A(x) x dx}{\int_X \mu_A(x) dx} \tag{2.6}$$

Recall that the RMI is given by the average of the four policy indices (Equation 2.1).

The AHP weights are also calculated by Matlab, using the script provided by Chiu (2015). Figure 2.2b shows an example of the calculated result of a policy index.

2.5 Questionnaires

As illustrated in Figure 2.2 'Collection of Survey Data', two questionnaires, which are anonymous, are used in the survey. The first questionnaire (both English and Norwegian versions) and an extract of the second questionnaire are attached in Appendix B.

First questionnaire – occupational information, performance levels, and general comments

The first questionnaire collects ratings of performance level for each indicator. Following Cardona et al. (2004), five performance levels are designated to the valuation of each indicator (Cardona et al. 2005, Carreño et al. 2007). These performance levels correspond to linguistic expressions including 'low', 'incipient', 'significant', 'outstanding', and 'optimal' or numerically in a scale from 1 to 5, respectively. The criteria of the performance levels are based on Cardona et al. (2005) and Lahidji (2009), but have been modified such that they can be representative for landslide hazards in Norway. Figure 2.3 shows extracts of the questionnaire. Participants can first read the brief description of the indicator to obtain an overview of the scope of the indicator (Figure 2.3a). They can then refer each performance level to the detailed criteria on another page (Figure 2.3b). They can also rate the performance level simply based on the linguistic expressions 'low' to 'optimal' for the worst to best performance level respectively (Figure 2.3a). The linguistic expressions allow them to answer the questionnaire even though they are not familiar with all the descriptions in the criteria.

Information about participants' organisations, job titles, and disciplines of work are also surveyed in order to understand their technical background. The performance levels are assessed in terms of two time scenarios (2015 and 2050) and three administrative levels (national, county, and municipality). Participants can choose to select 'not relevant' or 'not able to answer' if appropriate. All the questions regarding performance levels are mandatory.

After answering the performance levels, participants are requested to select and provide brief explanations on the factors that they predominantly consider while assigning performance levels for 2050. These factors include anthropogenic activities, climate, demography, knowledge and technology, socio-economy, risk perception, as well as other possible factors provided by the participants. In the end of the first questionnaires, participants are asked to provide their opinions on landslide risk management in Norway and the questionnaire.

(a) Indicator

M = Municipality; **C** = County; **N** = National

RI1. Systematic disaster and loss inventory		2015 M	2015 C	2015 N	2050 M	2050 C	2050 N
Mapping of loss caused by landslides in previous events; coverage and quality (incl. degree of details and systematicity) Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						

(b) Criteria

RI1. Systematic disaster and loss inventory Go to indicator

Low: Some basic or superficial data on previous landslide events.

Incipient: Continual registering of current landslide events, incomplete catalogues of the occurrence of some events and limited information on losses and effects.

Significant: Some complete catalogues of landslide events, systematisation of actual events and their economic, social, and environmental effects.

Outstanding: Complete inventory and multiple catalogues of landslide events; registry and detailed systematisation of effects and losses.

Optimal: Detailed inventory and complete mapping of all landslide events as well as corresponding consequences.

Figure 2.3 Evaluation of performance level of indicator RI1. (a): Scope of RI1 and options of answers. (b): Detailed descriptions of performance criteria of RI1.

Second questionnaire – relative weights of indicators

The second questionnaire consists of a form for allocating relative weights between pairs of indicators based on the Analytic Hierarchy Process (AHP) (see Section 2.3). In the present study, the relative weights are assumed constant over time and the same set of AHP weights is used for analysis for all the administrative levels. If the CR exceeds 0.1, the answers given by the participant will be studied. Inconsistent answers that lead to high CR are modified upon agreement with the participants.

2.6 Sampling method, delivery mode and response format of survey

Both questionnaires were sent out by email.

2.6.1 First questionnaire

Target participants for the first questionnaire (i.e. on performance levels) were invited from authorities, experts, and stakeholders that are involved in any stages/disciplines of landslide risk management in Norway. They are partners in WP3 Landslides triggered by hydro-meterological processes and WP4 Decision-making processes and impact of Klima 2050, which include various types of organizations, such as government agencies, local authorities, consultants, contractors, research institutes as well as academic bodies. A significant number of participants were also invited from municipalities and county governors.

Invitation emails to the survey were first sent to target participants. The first questionnaire was then distributed to those who show interest. The first questionnaire was delivered electronically

as Adobe™ Portable Document Format (PDF) survey forms. Survey participants can answer most of the questions just by selecting the buttons in the survey forms. The completed first questionnaire are submitted automatically by a click of the 'submit' button in the completed form.

2.6.2 Second questionnaire

The second questionnaire was sent out after collecting all the responses for the first questionnaire. It is important that those who assign the relative weights within a policy understand the indicators as well as the policy. Therefore, only those AHP weights given by "experts" in a particular public policy from Chiu (2015) were used in the present study. "Experts" in a particular public policy defined by Chiu (2015) are those whose job discipline is related to the policy and/or those who claim that they are familiar with the policy. These AHP weights by these "experts" mostly belong to the RI and RR policies. In order to obtain a similar number of sets of AHP weights for each public policy, it is prioritised in the present study to collect AHP weights for the other two public policies, i.e. DM and FP. As a result, respondents for the first questionnaire who are able to rate the performance level for all the indicators within DM and FP public policies were selected to answer the second questionnaire.

The second questionnaire was delivered as an interactive excel spreadsheet, in which an approximation of the CR can be obtained automatically from the answers. The completed second questionnaire had to be sent as email attachment.

3 Results

Unless otherwise mentioned, results are based on the combined data from the surveys conducted both by Chiu (2015) and during the present study.

3.1 Survey response

3.1.1 First questionnaire of survey for present study

A survey is conducted between mid-September and late October 2015 during the present study Figure 3.5a summarises the status of invitations and responses for the first questionnaire. A total of 46 invitations were sent to people in Norway, whose work is related to landslide risk management. Among these invitees, 28 (61%) of them answered the first questionnaire mainly to rate the landslide risk management performance in Norway. Six of them declined to answer the questionnaire due to lack of time or competence. The remainder (26%) did not give any response to the invitation or did not answer the survey. In addition, some may have forwarded the questionnaire to other colleagues.

3.1.2 Occupational backgrounds

Seventy percent of respondents for the first questionnaire work in the public sector (Figure 3.5b, for both surveys). Around 20% works in research institute such as SINTEF, NGI and NTNU. Around 10% works in the private sector, including a producer of building materials, consulting, financial, and insurance companies.

According to Figure 3.1c, slightly less than 50% of respondents are non-Klima 2050 partners.

More than two-thirds of respondents from the public sector work in local authorities including municipality and county (Figure 3.1d). The remainder works in various government agencies such as rail and road authorities (including Vegdirektoratet, Statens vegvesen, and Jernbaneverket), DSB and NVE.

With reference to Figure 3.1e, about one-third of respondents work with landslide risk assessment. About one-fifth has working tasks related information and/or emergency response. One-tenth works in physical mitigation measures and/or other disciplines such as supervision, planning, and management. Less people ($\leq 6\%$) work in research and education, insurance, legislation and finance.

In addition, based on the job titles of the respondents, the majority (86%) are at senior or expert level.

3.1.3 Geographical distribution of data

Considering also the results obtained by Chiu (2015), one to six sets of data for performance level are available for all the counties in Norway. In addition, there are one to two sets of data for 48 (11%) municipalities from all the counties, except Sør-Trøndelag. Figure 3.2 shows the geographical distribution of the data at county and municipality levels.

3.1.4 Second questionnaire

Four respondents from the first questionnaire provided their opinions on relative weights on certain public policies. Combining the answers by "experts" from Chiu (2015) (refer to Section 2.6.2 for definition of 'expert'), the number of data for AHP weights is summarised in Table 3.1.

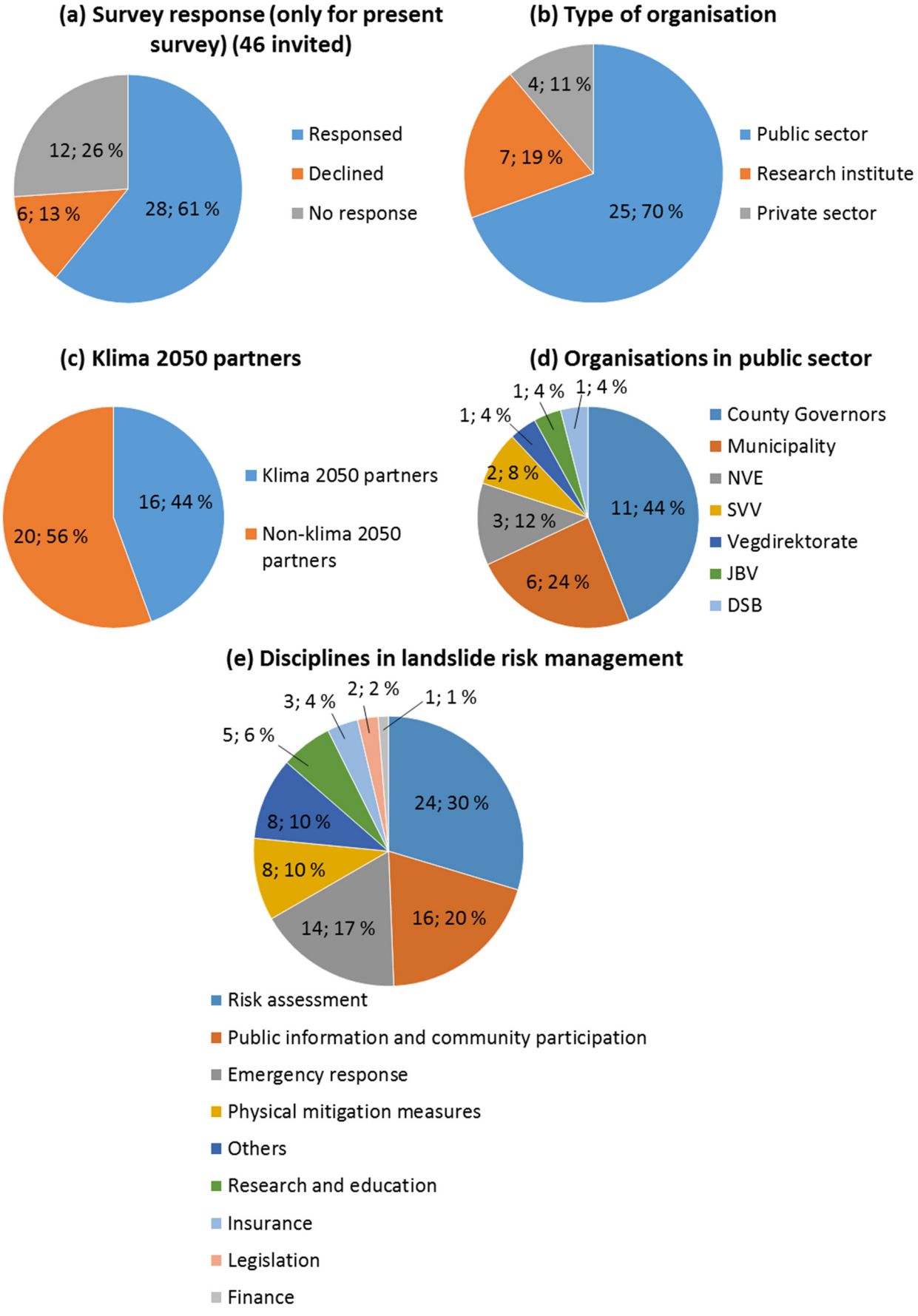


Figure 3.1 (a): Statistics on invitations and responses to the first questionnaire for survey conducted during the present study. (b) to (e): Background of respondents (total = 36) for the first questionnaire for the surveys conducted both by Chiu (2015) and during the present study. (NVE=Norwegian Water Resources and Energy Directorate; SVV= Statens Vegvesen; JBV=Jernbaneverket; DSB=Norwegian Directorate for Civil Protection)

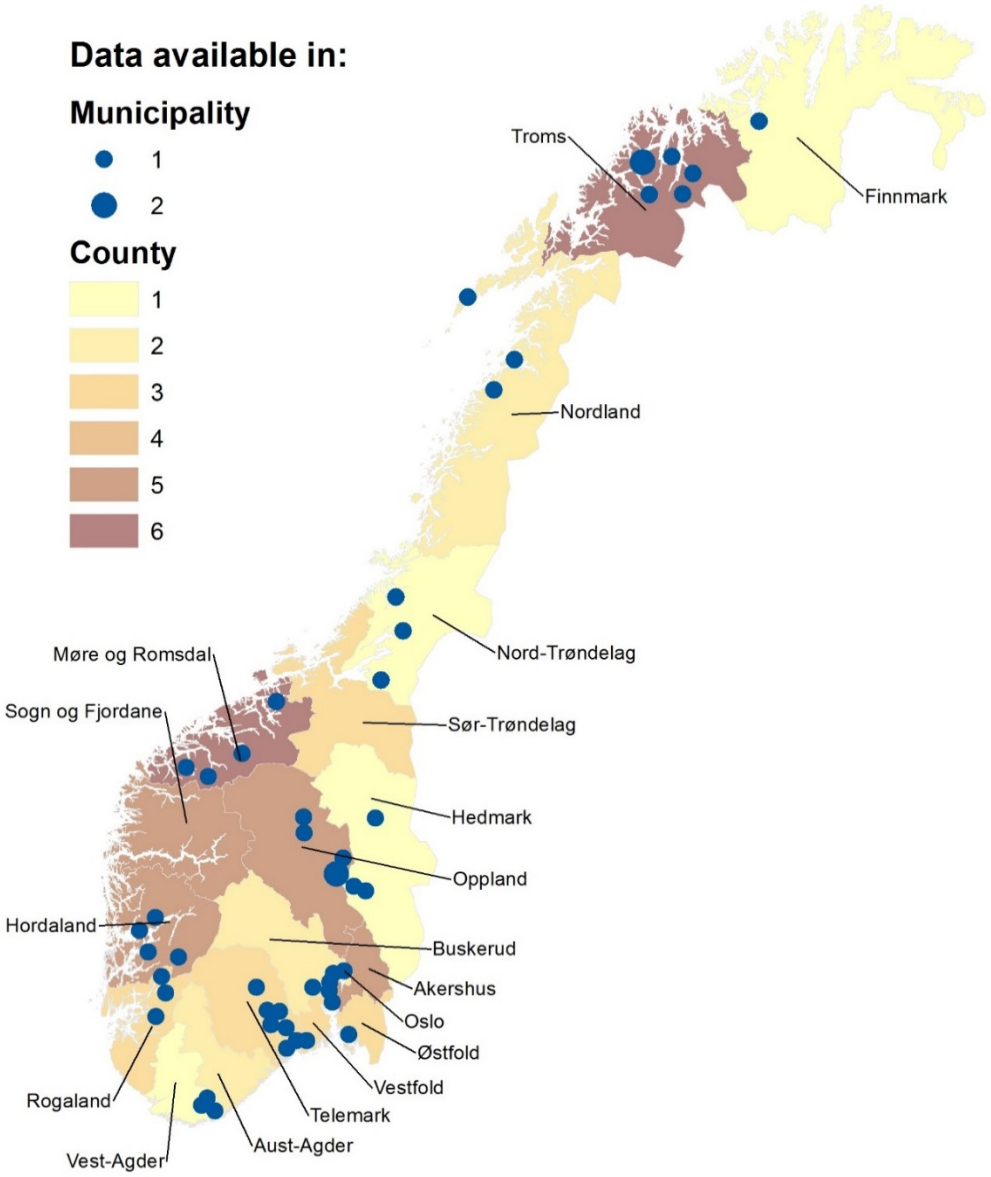


Figure 3.2 Geographical distribution of performance level data available at county and municipality levels. County data from Chiu (2015) are also used.

Table 3.1 Number of data of AHP weights

Public policy	No. of data		
	Chiu (2015)*	Present study	Total
RI	6	1	7
RR	4	1	5
DM	1	4	5
FP	0	3	3

*Only the results from "experts" are used.

3.2 Performance level

Performance between indicators is compared using median values. Figure 3.3 shows how the values are obtained. Median values of performance level at national, county, and municipality levels in Norway in 2015 and 2050 are shown in Figure 3.4. They are also put in Figure 3.5d to facilitate comparisons between different administrative level as well as years.

Note that several indicators are only applicable at national level. These include:
- *RI6. Training and education in risk management*
- *RR5. Updating and enforcement of safety standards and construction codes,* and
- *FP3. Insurance and disaster funds*

3.2.1 Year 2015

Indicators in 2015 at any administrative level generally have median values of 2 or 3, i.e. 'incipient' or 'significant' performance respectively (Figure 3.4). The majority of indicators have median values of 3, except the following indicators which have median values not larger than 2:
- *RR4. Housing improvement and relocation from prone-areas,*
- *RR6. Reinforcement and retrofitting of public and private assets,*
- *DM5. Rehabilitation and reconstruction planning,* and
- *FP1. Inter-institutional organisation and strengthening.*

Median values for national level are mostly equal to or occasionally higher than those for county and municipality levels in 2015 (Figure 3.4).

Median values of counties are mostly equal to those of municipalities in 2015, except that county medians are higher than municipality medians for the following indicators:
- *RI1. Systematic disaster and loss inventory,*
- *RI3. Hazard evaluation and mapping,*
- *RR3. Implementation of hazard-event control and protection techniques,* and
- *DM5. Rehabilitation and reconstruction planning*.

3.2.2 Year 2050 and changes

Most indicators have median values of 3 or 4 in 2050, i.e. 'significant' or 'outstanding' respectively. In addition, RR4, RR6, DM5 are still perceived to have poorer performance level than the other indicators at any administrative level in 2050 (Figure 3.4). Performance at national level is perceived to be generally better than county and municipality levels in 2050, particularly for all RI, some DM, and all FP indicators.

Performance at county and municipality levels are however mostly equal. Better performance is perceived at county level than municipality level in 2050 for the following indicators (Figure 3.4):
- *RI1. Systematic disaster and loss inventory*,
- *RR3. Implementation of hazard-event control and protection techniques*, and
- *FP2. Budget allocation and mobilisation*.

On the contrary, better performance is perceived at municipality level than county level for the following indicators (Figure 3.4):
- *RR2. Hydrographic basin intervention and environmental protection*, and
- *DM4. Community preparedness and training*

At any administrative level, the median values of the majority of indicators improved from 2015 to 2050 by one performance level (Figure 3.5d). No decrement in any median value of performance level is observed. Medians of all indicators at national level increase from 2015 to

2050, except for *FP3. Insurance and disaster funds*, which has no change, and *FP1. Inter-institutional organisation and strengthening* which is increased by two performance levels (Figure 3.3 or Figure 3.5d). At county level, around 60% of indicators (11 out of 17) improve (Figure 3.5d). Less improvement at county level is observed for RI and DM public policies. At municipality level, more than 80% of indicators (14 out of 17) improve (Figure 3.5d).

3.2.3 Other answers

Figure 3.5a-c presents the distribution of answers other than performance levels at different administrative levels. These answers include blank answers, 'not relevant', and 'not able to answer'. The distribution of these answers is similar between 2015 and 2050, therefore Figure 3.5a-c only shows the averages of both years. The total percentage of answers other than performance level range from 10% to 60%. All the indicators are given performance levels by the majority of respondents, except for *FP1. Institutional organisation and strengthening*.

The distribution of answers other than performance level is also similar between different administrative levels (Figure 3.5a-c). In particular, over 70% of respondents can answer the questions (i.e. give a performance level) in the RI public policy. Less people can answer in RR and DM public policies, especially:

- *RR2. Hydrographic basin intervention and environmental protection*,
- *RR6. Reinforcement and retrofitting of public and private assets*, and
- *DM5. Rehabilitation and reconstruction planning*.

In addition, only about 50% respondents can answer the questions in the FP public policy, which concerns allocation and use of financial resources for risk management activities.

3.2.3.1 Blank answers

There is a larger proportion of no data for county level (Figure 3.5b). This is due to a larger number of people who provided blank answers for county level during the survey conducted by Chiu (2015). Note that blank answers from Chiu (2015) may also mean irrelevant questions or that respondents could not answer.

3.2.3.2 'Not relevant'

Answers for 'not relevant' are less than 10% for most indicators. Irrelevant questions occur more often for county and municipality levels (Figure 3.5b-c). Comparing between public policies, there are relatively large proportions of 'not relevant' at any administrative level for the RR and FP public policies, particularly for:

- *RR6. Reinforcement and retrofitting of public and private assets,* and
- *FP1. Inter-institutional organisation and strengthening*.

3.2.3.3 'Not able to answer'

At any administrative level, among all the non-performance level answers, the majority is represented by ‘not able to answer’ and consists of about 6% to 64% of all answers (Figure 3.5a-c). 'Not able to answer' is least observed for the RI public policy, but more often for the other public policies. The highest percentage of 'not able to answer' is observed in:

- *RR2. Hydrographic basin intervention and environmental protection*,
- *RR6. Reinforcement and retrofitting of public and private assets*,
- *DM5. Rehabilitation and reconstruction planning*, and
- all the FP indicators.

3.2.3.4 Correlation between performance level and non-performance level answers

At any administrative level, it is apparent that those indicators that have a larger percentage of 'not relevant' and/or 'not able to answer' have a relatively low performance level, for example (Figure 3.5a-d):

- *RR6. Reinforcement and retrofitting of public and private assets*,
- *DM5. Rehabilitation and reconstruction planning*, and
- all the FP indicators.

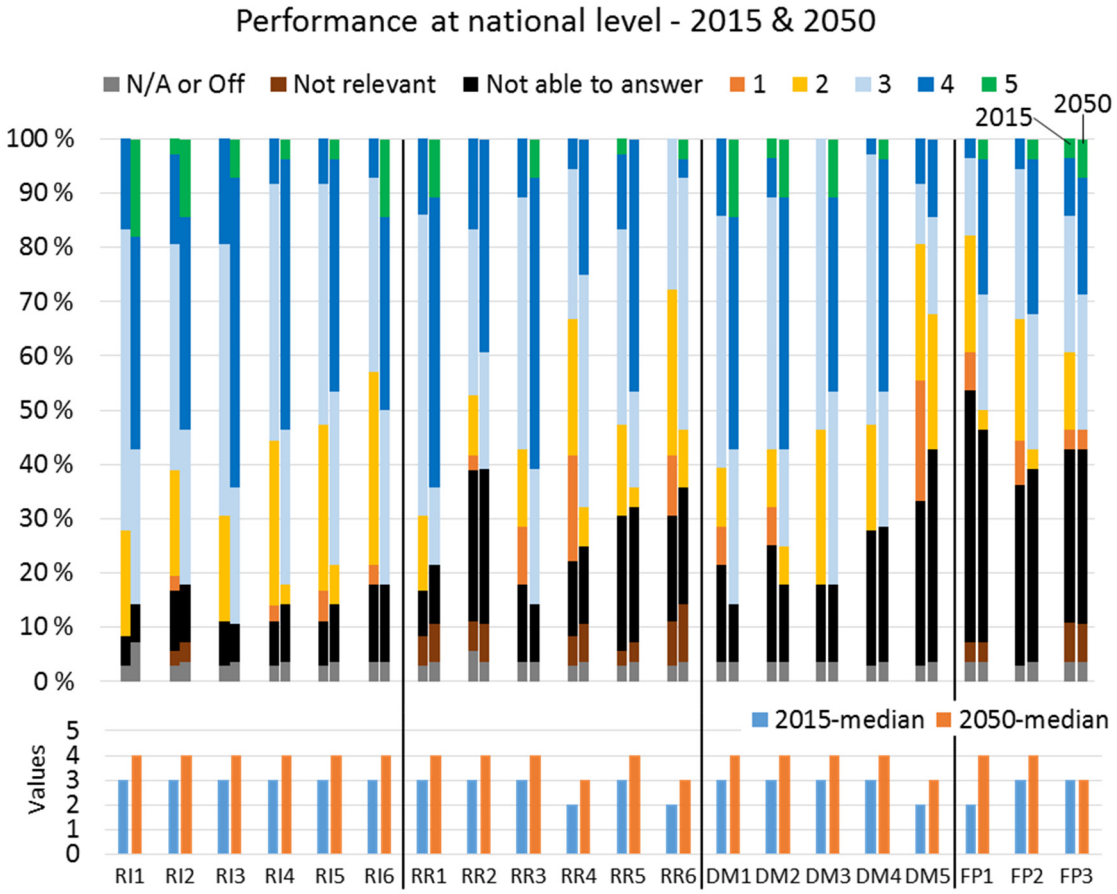


Figure 3.3 How the (median) value of an indicator is obtained, exemplified by national level results. The top figure shows the distribution of answers regarding performance level at national level. The answers consist of both performance levels (1 = low; 2 = incipient; 3 = significant; 4 = outstanding; 5 = optimal) and other answers including 'not relevant', 'not able to answer', and blank answers. The bottom figure shows the corresponding median value of the indicator calculated from the performance level data.

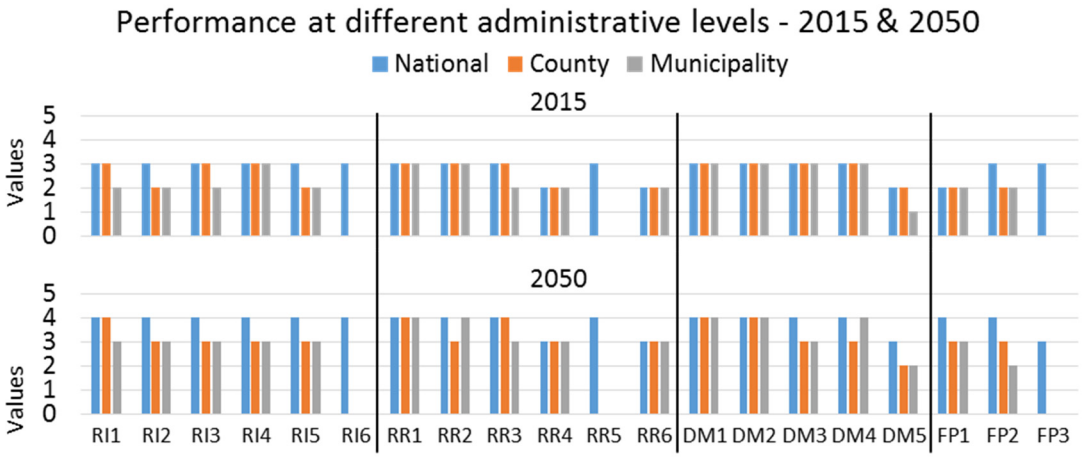


Figure 3.4 Median value of performance level for each indicator at different administrative levels in 2015 (top) and 2050 (bottom).

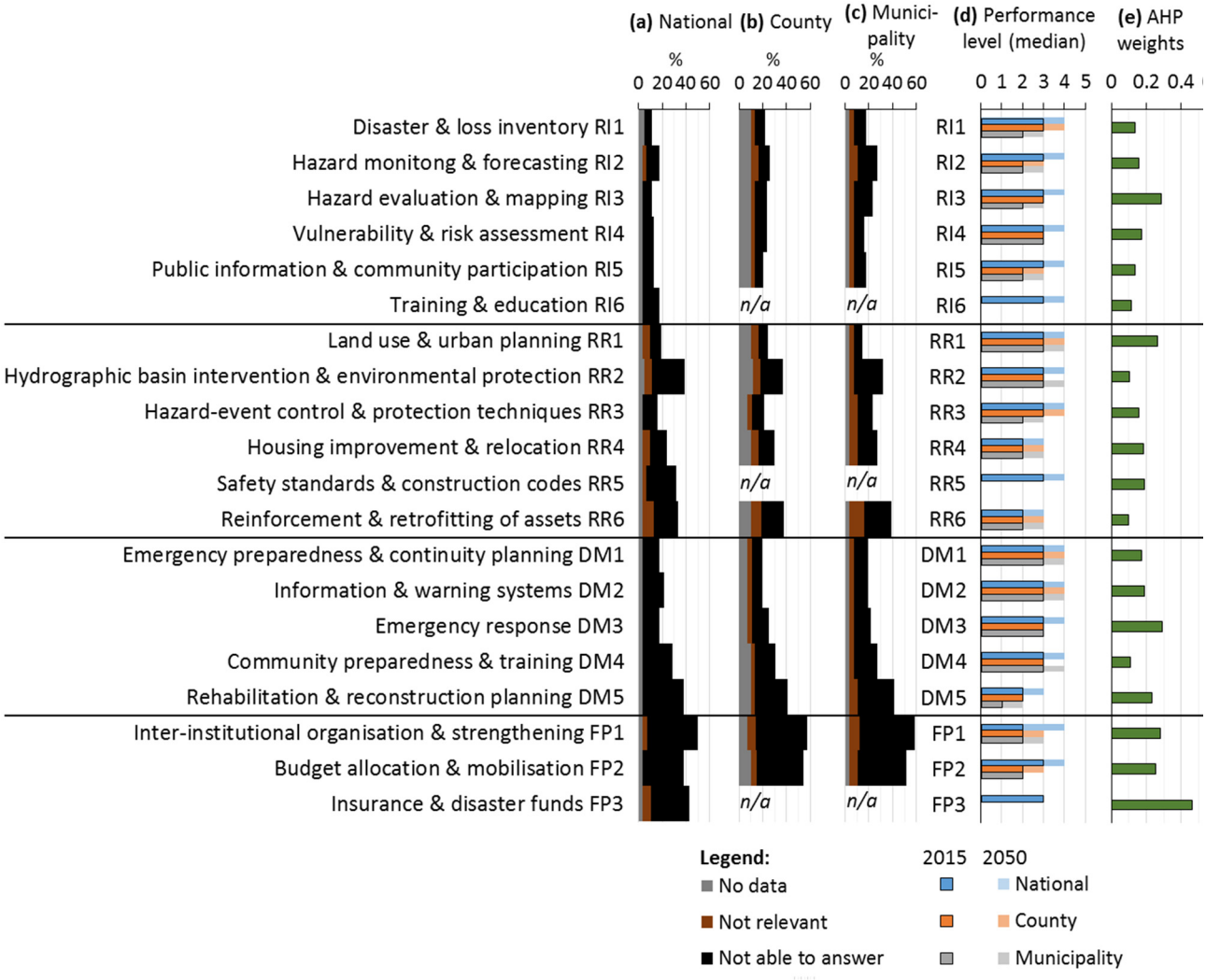


Figure 3.5 (a) to (c): Average distribution of answers including blank answers, 'not relevant', and 'not able to answer' in 2015 and 2050 at different administrative levels. (d): Median value of performance level for each indicator at different administrative levels in 2015 and 2050. (Performance levels: 1 = low; 2 = incipient; 3 = significant; 4 = outstanding; 5 = optimal). (e) AHP weights of different indicators. The AHP weights for each public policy sum up to 1. RI6, RR5, and FP3 are not applicable for county and municipality levels (denoted by 'n/a'). Note that the title of some indicators are simplified.

3.3 AHP weights

The AHP weights used to calculate the policy indices are the average of different sets of AHP weights obtained by different respondents. The averaged weights within each policy are standardised to a sum of 1 before being inputted in the membership functions (see Figure 2.2).

Eleven sets of AHP weights from Chiu (2015) are used (see Table 3.1). Based on the way that the indicators and their criteria are reformulated, AHP weights for the RI and RR public policies are directly re-used from the results by Chiu (2015), whereas those for the DM public policy are adjusted. For instance, AHP weights of two indicators in Chiu (2015) are added up if both indicators are combined together in the present survey. Details of the adjustment are given in Appendix A.

The standardised averages for each policy is plotted in Figure 3.6. They are also shown in Figure 3.5e for comparison.

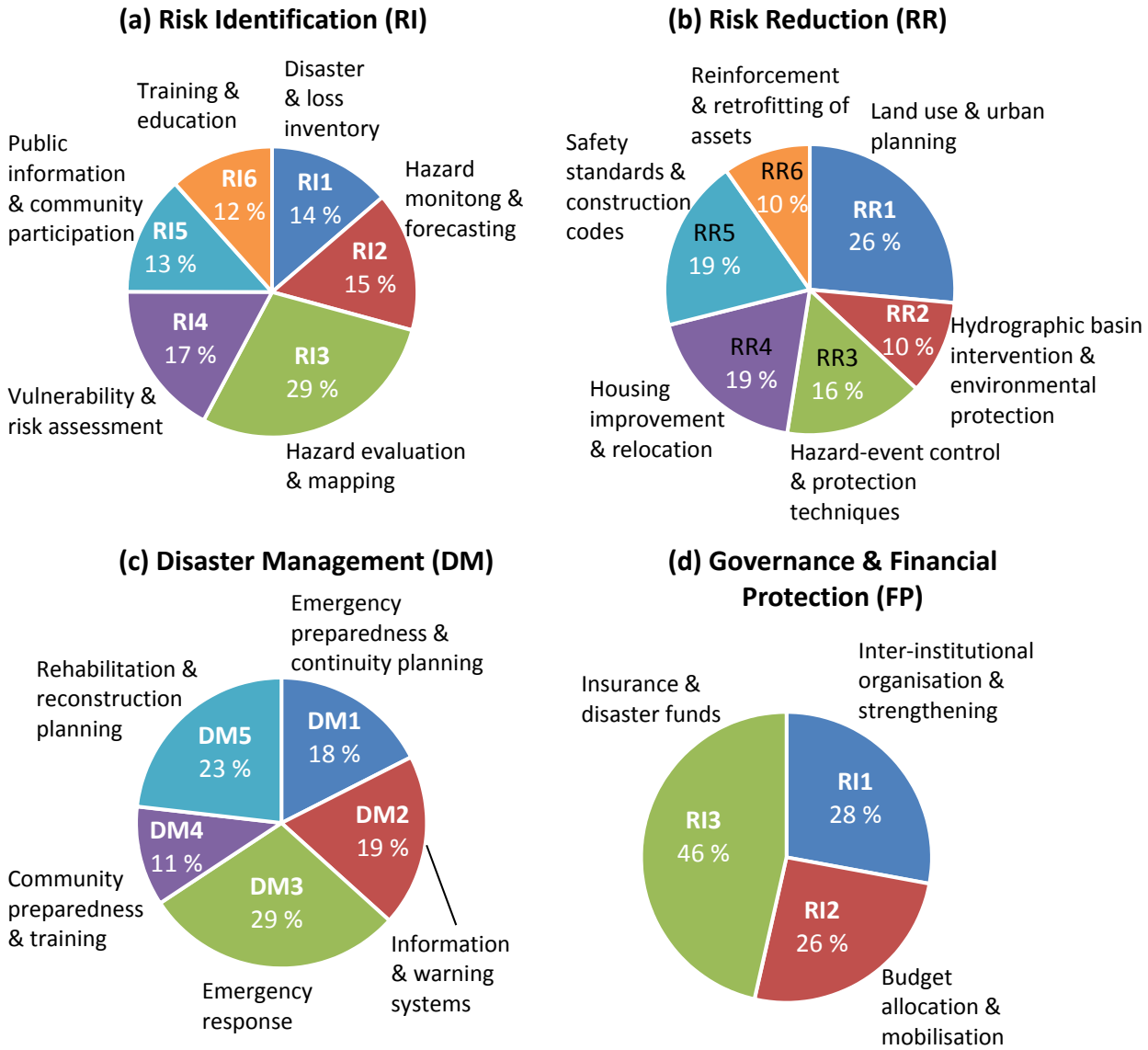


Figure 3.6 Distribution of AHP weights. Note that the title of some indicators are simplified.

According to Figure 3.6, relative weights varies between indicators within each policy. In addition, one indicator in each policy has a particularly higher relative weight than the others, including:

- *RI3. Hazard evaluation and mapping* (w = 0.29),
- *RR1. Land use and urban planning* (w = 0.26),
- *DM3. Emergency response* (w = 0.29), and
- *FP3. Insurance and disaster funds* (w = 0.46).

3.4 Landslide risk management indices

Considering all the available data of performance levels and AHP weights, the landslide risk management indices in 2015 and 2050, including RMI_{RI}, RMI_{RR}, RMI_{DM}, RMI_{FP}, and RMI, are calculated and summarised in Table 3.2 and Figure 3.7. Figure 3.8 and Figure 3.9 illustrate the geographical distribution of landslide risk management indices at county and municipality levels in 2015 and 2050 respectively.

Table 3.2 Landslide risk management indices at different administrative levels in 2015 and 2050. The cells for indices in 2015 and 2050 are conditionally formatted based on one scale (lowest to highest: red to green), whereas those for % difference are on another (lowest to highest: white to purple).

Year	Index / Adm. level	RMI_{RI}	RMI_{RR}	RMI_{DM}	RMI_{FP}	RMI
2015	National	45.17	40.74	41.66	40.82	42.1
	County	39.93	39.46	41.66	17.26	34.58
	Municipality	26.67	35.08	42.28	17.26	30.32
2050	National	76.66	64.08	66.05	57.97	66.19
	County	48.26	57.5	50.36	45.17	50.32
	Municipality	45.17	55.67	53.74	36.68	47.81
% difference	National	70 %	57 %	59 %	42 %	57 %
	County	21 %	46 %	21 %	162 %	46 %
	Municipality	69 %	59 %	27 %	112 %	58 %

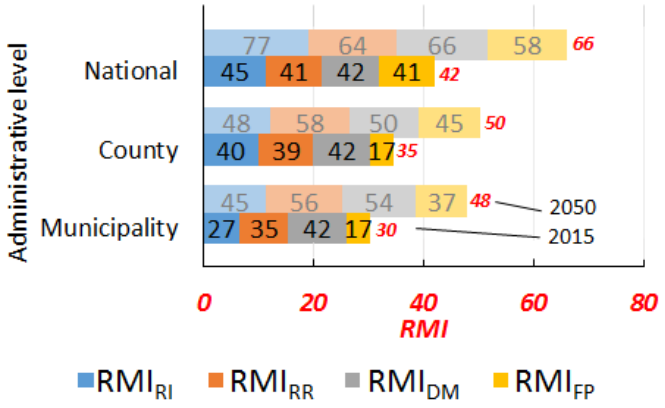
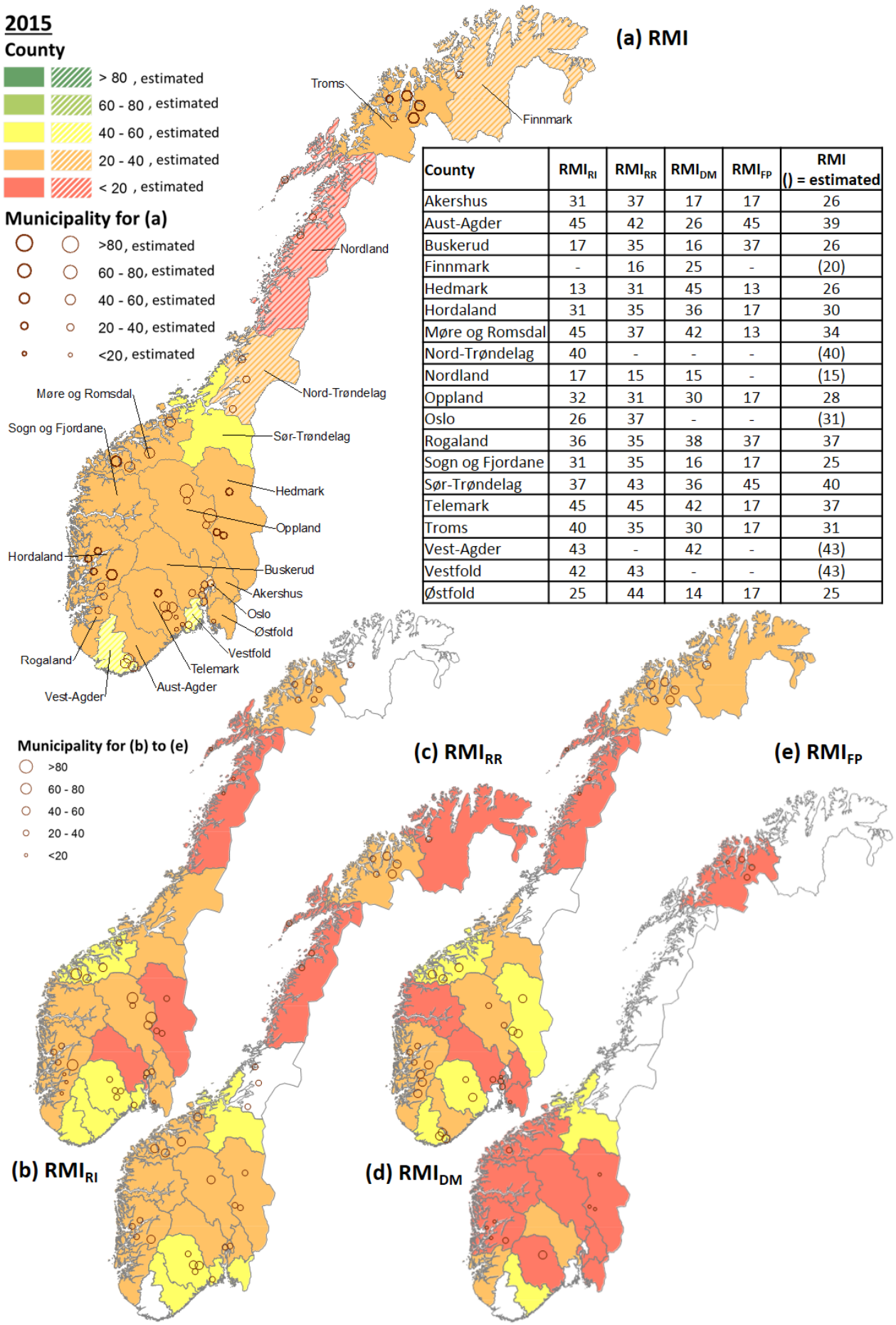
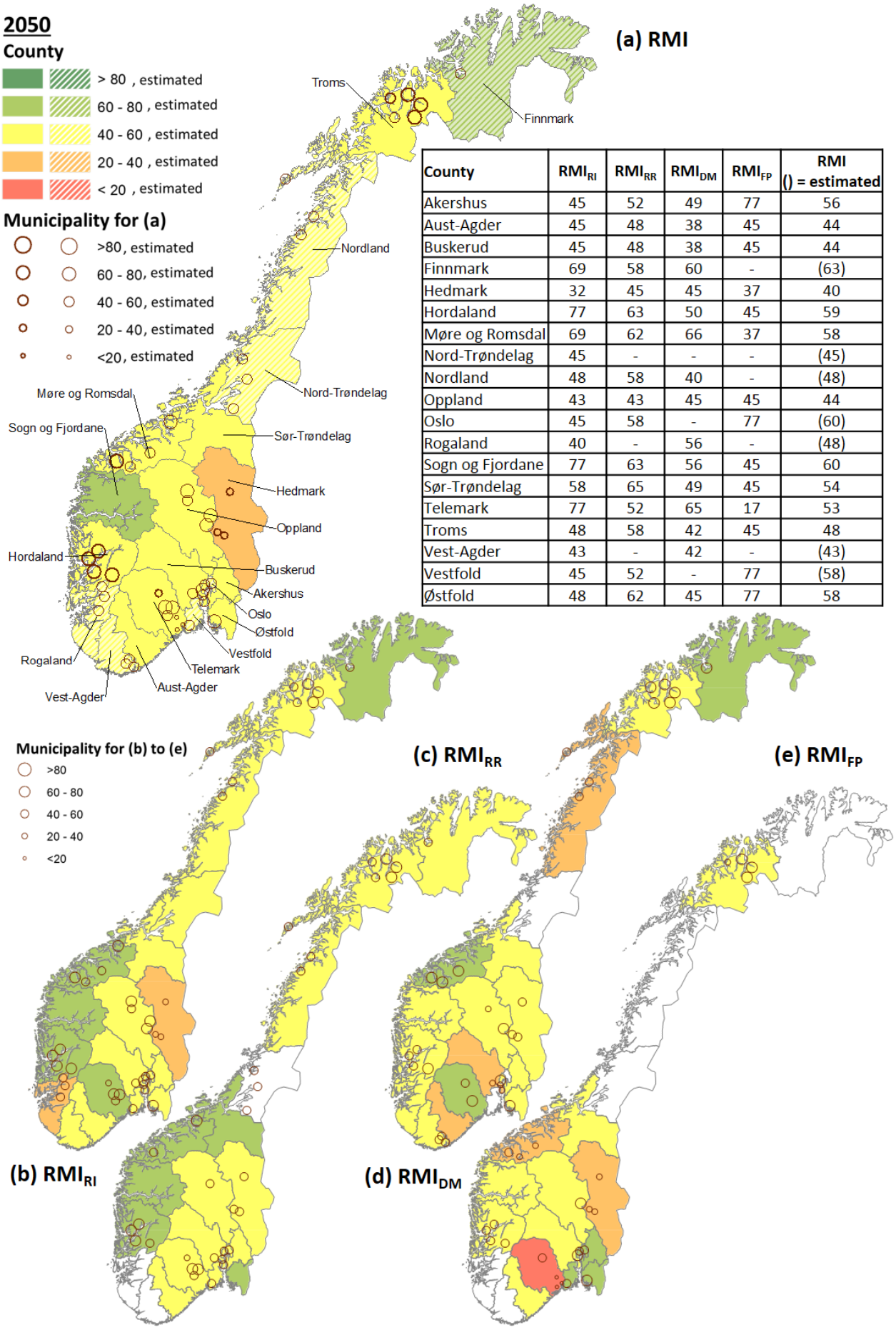


Figure 3.7 Landslide risk management indices at different administrative levels in 2015 and 2050. The horizontal axis represent RMI. The values of RMI are labelled in red whereas policy indices (i.e. RMI_{RI}, RMI_{RR}, RMI_{DM}, RMI_{FP}) are labelled on the bars. RMI is defined as the average of the policy indices.



County	RMI_{RI}	RMI_{RR}	RMI_{DM}	RMI_{FP}	RMI () = estimated
Akershus	31	37	17	17	26
Aust-Agder	45	42	26	45	39
Buskerud	17	35	16	37	26
Finnmark	-	16	25	-	(20)
Hedmark	13	31	45	13	26
Hordaland	31	35	36	17	30
Møre og Romsdal	45	37	42	13	34
Nord-Trøndelag	40	-	-	-	(40)
Nordland	17	15	15	-	(15)
Oppland	32	31	30	17	28
Oslo	26	37	-	-	(31)
Rogaland	36	35	38	37	37
Sogn og Fjordane	31	35	16	17	25
Sør-Trøndelag	37	43	36	45	40
Telemark	45	45	42	17	37
Troms	40	35	30	17	31
Vest-Agder	43	-	42	-	(43)
Vestfold	42	43	-	-	(43)
Østfold	25	44	14	17	25

Figure 3.8 Geographical distribution of landslide risk management indices at county and municipality levels in 2015. RMI of some counties/municipalities are estimated due to lack of results from all policy indices.



County	RMI_{RI}	RMI_{RR}	RMI_{DM}	RMI_{FP}	RMI () = estimated
Akershus	45	52	49	77	56
Aust-Agder	45	48	38	45	44
Buskerud	45	48	38	45	44
Finnmark	69	58	60	-	(63)
Hedmark	32	45	45	37	40
Hordaland	77	63	50	45	59
Møre og Romsdal	69	62	66	37	58
Nord-Trøndelag	45	-	-	-	(45)
Nordland	48	58	40	-	(48)
Oppland	43	43	45	45	44
Oslo	45	58	-	77	(60)
Rogaland	40	-	56	-	(48)
Sogn og Fjordane	77	63	56	45	60
Sør-Trøndelag	58	65	49	45	54
Telemark	77	52	65	17	53
Troms	48	58	42	45	48
Vest-Agder	43	-	42	-	(43)
Vestfold	45	52	-	77	(58)
Østfold	48	62	45	77	58

Figure 3.9 Geographical distribution of landslide risk management indices at county and municipality levels in 2050. RMI of some counties/municipalities are estimated due to lack of results from all policy indices.

3.4.1 Policy indices RMI_{RI}, RMI_{RR}, RMI_{DM}, RMI_{FP}

Comparison of performance between public policies can be carried out quantitatively using the policy indices. All policy indices in 2050 are larger than those in 2015. The policy indices at any administrative level in 2015 and 2050 range from 17 to 45 and 37 to 77 respectively. In any year, policy indices at national level are generally comparable and higher than those at county and municipality levels (Table 3.2 and Figure 3.7). In addition, those at county level are usually slightly higher than those at municipality level. These observations are correspondent to the differences in performance level as described in Section 3.2. In 2050, policy indices at national level become significantly higher than those at county and municipality levels (Table 3.2 and Figure 3.7).

According to Figure 3.8 and Figure 3.9, there are different perceptions among municipalities in the same county even for a single public policy. In addition, based on the results, the policy indices at municipality level often correlate well with those at county level (i.e. the sizes of circles vary often with the county's colour in Figure 3.8b-e and Figure 3.9b-e).

3.4.1.1 RMI_{RI}

In both years, RMI_{RI} is the highest at national level among all policy indices, especially in 2050 (darkest green cell in Table 3.2). However, it is relatively low at municipality level, especially in 2015 (Table 3.2 and Figure 3.7). It has the largest improvement at national and municipality levels (69 to 70%) but least at county level (21%) (Table 3.2).

Based on the RMI_{RI} in different counties, Southern Norway generally has best performance among other regions of Norway (> 40, Figure 3.8b) in 2015, but it is the highest in Western Norway (60-80, Figure 3.9b) in 2050. It is relatively low in Northern Norway in both years.

RMI_{RI} varies the most among municipalities than the other policy indices in both years (Figure 3.8b and Figure 3.9b).

3.4.1.2 RMI_{RR}

RMI_{RR} values are comparable (±6) at any administrative level in both years (orange bars in Figure 3.7). Its percentage of increment is also similar between different administrative levels (46 to 59%, Table 3.2).

Similar to RMI_{RI}, RMI_{RR} is the highest in Southern Norway ((> 40, Figure 3.8c) but relatively low in Northern Norway in 2015. In 2050, RMI_{RR} is also the highest in Western Norway (60-80) and it ranges from 40 to 60 in other regions (Figure 3.9c).

RMI_{RR} varies more among different municipalities in 2050 than 2015 (Figure 3.9c and Figure 3.8c respectively).

3.4.1.3 RMI_{DM}

Similar to RMI_{RR}, RMI_{DM} values are also comparable (±6) at any administrative level in both years (grey bars in Figure 3.7). It has the largest improvement at national level (59%) but smaller at local levels (21 to 27%) (Table 3.2).

RMI_{DM} varies a lot between counties in different regions in both years (Figure 3.8d and Figure 3.9d).

RMI_{DM} also varies more among different municipalities in 2050 than 2015 (Figure 3.9d and Figure 3.8d respectively).

3.4.1.4 RMI_{FP}

RMI_{FP} is the lowest among all policy indices at any administrative level in any year (Table 3.2 and Figure 3.7), especially at county and municipality levels in 2015 (RMI_{FP} = 17, red cells in Table 3.2). RMI_{FP} is at least doubled in 2050 at county and municipality level (darkest purple cells in Table 3.2), however, it only increases by 41% at national level from 2015 to 2050.

The available RMI_{FP} of different counties also shows that the policy index is generally low in different regions in Norway in 2015 (<20, Figure 3.8e). However, it varies a lot between counties in different regions in 2050 (Figure 3.9e).

RMI_{FP} also varies also more among different municipalities in 2050 than 2015 (Figure 3.9e and Figure 3.8e respectively).

3.4.2 RMI

RMI at any administrative level in 2015 and 2050 ranges from 30 to 42 and 48 to 66 respectively (Table 3.2 and Figure 3.7). Considering the membership functions in a fuzzy set for landslide risk management performance level (Figure 2.2a), and recalling the 5 performance levels (1: Low, 2: Incipient, 3: Significant, 4: Outstanding and 5: Optimal), these RMI ranges correspond to '3: Significant' and between '3: Significant' and '4: Outstanding' respectively. In addition, the order of RMI for different administrative level in 2015 and 2050 are the same – from highest to lowest: national, county, and municipality.

The RMI values of counties in 2015 are mostly between 20 and 40, but Nordland has the lowest RMI (estimated to be 15) (see Figure 3.8a and the accompanying table).

In 2050, most counties have RMI of around 40 to 63 (see Figure 3.9a and the accompanying table). Hedmark has a RMI slightly lower than the others whereas Sogn og Fjordane and Finnmark have a RMI slightly higher than the others.

3.5 Factors considered for 2050

Respondents are asked to select at most three factors that dominate their evaluation for 2050. Six factors, all of which are given in the questionnaire, are chosen by the respondents (Figure 3.10). Knowledge and technology, climate, risk perception, and anthropogenic activities are the most popular factors being considered.

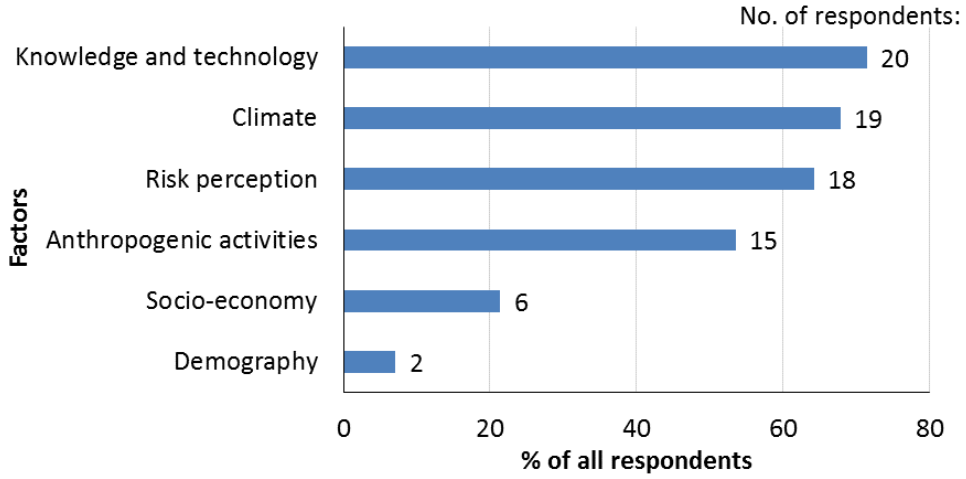


Figure 3.10 Distribution of factors considered for performance levels in 2050.

Brief explanations of the choices are also given by the respondents and are summarised below:

- Knowledge and technology: It is believed to bring positive impact on the performance level of landslide risk management in Norway in 2050. It is considered that, by 2050, Norway will have longer traditions and more experiences to construct infrastructure that takes landslide risk into consideration. There will also be advancement in monitoring, early warning systems, and modelling. In addition, more information will be available so there will be better knowledge about the landslide hazardous areas.

- Climate: It is generally agreed that there will be increased precipitation and more extreme weather events in the future.

- Risk perception: It is expected that people's awareness of landslide risk will increase, partly due to more work done in mapping, risk analyses, and planning. It is also pointed out that laymen's risk perceptions can be influenced by recently happened events and degree of damages.

- Anthropogenic activities: They are considered to bring both positive and negative impacts on the effectiveness of landslide risk management in Norway in 2050. It is believed that increased extent of development (including transport system) will increase the pressure on the nature. However, installation of mitigation measures and appropriate planning, together with a more realistic impact assessment in proposed development, are considered to be able to control landslide risk.

- Socio-economy: one respondent mentioned that arising pressure by the society for security will ultimately influence political leadership.

- Demography: one respondent pointed out that the population will become agglomerating in 2050.

3.6 Comments on landslide risk management in Norway

Based on the comments from the respondents, it is perceived that public risk awareness has been increasing and landslide risk management in Norway has been improving in general. Despite landslide risk awareness is aroused thanks to the media, there are opinions that focus of landslide risk management in Norway should be put on the early warning systems and education to the public of the risks that landslides can involve.

It is pointed out that there is a great potential to develop the general picture of landslide risk at the national level in Norway. In particular, it is considered that too little focus related to landslide risk has been put on built-up areas and infrastructure, as well as the areas in-between. One respondent mentions that uncertainty associated with unknown landslide-prone areas is high.

It is regarded that landslide hazard mapping has significantly been improved both qualitatively and quantitatively during recent years. However, the progress is still considered too slow due to limited budget. It is pointed out that mapping and analyses of landslides have high priority in Norway where landslide risk is known to be high, but not elsewhere. Mapping of quick clays and brittle soils is also considered inadequate. In addition, there is a lack of an overview of which areas have been mapped and associated with low risk, since some mapping work is done privately and some by various organisations. Having an overview and sharing of data are regarded as beneficial to both private institutions and government agencies.

In addition, individual respondents reflect that there is too little focus on preventive measures. The public sector also needs more personal and financial resources for mitigations in existing development.

Through joint projects between government agencies, there are strengthened interactions and more opportunities for both planning (buildings, infrastructure, etc.) and emergency response. Some respondents also mention that the organisation of landslide risk management system in Norway is relatively well developed and functioning. However, there are comments concerning that the national responsibility is fragmented and not well coordinated. It is also considered that most people in the municipalities have too little knowledge regarding landslide hazards, mapping, and preventive/mitigation measures.

One respondent assigns lower performance levels for FP indicators in 2050 then today due to the risk that the solidarity schemes can be changed to spread the risk on individuals.

Last but not least, it is considered important to appropriate landslide risk management to meet the challenges associated with the changing climate.

4 Discussion

In general, landslide risk management in Norway is perceived to be '3: significant' today and many aspects are expected to be improved to '4: outstanding' by 2050 (Sections 3.2 and 3.4.2). It is regarded as a fair result based on the known landslide risk management activities in Norway described in Section 1.2.3.

4.1 National-level vs Sub-national level perceptions

Based on the performance levels and landslide risk management indices, perceptions at the sub-national levels (i.e. county and municipality) are often more negative than those at the national level, especially related to FP. The difference in perceptions between national and sub-national levels generally becomes greater in 2050. This is an interesting observation since one may expect that the national perceptions should be based on the concerted efforts from the sub-national levels. The difference in perceptions may reflect different expectations by the respondents on different administrative levels – possibly higher expectations at local levels than the national level). It may also be psychological -- one may think that other municipalities/-counties perform better so the performance of the country as a whole should be better.

4.2 Landslide risk awareness and hazard assessment

RMI_{RI} is the highest among all policy indices in 2015 at national level and RMI_{RI} is exceptionally high at the national level in 2050 (Section 3.4.1.1). The high RMI_{RI} in 2050 may indicate a much higher expectation on risk awareness and assessment of landslide hazards for the whole country in the future than today. RMI_{RI} varies among municipalities in the same county in both years. This may imply that the performance between municipalities in the RI public policy do not conform with each other today but is not expected to reach the same standard in 2050. RMI_{RI} projected in 2050 to be the highest in Western Norway. This region also has high landslide hazards. This may reveal a greater focus on landslide hazard assessment and public awareness in Western Norway.

In particularly, based on the highest relative weight among RI indicators, it is considered to put most focus on hazard evaluation and mapping (RI3). This is also reflected by the comments from respondents; although landslide hazard mapping is regarded to have improved, limited budget and resources hinder the progress. There is also a lack of maps associated with certain types of soil and an overview of the available data.

4.3 Risk reduction and disaster management

It is observed that the performance in the RI and DM public policy is similar at any administrative levels based the similar values of RMI_{RI} and RMI_{DM} (Sections 3.4.1.2 and 3.4.1.3). The performance in these two public policies is medium compared to the other public policies.

However, it is observed that indicators associated with upgrading, retrofitting, and reconstruction of assets have the lowest performance levels in both 2015 and 2050 (Section 3.2.2). These indicators include:

- *RR4. Housing improvement and relocation from prone-areas*,
- *RR6. Reinforcement and retrofitting of public and private assets*, and
- *DM5. Rehabilitation and reconstruction planning.*

At the same time, there is a relatively large number of respondents who cannot assign the performance level for these indicators (Section 3.2.3). This may indicate that many respondents are not familiar with the indicators. This may also imply that many respondents do not consider

these indicators as relevant or applicable in Norway. For instance, landslide disasters in Norway are generally small and outside cities, or usually only bring about local disturbances (also comments by respondents in Chiu (2015)). Therefore, housing improvement, settlement relocation, and rehabilitation and reconstruction planning, may not have been a huge concern in Norway. In addition, according to the Planning and Building Act, the technical requirement (safety class) of buildings are hazard-based but not risk-based (PBL § 7-3) (also mentioned in Section 1.2.3). As a result, there is apparently no lawful obligation to retrofit of buildings in order to reduce landslide risk.

4.4 Governance and financial protection

In addition, the policy index for the FP public policy (i.e. RMI_{FP}) is the lowest among other policy indices at any administrative level in any year (Section 3.4.1.4). The difference is especially large at county and municipality levels in 2015, but the index is expected to have the most significant improvement at both administrative levels. The lower RMI_{FP} at the local levels than the national level may imply that most respondents demand a better focus on inter-institutional organisation and allocation and use of financial resources for dealing with landslides at local level. Negative comments about budget and resources have also been given by respondents.

However, the results for RMI_{FP} are associated with relatively large uncertainties. For instance, there is comments reflecting that organisation is fragmented and poorly coordinated at national level. These comments do not coincide with the observed results of RMI_{FP}. The uncertainties are likely related to the limited knowledge of most respondents in finance/insurance. There is a significant number of respondents who cannot answer or choose "not relevant" while evaluating the performance level of FP indicators. There are also fewer answers available for AHP weights for FP public policy. The uncertainties are in one way predictable since there is only a minority who works in finance, insurance, and legislation, which are related to the public policy.

4.5 Landslide risk management in the future

A trend of improvement in landslide risk management is observed, in spite that climate change will likely pose greater landslide hazards, and expanded development, as well as urban agglomeration, can increase exposure to landslides (Section 3.4.1). This is probably because respondents generally believe that better knowledge and technology, increased risk awareness, and appropriate planning and mitigations are powerful enough to adapt to climate change and future development. This is an interesting observation. It is also worth to justify whether these perceptions reveal adequate risk awareness.

4.6 Insights on prioritization of future work plans in Klima 2050

The RMI method is a useful tool to orient the potential improvement needed in the landslide risk management system. Since a policy index is based on both performance levels and relative weights, relative weight of an indicator can be regarded as the expected focus of a particular public policy. An indicator which has the highest relative weight influences the policy index the most. If an indicator has a relatively high relative weight but weakest perception, the policy index will be dragged down significantly by that indicator. One can identify this type of indicator and prioritise direction of improvement by studying the performance level together with its relative weight. This can therefore be a useful strategic procedure for prioritisation of the future work in Klima 2050.

According to Figure 3.5, *RI3 Hazard evaluation and mapping* has relatively negative perceptions at municipality level in both years but highest relative weights among other indicators in the RI public policy. *RR4 Housing improvement and relocation from prone-areas* and *DM5 Rehabilitation and reconstruction training* have relatively low performance levels at any administrative level in both years but have the second highest relative weights in RR and DM public policies respectively. Relatively negative perceptions in both 2015 and 2050 may also reveal a general pessimism on the prospects of these aspects. As a result, landslide hazard mapping for municipalities' use, housing improvement and relocation schemes, and rehabilitation and reconstruction plans are recommended to be prioritised in order to improve the overall perceptions of landslide risk management in Norway.

Comments from the respondents reflect that several aspects of the landslide risk management in Norway can be improved or adjusted. These include focus of landslide risk management, landslide hazard mapping, national responsibility on landslide risk management, and knowledge of practitioners in municipalities. More specific recommendation for improvement include more budget and resources for mapping activities as well as mitigations in existing development, better overview of landslide risk in Norway, enhanced sharing of existing landslide hazards data. The above suggestions may also be taken in account for the future work plan of Klima 2050.

4.7 Reliability of survey results

Ideally, the survey should have had at least 100 respondents to be analysed quantitatively and to provide reliable statistical results. With more responses, a more realistic geographical distribution of perceptions, as exemplified by Figure 3.8 and Figure 3.9) can also be produced. Nevertheless, the present results are still able to deliver examples of viewpoint on landslide risk management in Norway.

Great uncertainties may also be associated with the knowledge level of respondents and how well they understand the questions. It is reflected that the questions are too difficult and comprehensive. In addition, some evaluation criteria are unclear. There are also too many technical terms which affect the understanding of the questions. As discussed above, results for FP indicators are considered relatively unreliable since a large percentage of respondents who cannot assign performance levels for these indicators and/or think that the indicators are not relevant and there are limited number of experts in the FP public who take part in the survey.

4.8 Limitations

Perception is subjective. It may be affected by knowledge and expectation. It may also be influenced by personal experience, such as the awareness of recent events. Although there are benchmark criteria for each indicators, the criteria are descriptive and may be perceived differently by different people. Therefore, extra care should be taken while using the survey results.

In addition, the scope of the survey is comprehensive, since landslide risk management of a country is a topic that consists of many aspects -- from technical to political. Based on the experience obtained via the present study and Chiu (2015), most of the potential participates of the survey are geologists, engineers, and emergency planners, which are experts in the RI, RR, and DM public policies. There are much fewer practitioners in finance/insurance who are also familiar with landslide risk management, therefore the pool of experts for the FP public policy is much smaller than that for the other public policies. Therefore, it is difficult to obtain good quality data which are sufficient for statistical analysis for all the questions.

4.9 Further applications

The current methodology is able to assess the performance of a risk management system associated with natural disasters. One can also use the results to identify and prioritise strategies for improvement. Therefore, similar evaluations can also be adopted for other types of natural hazards, such as floods, which is another significant type of natural hazards in Norway.

The reliability of the results is dependent on how well participants understand the questions. There is feedback that the questions are too difficult to understand and too many difficult technical terms have been used. Therefore, if the same methodology is used again in the future, it is recommended to consult practitioners for appropriate terms to be used in the questionnaires in order to make the questions more understandable. Possible candidates can be those who are involved in landslide risk management in municipalities. One of the respondents also suggests interviews where questions can be explained to survey participants directly. However, this is highly dependent on the availability of resources.

Perceptions by non-experts should also be considered for evaluation of the effectiveness of landslide risk management, since the public is the beneficiary of landslide risk management. Rød (2013) found that public's perceptions on the usefulness of risk information as well as risk communication may influence people's willingness to follow evacuation instructions. This also indicates that effective risk communication between the public and experts plays an important role in landslide risk management. Therefore, surveying public's perceptions of landslide risk management should give insights on whether the landslide risk management system functions to provide safety to a community. Hence, a public survey should be conducted alongside with the survey carried out in the present study for experts. Perceptions between experts and the public should be compared to justify whether public's risk perceptions are adequate and mitigation strategies can meet the needs of the public.

5 Conclusions

A survey on perceptions of landslide risk management in Norway was conducted between mid-September and later October, 2015. A total of 28 responses were received, corresponding to 61% of response rate. Respondents for the survey are involved in all stages of landslide risk reduction strategies and include technical staff, decision-makers, and stakeholders. The survey is in the form of opinion questionnaires and aims at collecting ratings of performance and relative importance of different indicators. These indicators are related to four public policies, including Risk Identification (RI), Risk Reduction (RR), Disaster Management (DM), and Governance and Financial Protection (FP). Results of the survey are used to obtain the Risk Management Index (RMI) proposed by Cardona et al. (2004), which provides a tool to measure a territory's performance in landslide risk management. A similar survey in Norway was conducted by Chiu (2015), from which the questionnaires for the present study are modified. Relevant data from Chiu (2015) were also used in the present study. In addition, participants were asked to explain the main factors that they considered while projecting their perceptions to the future. General comments about landslide risk management in Norway and the questionnaire were also collected.

Perceptions are given for two time periods: 2015 and 2050. In addition, respondents are asked to answer based on national, county, and municipality levels.

Key observations of the survey results are summarised in the following:

1. RMI at any administrative level in 2015 ranges from 30 to 42, correspondent to performance at level 3: Significant. In 2050, the RMI values increase and ranges from 46 to 66, correspondent to performance level 3: Significant to 4: Outstanding.
2. Policy indices are higher for the national level than sub-national administrative levels.
3. RMI_{RI} at national level is the highest among all policy indices in both years, especially in 2050.
4. Within the RR and DM public policies, indicators associated with upgrading, retrofitting, and reconstruction of assets have the lowest performance levels in both years but a large number of answers of 'not relevant' and 'not able to answer'.
5. RMI_{FP} is the lowest among all policy indices in any year, especially at the municipality and county levels.
6. The indicators considered to be most critical are indicators considered important for the landslide risk management, but within which the performance is considered as low. Technically this would be indicators with relatively low performance levels combined with high relative weights. This combination was identified for the three indicators: *RI3. Hazard evaluation and mapping* (relatively low rating at municipality level)*, RR4. Housing improvement and relocation from prone-areas*, and *DM5. Rehabilitation and reconstruction training*.
7. At the end of the survey, the respondents were requested to identify and provide brief explanations on the factors they had predominantly considered when evaluating the change in landslide risk performance from 2015 to 2050. The most frequent considered factors in this connection were factors related to knowledge and technology, climate, risk perception, and anthropogenic activities.

It is interesting that the perceptions for the national level are more positive than those for the sub-national levels (point 2). This may be due to two reasons: (1) higher expectations at local levels than the national level; and (2) a psychological reason that one assumes other municipalities/counties perform better.

The high RMI_{RI} in 2050 may indicate a much higher expectation on risk awareness and assessment of landslide hazards for the whole country in the future than today (point 3). In

particular, the high relative weights of *RI3. Hazard evaluation and mapping* indicates that respondents consider hazard evaluation and mapping to be more important than the other aspects in the RI public policy (point 6). However, results show that RI3 has relatively negative perceptions at municipality level. In addition, individual respondents also suggest to allocate more budget and resources for mapping activities, to obtain a better overview of landslide risk in Norway, and to enhance the sharing of existing landslide hazards data. These may imply the need for prioritising landslide mapping activities in Norway.

The obtained results for those indicators associated with upgrading, retrofitting, and reconstruction of assets may be related to the fact that these landslide risk reduction strategies are uncommon in Norway today (point 4). However, two of these indicators, *RR4. Housing improvement and relocation from prone-areas* and *DM5. Rehabilitation and reconstruction training* are considered relatively importance (point 6). These may also suggest the need to include these approaches in the landslide risk management system in Norway.

In addition, the low RMI_{FP} at sub-national levels (point 5) may imply that most respondents demand a better focus on inter-institutional organisation and allocation and use of financial resources for dealing with landslides at local level. However, the results for RMI_{FP} are associated with large uncertainties mainly due to the significantly small number of participants who are experts in finance/insurance.

In spite that climate change and expanded development are considered to pose greater landslide hazards in the future (point 7), landslide risk management in Norway is perceived to improve in the long term. The reason may be related to respondents' belief that better knowledge and technology, increased risk awareness, and appropriate planning and mitigations in the future are powerful enough to adapt to climate change and development.

The survey results and comments summarised above may provide insights on the planning of future works in Klima 2050. However, due to the limited number of response, the present results can only deliver examples of viewpoints on landslide risk management in Norway. The results are also associated with large uncertainties since perception is subjective and respondents may not have sufficient knowledge to understand all the questions. Therefore, extra care should be taken for using the present results.

Nevertheless, the current methodology demonstrates a way to survey perceptions of landslide risk management as well as to identify possible directions for improvement in the landslide risk management strategies. It is considered that the method can also be applied in other types of natural hazards in Norway, such as floods. However, the questions in the survey should be further simplified or reformulated to make them more understandable. It is suggested to consult practitioners in municipalities about the appropriate terms that should be used in the questions. Last but not least, it is recommended to expand the present approach of surveying perceptions on landslide risk management to obtain perceptions from the public – comparisons between perceptions by experts and the public enable a more comprehensive evaluation of the effectiveness of landslide risk management.

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Appendix A References of indicators and criteria

Indicator in present survey	**References**	**Re-use of AHP weights data from Chiu (2015)**
RI1. Systematic disaster and loss inventory	RI1 in Chiu (2015)	= RI1 in Chiu (2015)
RI2. Hazard monitoring and forecasting	RI2 in Chiu (2015)	= RI2 in Chiu (2015)
RI3. Hazard evaluation and mapping	RI3 in Chiu (2015)	= RI3 in Chiu (2015)
RI4. Vulnerability and risk assessment	RI4 in Chiu (2015)	= RI4 in Chiu (2015)
RI5. Public information and community participation	RI5 in Chiu (2015)	= RI5 in Chiu (2015)
RI6. Training and education	RI6 in Chiu (2015), but criteria 2 and 5 in Chiu (2015) are modified to be more logical.	= RI6 in Chiu (2015)
RR1. Land use and urban planning	RR1 in Chiu (2015)	= RR1 in Chiu (2015)
RR2. Hydrographic basin intervention and environmental protection	RR2 in Chiu (2015)	= RR2 in Chiu (2015)
RR3. Hazard-event control and protection techniques	RR3 in Chiu (2015), but criteria 3 and 5 in Chiu (2015) are replaced by Lahidji (2009) accordingly.	= RR3 in Chiu (2015)
RR4. Housing improvement and relocation from prone-areas	RR4 in Chiu (2015)	= RR4 in Chiu (2015)
RR5. Safety standards and construction codes	RR5 in Chiu (2015)	= RR5 in Chiu (2015)
RR6. Reinforcement and retrofitting of assets	RR6 in Chiu (2015)	= RR6 in Chiu (2015)
DM1. Emergency preparedness and continuity planning	*DM1. Organization and coordination of emergency operations* and *DM4. Simulation, updating and test of inter-institutional response* in Chiu (2015).	= DM1 + DM4 in Chiu (2015)
DM2. Information and warning systems	*'Early warning*' by Lahidji (2009), scope similar to *DM2. Emergency response planning and implementation of warning systems* in Chiu (2015).	= DM2 in Chiu (2015)
DM3. Emergency response	Replaced by indicator *'Emergency response*' Lahidji (2009), scope similar to part of *DM2. Emergency response planning and implementation of warning systems* and *DM3. Endowment of equipment, tools and infrastructure* in Chiu (2015).	= (DM2 + DM3)/2 in Chiu (2015)
DM4. Community preparedness and training	Same as DM5 in Chiu (2015)	= DM5 in Chiu (2015)

DM5. Rehabilitation and reconstruction planning	Same as DM6 in Chiu (2015)	= DM6 in Chiu (2015)
FP1. Inter-institutional organisation and strengthening	Combination of *FP1. Inter-institutional, multi-sectoral and decentralizing organization* and *FP2. Reserve funds for institutional strengthening* in Chiu (2015)	n/a
FP2. Budget allocation and mobilisation	Same as FP3 in Chiu (2015)	n/a
FP3. Insurance and disaster funds	Combination of *FP5. Insurance coverage and loss transfer strategies of public assets* and *FP6. Housing and private sector insurance and reinsurance coverage* in Chiu (2015), reformulated with reference to indicator *'Insurance and disaster funds*' in Lahidji (2009)	n/a

Note that the indicators and criteria in Chiu (2015) are modified from Cardona et al. 2005 and Carreño et al. 2007.

Appendix B Questionnaires

B.1 Introduction

The first questionnaire of the survey is modified from the surveys originally proposed by Cardona et al. (2004) for the evaluation of the Risk Management Index (RMI). The second questionnaire is modified from an AHP weights calculation spreadsheet which was provided by Bjørn Kalsnes of the Norwegian Geotechnical Institute.

Both questionnaires are available in English and Norwegian. However, only the Norwegian version of the questionnaires were sent to participants.

B.2 First questionnaire (English Version)

Opinion survey on landslide risk management in Norway

The objective of this survey is to collect data on perceptions of landslide risk management in Norway. Participants in this survey are invited from stakeholders, experts and authorities involved in landslide risk management activities in Norway.

Landslide here includes: '*steinskred*', '*steinsprang*', '*fjellskred*','*løsmasseskred, uspesifisert*', '*jordskred*', '*flomskred*', '*leirskred*', '*kvikkleireskred*',' and '*utglidning*'.

You are asked to rate the performance of landslide risk management in Norway within four public policies:

- **Risk Identification (RI)** - Individual and social risk awareness of landslide hazards, methodological approaches in landslide hazard assessment.
- **Risk Reduction (RR)** - Prevention and mitigation measures against landslides
- **Disaster Management (DM)** - Response and recovery following a disaster
- **Governance and Financial Protection (Loss Transfer) (FP)** - Allocation and use of financial resources for dealing with disaster

<u>Guidelines for answering the survey:</u>

1. Please answer the survey in order.
2. You are asked to answer based on municipality, county, and national levels, correspondingly in columns K, F, and N. Your answers for county and municipality levels should be based on the county(ies)/municipality(ies) you are most familiar with regarding landslide risk management. You will be asked to specify them in the beginning of the questionnaire.
3. If your perceptions vary significantly between different counties/municipalities, (e.g. at least 2 performance levels in many of the indicators), answer these counties/municipalities in separate questionnaires and specify these counties/municipalities in the beginning of each questionnaire.
4. You are asked to rate the performance of risk management in present situation (columns for 2015) and how you think that will be in 2050 (columns for 2050), based on your perceptions on how the society will change in the future.

5. You should rate the performance based on the explanations given in P. 8 to 14. Rating can also be undertaken based on the short descriptions for each indicator and the levels 'Low', 'Incipient', 'Significant', 'Outstanding', or 'Optimal'.
6. Choose 'Not relevant' if you think the indicator is not relevant for a particular administrative level.
7. Choose 'Not able to answer' if you do not have knowledge of the indicator for a particular administrative level.
8. **Example on answering the questionnaire:**

Below is an example on how to rate the indicator about 'advancement, coverage, and maintenance of instrumentation in hazard monitoring and forecasting.' In the example, the indicator is rated as:

- In 2015,
  - 'Incipient' at municipality level, i.e. corresponding to the description: 'Basic instrumentation networks with problems of updated technology and continuous maintenance.'
  - 'Significant' at county level, i.e. corresponding to the description: 'Some networks with advanced technology; improved prognostics and information protocols established.'
  - 'Outstanding' at national level, i.e. corresponding to the description: 'Good and progressive instrumentation, advanced research on the majority of landslide hazards, and some automatic warning systems working.'
- In 2050:
  - 'Significant' at municipality level.
  - 'Outstanding' at county level.
  - 'Significant' at national level.

		M = Municipality; **C** = County; **N** = National					
		2015			**2050**		
RI2. Hazard monitoring and forecasting		**M**	**C**	**N**	**M**	**C**	**N**
Advancement, coverage and maintenance of instrumentation in hazard monitoring and forecasting.	Low						
	Incipient	X					
	Significant		X		X		X
	Outstanding			X		X	
	Optimal						
	Not relevant						
	Not able to answer						

Good luck!

1. Personal and Occupational Information

Please fill in the following:

Organization:

Title/Occupation:

Discipline in risk management:
(Select applicable buttons (s))

- ☐ Risk assessment
- ☐ Emergency response
- ☐ Insurance
- ☐ Finance
- ☐ Other, please specify: _____
- ☐ Physical mitigation measures
- ☐ Research and education
- ☐ Public information and community participation
- ☐ Legislation

Most familiar counties/municipalities

For county and municipality levels, you are required to answer based on the counties/ municipalities that you are most familiar with regarding landslide risk management.

Please specify which county(ies) you are most familiar with, ranked from 1. to 3.:
Select N/A if you do not have any.

1. --Select here-- --Select here-- --Select here--

Please specify up to three municipality(ies) you are most familiar with, ranked from 1. to 3.:
Write N/A if you do not have any.

1. **2.** **3.**

2. RI - Risk Identification

How will you rate the following indicator?
Select 1 per column per indicator. See criteria for classification of each indicator on p. 52-53.

M = Municipality; **C** = County; **N** = National

		2015			2050		
RI1. Systematic disaster and loss inventory		**M**	**C**	**N**	**M**	**C**	**N**
Mapping of loss caused by landslides in previous events; coverage and quality (incl. degree of details and systematicity) Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RI2. Hazard monitoring and forecasting		**M**	**C**	**N**	**M**	**C**	**N**
Advancement, coverage and maintenance of instrumentation in hazard monitoring and forecasting. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RI3. Hazard evaluation and mapping		**M**	**C**	**N**	**M**	**C**	**N**
Details/accuracy in landslide hazard mapping and evaluation of landslide hazards. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RI4. Vulnerability and risk assessment		**M**	**C**	**N**	**M**	**C**	**N**
Coverage of vulnerability and risk analyses including analysis of exposed area, buildings and infrastructure. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RI5. Public information and community participation		**M**	**C**	**N**	**M**	**C**	**N**
Scope and frequency of promotion of landslide risk management issues to the public, and involvement of private sectors and NGOs in promotion activities. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RI6. Training and education in risk management				**N**			**N**
Provision of community training and education in landslide hazards and risk management. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						

3. RR - Risk Reduction

How will you rate the following indicator?
Select 1 per column per indicator. See criteria for classification of each indicator on p. 54-55.

M = Municipality; **C** = County; **N** = National

		2015			2050		
RR1. Land use and urban planning		**M**	**C**	**N**	**M**	**C**	**N**
Consideration of risks (incl. landslide risks) in land use and urban planning. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RR2. Hydrographic basin intervention and environmental protection		**M**	**C**	**N**	**M**	**C**	**N**
Plan for environmental protection and intervanetion in deteriorated/strategic basins and sensitive zones. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RR3. Implementation of hazard-event control and protection techniques		**M**	**C**	**N**	**M**	**C**	**N**
Extent and level of landslide mitigation works for the protection of human settlements and social investment. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RR4. Housing improvement and relocation from prone-areas		**M**	**C**	**N**	**M**	**C**	**N**
Housing improvement works and implementation of relocation programme of housing in prone-areas/ non mitigable risk zones. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
RR5. Updating and enforcement of safety standards and construction codes				**N**			**N**
Enforcement of safety standards and construction codes and updating of them based on local particularities. Go to criteria	Low	X	X		X	X	
	Incipient	X	X		X	X	
	Significant	X	X		X	X	
	Outstanding	X	X		X	X	
	Optimal	X	X		X	X	
	Not relevant	X	X		X	X	
	Not able to answer	X	X		X	X	
RR6. Reinforcement and retrofitting of public and private assets		**M**	**C**	**N**	**M**	**C**	**N**
Obligatory retrofitting of principal public and private buildings and implementation of programs of fiscal incentives for housing rehabilitation. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						

4. DM - Disaster Management

How will you rate the following indicator?
Select 1 per column per indicator. See criteria for classification of each indicator on p. 56-57.

M = Municipality; **C** = County; **N** = National

		2015			2050		
DM1: Emergency preparedness and continuity planning		**M**	**C**	**N**	**M**	**C**	**N**
Coordination between public, private and community based bodies for response in case of emergencies; frequency of testing of contingency plans and updating for operational procedures. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
DM2: Information and warning systems		**M**	**C**	**N**	**M**	**C**	**N**
Implementation of information and warning systems. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
DM3: Emergency response		**M**	**C**	**N**	**M**	**C**	**N**
Establishment of emergency plans and accessbility to equipment and materials at emergency situations Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
DM4: Community preparedness and training		**M**	**C**	**N**	**M**	**C**	**N**
Popularisation and frequency of training program on emergency response among the community and in coordination with other organisations and NGOs. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
DM5. Rehabilitation and reconstruction planning		**M**	**C**	**N**	**M**	**C**	**N**
Comprehensiveness and details in reconstruction plans dealing with physical damage and social recovery based on risk scenarios over the territory. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						

5. FP - Governance and Financial Protection

How will you rate the following indicator?
Select 1 per column per indicator. See criteria for classification of each indicator on p. 58.

M = Municipality; **C** = County; **N** = National

		2015			2050		
FP1. Inter-institutional organisation and strengthening		**M**	**C**	**N**	**M**	**C**	**N**
Implementation, expertise, and financial autonomy of reserve funds for operating a risk management system incorporated by inter-institutional, multi-sectoral and decentralising organisations. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
FP2. Budget allocation and mobilisation		**M**	**C**	**N**	**M**	**C**	**N**
Allocation of budget to local organisations / organisations in various stages of the landslide risk management system, incentives for environmental protection and security. Go to criteria	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant						
	Not able to answer						
FP3. Insurance and disaster funds				**N**			**N**
Insurance coverage for private and public assets, implementation of loss transfer strategies (such as reinsurance groups, etc.) and economic incentive for risk reduction and mass insurance. Go to criteria	Low	X	X		X	X	
	Incipient	X	X		X	X	
	Significant	X	X		X	X	
	Outstanding	X	X		X	X	
	Optimal	X	X		X	X	
	Not relevant	X	X		X	X	
	Not able to answer	X	X		X	X	

6. Consideration of factors for 2050

Which of the following factors did you predominantly consider while assigning performance levels of landslide risk management activities for 2050? (Select up to 3)

Please explain briefly your choice(s) below if applicable.

Factors	2050
☐ Anthropogenic activities	
☐ Climate	
☐ Demography	
☐ Knowledge and technology	
☐ Socio-economy	
☐ Risk perception	
☐ Others, please specify below:	

7. General comments

What are your opinions on landslide risk management in Norway?

What are your opinions on this questionnaire?

Please click the submit button (top right) to send the completed questionnaire to email: kyc@ngi.no
Thanks for your participation!

RI - Risk Identification

RI1. Systematic disaster and loss inventory

Go to indicator

Low: Some basic or superficial data on previous landslide events.

Incipient: Continual registering of current landslide events, incomplete catalogues of the occurrence of some events and limited information on losses and effects.

Significant: Some complete catalogues of landslide events, systematisation of actual events and their economic, social, and environmental effects.

Outstanding: Complete inventory and multiple catalogues of landslide events; registry and detailed systematisation of effects and losses.

Optimal: Detailed inventory and complete mapping of all landslide events as well as corresponding consequences.

RI2. Hazard monitoring and forecasting

Go to indicator

Low: Minimum/deficient instrumentation.

Incipient: Basic instrumentation networks with problems of updated technology and continuous maintenance.

Significant: Some networks with advanced technology; improved prognostics and information protocols established.

Outstanding: Good and progressive instrumentation, advanced researchon the majority of landslide hazards, and some automatic warning systems working.

Optimal: Wide coverage of station and sensor networks for landslide hazards in all parts of the territory; permanent and opportune analysis of information and automatic early warning systems working continuously.

RI3. Hazard evaluation and mapping

Go to indicator

Low: Superficial evaluation and basic maps covering the influence and susceptibility of landslides.

Incipient: Some descriptive and qualitative studies of landslide-prone terrain or landslide hazard studies for larger regions and some specific areas.

Significant: Some hazard maps based on probabilistic techniques for national/county level and for some smaller regions. Generalised use of GIS for mapping the principle hazards.

Outstanding: Evaluation is based on advanced and adequate resolution methodologies for the majority of landslide hazards. Microzonification of some regions based on probabilistic techniques.

Optimal: Detailed studies of landslide hazards throughout the country/county. Micro zoning of the majority of cities and detailed hazard maps at national/county level.

RI4. Vulnerability and risk assessment

Go to indicator

Low: Identification and mapping of the principle elements exposed in prone zones.

Incipient: General studies of physical vulnerability when faced with the most recognised landslide hazards, using GIS.

Significant: Evaluation of potential damage and loss scenarios for some landslide events. Analysis of the physical vulnerability of some essential buildings.

Outstanding: Detailed studies of risk using probabilistic techniques taking into account the economic and social impact of the majority of landslide hazards in some regions. Vulnerability analysis for the majority of essential buildings and life lines.

Optimal: Generalised evaluation of risk, considering physical, social, cultural and environmental factors. Vulnerability analysis also for private buildings and the majority of life lines.

RI5. Public information and community participation

Go to indicator

Low: Sporadic information on risk management in normal conditions and more frequently when disaster occur.

Incipient: Press, radio and television coverage oriented towards preparedness in case of emergency. Production of illustrative materials on dangerous phenomena.

Significant: Frequent opinion programs on risk management issues at the territory level and local levels. Guidelines for vulnerability reduction. Work with communities and NGOs.

Outstanding: Generalised diffusion and progressive consciousness; conformation of some social networks for civil protection and NGOs that explicitly promote risk management issues and practice.

Optimal: Widescale participation and support form the private sector for diffusion activities. Consolidation of social networks and notable participation of professionals and NGOs at all levels.

RI6. Training and education in risk management

Go to indicator

Low: Incipient incorporation of topics about landslides and risk management in formal education and programs for community participation.

Incipient: Production of teaching guides in landslides and risk management for teachers and community leaders in some places.

Significant: Widening of curricular reform to higher education programs to include landslides and risk management. Specialisation courses offered at various universities. Considerable production of teaching materials and undertaking of frequent courses for community training.

Outstanding: As 'significant' + progressive incorporation of landslide risk management in primary and secondary curricula.

Optimal: High technical capacity in the country/county/municipality to generate landslide risk knowledge. Generalised curricular reform throughout the territory and in all stages of education. Wide ranging production of teaching materials. Permanent schemes for community training.

RR - Risk Reduction

RR1. Risk consideration in land use and urban planning

Go to indicator

Low: Consideration of some means for identifying risk, and environmental protection in physical planning.

Incipient: Promulgation of some local regulations and legislation that consider landslide hazards as a factor in development planning.

Significant: Progressive formulation of land use regulations in the various cities that take into account landslide hazards and risks.

Outstanding: Wide ranging formulation and updating of territorial organisation plans with a preventive approach in the majority area of the country/county/municipality.

Optimal: Generalised approval and control of implementation of territorial organisation plans that include risk analysis (incl. landslide risk) as a major factor.

RR2. Hydrographic basin intervention and environmental protection

Go to indicator

Low: Mapping of basins and areas with severe environmental deterioration or those considered to be most fragile.
Incipient: Promulgation of legal dispositions at national/county/municipality level and some local ones that establish the obligatory nature of reforestation, environmental protection and river basin planning
Significant: Formulation of some plans for organisation and intervention in strategic water basins and sensitive zones taking into account landslide risk and vulnerability aspects.

Outstanding: Appreciable number of regions and water basins with environmental protection plans, impact studies and ordering of agricultural areas and that consider landslide risk a factor in determining investment divisions.

Optimal: Intervention in a considerable number of deteriorated basins, sensitive zones and strategic ecosystems. Majority regions have environmental intervention and protection plans.

RR3. Implementation of hazard-event control and protection techniques

Go to indicator

Low: Some structural control and stabilisation measures in some prone-areas.

Incipient: Effective structural defences in exposed areas regarding relatively frequent events (more frequent than 50-year return period).

Significant: Establishment of measures and regulations for the design and construction of hazard control and protection works in harmony with national/county/municipality dictates.

Outstanding: Wide scale intervention in mitigation risk zones using protection and control measures.

Optimal: Effective structural defences and systematic approach to protecting livelihoods and assets from low frequency-high consequence events.

RR4. Housing improvement and relocation from prone-areas Go to indicator

Low: Identification and inventory of a few of human settlements located in landslide prone areas.

Incipient: Promulgation of legislation which establishes the priority of dealing with landslide risk in deteriorated urban areas.

Significant: Programs for upgrading the surroundings, existing housing, and relocation from prone-areas in the most critical areas.

Outstanding: Progressive intervention of human settlements in landslide prone areas in the majority of regions/areas and adequate treatment of the cleared areas.

Optimal: Notable control of landslide prone areas in the country/county and relocation of the majority of housing constructed in non mitigable risk zones.

RR5. Updating and enforcement of safety standards and construction codes Go to indicator

Low: Voluntary use of norms and codes from other countries without major adjustments.

Incipient: Adaptation of some requirements and specifications according to some national and local criteria and particularities.

Significant: Promulgation and updating of obligatory national standards/norms based on international norms.

Outstanding: Technological updating of the majority of security and construction standards for new and existing buildings with special requirements for special buildings and life lines.

Optimal: Permanent updating of standards and security norms: establishment of local regulations for construction.

RR6. Reinforcement and retrofitting of public and private assets Go to indicator

Low: Retrofitting and sporadic adjustments to buildings and life lines.

Incipient: Promulgation of intervention norms with regards to the vulnerability of existing buildings. Strengthening of essential buildings such as hospitals or those considered indispensable.

Significant: Some mass programs for evaluating vulnerability, rehabilitation and retrofitting of hospitals, schools, and the central offices of life line facilities. Obligatory nature of retrofitting.

Outstanding: Progressive number of buildings retrofitted, life lines intervened, some buildings of the private sector retrofitted autonomously or initiated by fiscal incentives from the government.

Optimal: Massive retrofitting of principal public and private buildings. Permanent programs of incentives for housing rehabilitation.

DM - Disaster Management

DM1: Emergency preparedness and continuity planning

Go to indicator

Low: Continuity plans do not exist or are not operational (no trained personnel, no updating, etc.).

Incipient: Basic contingency plans are in place in ministries, large hospitals, public utilities, large municipalities, and major corporations.

Significant: Legal requirements and/or incentive mechanisms (e.g. use of certification) for public and private organisations to adopt extensive preparedness and continuity plans.

Outstanding: Some coordination of continuity plans among ministries, local authorities and operators of lifelines; occasional joint simulation exercises.

Optimal: Widespread emergency preparedness and continuity planning in public and private organisations; frequent updating of plans in larger organisations based on the results of joint exercises.

DM2: Information and warning systems

Go to indicator

Low: No early warning system.

Incipient: Basic early warning systems available for decision-makers and risk managers

Significant: Adequate early warning systems coupled with media announcements, reaching a majority of the population ahead of an event.

Outstanding: Advanced early warning systems coordinated with emergency response in essential government services and lifelines

Optimal: Advanced early warning systems, integrated with preparedness and emergency response plans.

DM3: Emergency response

Go to indicator

Low: Fragmented organisation and scattered resources ofr emergency response; predominance of voluntary responders.

Incipient: Professional search and rescue services, evacuation possibilities, temporary shelters and central operations centers available in the most hazard-prone areas.

Significant: Existence of a national organisation of emergency response with coordination authority; adequate supplies of medical, transport, communications and other specialised equipment in all important cities and densely populated areas, as well as in emergency situations.

Outstanding: Clear definition of roles and responsibilities at local, regional and national levels; proportionate allocation of resources.

Optimal: Permanent coordination between responders in national agencies, local government, NGOs and communities. Specialised equipment and well-trained rescue services available throughout the country.

DM4: Community preparedness and training

Go to indicator

Low: Occasional informative meetings with community in order to illustrate emergency procedures during disasters.

Incipient: Sporadic training courses with civil society organisations dealing with disaster related themes.

Significant: Community training activities are regularly programmed on emergency response in coordination with community development organisations and NGOs.

Outstanding: Courses on preparedness, prevention and reduction of risk are run frequently with communities in the majority of cities and municipalities.

Optimal: Permanent prevention and disaster response courses in all municipalities in coordination with other organisations and NGOs.

DM5. Rehabilitation and reconstruction planning

Go to indicator

Low: Design and implementation of rehabilitation and reconstruction plans only after important disasters.

Incipient: Planning of some provisional recovery measures in some cities.

Significant: Diagnostiske prosedyrer og planer for reetablering, for reparasjon av infrastruktur og for samfunnsgjenoppbygging er tilgjengelig på nasjonalt nivå og i enkelte byer.

Outstanding: Ex ante undertaking of recovery plans and programs to support physical and social recovery are established in most cities.

Optimal: Detailed reconstruction plans dealing with physical damage and social recovery based on risk scenarios. Specific legislation exists and anticipated measures for reactivation.

FP - Governance and Financial Protection

FP1. Inter-institutional organisation and strengthening

Go to indicator

Low: Basic organisations at the national level arranged in commissions, principally with an emergency response approach and dependent on funds from the nation.

Incipient: Inter-institutional and multi-sectoral organisation for integral risk management established and supported by national level resources, formulation of a general risk management plan.

Significant: Inter-institutional risk management systems active at local level in various counties. Inter-ministerial work in the design of public policies for vulnerability reduction. Some occasional funds to co-finance risk management project in the municipality exist in an inter-institutional way / Economic support and search for international funds for institutional development and strengthening of risk management in the whole country.
Outstanding: Continuous implementation of risk management projects associated with programs of adaptation to environmental protection, climate change, and energy. Reserve funds to co-finance projects, institutional strengthening and recovery in times of disaster established locally.
Optimal: Expert personnel with wide experience incorporating risk management in sustainable human development planning in major counties. Reserve funds for inter-institutional strengthening operating in the majority of counties.

FP2. Budget allocation and mobilisation

Go to indicator

Low: Limited allocation of national budget to competent institutions for emergency response.

Incipient: Legal norms establishing budgetary allocations to national level organisations with risk management objectives.
Significant: Legally specified specific allocations for risk management at the local level and frequent undertaking of interadministrative agreements for execution of prevention projects.
Outstanding: Progressive allocation of discretionary expenses at national and municipal levels for vulnerability reduction, the creation of incentives for environmental protection and security.
Optimal: As 'outstanding' + National orientation and support for loans from multilateral loan organisations.

FP3. Insurance and disaster funds

Go to indicator

Low: Little or no insurance mechanism available for private goods, buildings, corporations and local governments.

Incipient: Ad-hoc mechanisms to support the victims of past disasters by transferring a significant share of financial losses to the nation.

Significant: Insurance against natural disasters is gradually developing on probabilistic risk evaluations basis.

Outstanding: Insurance coverage for a significant share of private and public buildings; limited cost-sharing mechanisms at local government level.

Optimal: Widespread coverage for private and public buildings; substantial insurance penetration for plants, equipment, and business interruption; existence of government-sponsored disaster funds and legislation to support disaster-stricken municipalities. Well-developed risk transfer instruments exists (such as reinsurance groups, etc.) and joint programs between government and insurance companies for generating economic incentives for risk reduction and mass insurance.

B.3 First questionnaire (Norwegian Version)

Spørreundersøkelse/meningsmåling om skredrisikohåndtering I Norge

Hensikten med denne undersøkelsen er å samle informasjon om oppfatning av skredrisikohåndtering i Norge. Deltagerne i denne undersøkelsen omfatter problemhavere, representanter fra lokale myndigheter, vitenskapelig personell og eksperter involvert i aktiviteter innen skredrisikohåndtering i Norge.

Skred omfatter her: '*steinskred*', '*steinsprang*', '*fjellskred*','*løsmasseskred, uspesifisert*', '*jordskred*', '*flomskred*', '*leirskred*', '*kvikkleireskred*',' and '*utglidning*'.

I undersøkelsen vurderes nivået for på skredrisikohåndtering i Norge innen de fire aspektene: risikoidentifikasjon, risikoreduksjon, krisehåndtering og ledelse og finansiell sikring

- **Risikoidentifikasjon (RI)** – Individuell og sosial risikobevissthet i forhold til skredfare, metodikk for skredfarevurdering.
- **Risikoreduksjon (RR)** – Fareforebyggende og konsekvensreduserende tiltak mot skred.
- **Krisehåndtering (DM)** – Akutthåndtering av og gjenoppbygging etter kriser.
- **Ledelse og finansiell sikring (FP)** – Allokering og bruk av midler for krisehåndtering.

<u>Retningslinjer for besvarelse av undersøkelsen:</u>

1. Vennligst besvar i nummerert rekkefølge.
2. Du blir bedt om å svare på kommunalt-, fylkes- og nasjonalt nivå, henholdsvis i kolonnene K, F og N. Svarene for kommunalt- og fylkesnivå baseres på de kommuner/fylker du har best kjennskap til når det gjelder skredrisikohåndtering. Disse spesifiseres i starten av undersøkelsen.
3. Hvis det er store forskjeller mellom de fylker/kommuner du har valgt (minst to nivåer i forskjell for mange av indikatorene) kan du fylle ut ett skjema per fylke/kommune og spesifisere hvilke i begynnelsen av hvert skjema.
4. I spørreskjemaet blir du bedt om å vurdere risikohåndteringssituasjonen i dagens situasjon (2015-kolonnene) og hvordan du tror den kommer til å være i 2050 (2050-kolonnene), basert på hvordan du tror samfunnet kommer til å endre seg i framtida.

5. Bruk forklaringene på side 8 -14 (eller gitt i link) ved karakterisering av den enkelte indikator. Eventuelt kan karakterisering gjøres ut fra de korte beskrivelsene "Minimal", "Lav","Middels","Fremragende" eller "Optimal".
6. Velg 'Ikke relevant' hvis du ikke synes indikatoren er relevant for det administrative nivået avkrysningen gjelder.
7. Velg 'Vet ikke' – om du ikke har kunnskap om indikatoren på det administrative nivået avkrysningen gjelder.
8. **Eksempel på utfylling:**

Nedenfor ser du eksempel på utfylling av skjemaet for karakterisering av indikatoren: "Nivå, omfang og vedlikehold av instrumentering i overvåkning og varsling av skred." I eksempel-utfyllingen er denne vurdert til å være:

- I 2015:
  - "Lav" på kommunalt nivå, dvs. passer til beskrivelsen: "Grunnleggende instrumenteringsnettverk, men med teknologisk og vedlikeholdsmessig etterslep."
  - "Middels" på fylkesnivå, dvs. passer til beskrivelsen: "Noen instrumenteringsnettverk med avansert teknologi med forbedret forutsigbarhet og informasjonsprotokoller." og
  - "Fremragende" på nasjonalt nivå, dvs. passer til beskrivelsen: "God og omfattende instrumentering; avansert teknologi basert på forskning for hoveddelen av skredtypene; noen automatiserte varslingssystemer er i drift."
- I 2050:
  - "Middels" på kommunalt nivå og
  - "Fremragende" på fylkesnivå.
  - "Middels" på nasjonalt nivå

K = Kommune; **F** = Fylke; **N** = Nasjonal

RI2. Fareovervåkning og varsling		2015 K	2015 F	2015 N	2050 K	2050 F	2050 N
Nivå, omfang og vedlikehold av instrumentering i overvåkning og varsling av skred. Gå til kriterier	Minimal						
	Lav	X					
	Middels		X		X		X
	Fremragende			X		X	
	Optimal						
	Ikke relevant						
	Vet ikke						

Lykke til!

1. Bakgrunnsinformasjon om deltageren

Vennligst fyll ut følgende:

Organisasjon:

Tittel/yrke:

Arbeidfelt i risikohåndtering:
(Velg passende knapp(er))

Risikovurdering	Fysiske forebyggende tiltak
Akutthåndtering	Forskning og utdannelse
Forsikring	Offentlig informasjon og samfunnsinnvolvering
Finans	Lovgivning
Andre, vennligst spesifiser: _____	

Fylke/kommune du kjenner best

For fylke- og kommunenivå, vennligst baser svarene dine på det fylket/den kommunen du er best kjent med når det gjelder håndtering av skredrisiko.

Vennligst spesifisert hvilke fylker du er best kjent med, rangert fra 1. til 3.

Velg N/A hvis du ikke er kjent med noen.

1. **2.** **3.**

Vennligst spesifiser opp til tre kommuner du er best kjent med, rangert fra 1. til 3.

Skriv N/A hvis du ikke er kjent med noen.

1. **2.** **3.**

2. RI - Risiko identifikasjon

Hvordan vil du karakterisere de følgende indikatorene? Velg 1 per kolonne per indikator. Kriterier for rangering av den enkelte indikator finnes på side 67-68.

K = Kommune; **F** = Fylke; **N** = Nasjonal

		2015			2050		
RI1. Systematisert kartlegging av skredhendelser og tap		**K**	**F**	**N**	**K**	**F**	**N**
Kartlegging av skader forårsaket av skred i tidligere hendelser; Omfang og kvalitet (inkl. detaljnivå og systematikk). Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RI2. Fareovervåkning og varsling		**K**	**F**	**N**	**K**	**F**	**N**
Nivå, omfang og vedlikehold av instrumentering i overvåkning og varsling av skred. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RI3. Fareevaluering og -kartlegging		**K**	**F**	**N**	**K**	**F**	**N**
Detaljering/nøyaktighet i skredfarekartlegging og –vurdering. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RI4. Sårbarhets- og risikovurdering		**K**	**F**	**N**	**K**	**F**	**N**
Omfang av risiko og sårbarhetsanalyse inkl. analyse av eksponerte områder, bygninger og infrastruktur. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RI5. Offentlig informasjon og samfunnsdeltagelse		**K**	**F**	**N**	**K**	**F**	**N**
Omfang og hyppighet av befolkningsopplysning om risikohåndtering, involvering av privat sektor og ideelle organisasjoner. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RI6. Kursing og utdannelse i risikohåndtering				**N**			**N**
Tilbud av kurs og utdanning innen skredfare og risikohåndtering. Gå til kriterier	Minimal	X	X		X	X	
	Lav	X	X		X	X	
	Middels	X	X		X	X	
	Fremragende	X	X		X	X	
	Optimal	X	X		X	X	
	Ikke relevant	X	X		X	X	
	Vet ikke	X	X		X	X	

3. RR - Risiko reduksjon

Hvordan vil du karakterisere de følgende indikatorene? Velg 1 per kolonne per indikator. Kriterier for rangering av den enkelte indikator finnes på side 69-70.

K = Kommune; **F** = Fylke; **N** = Nasjonal

		2015			2050		
RR1. Arealbruk og arealplanlegging		**K**	**F**	**N**	**K**	**F**	**N**
Hensyn til risiko (inkl. skredrisiko) i arealbruk og arealplanlegging. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RR2. Bevaring av miljø og tilsigssoner		**K**	**F**	**N**	**K**	**F**	**N**
Plan for bevaring av miljø, tilsigsfelt og sensitive soner. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RR3. Implementasjon av forebyggende og beskyttende tiltak		**K**	**F**	**N**	**K**	**F**	**N**
Omfang og nivå av forebyggende tiltak mot skred for beskyttelse av befolkningen. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RR4. Bygningsforsterkning og relokasjon i utsatte områder		**K**	**F**	**N**	**K**	**F**	**N**
Forsterkning av bygninger og relokaliserings program for utsatte områder/områder det ikke er hensiktsmessig å sikre. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
RR5. Håndheving og oppdatering av sikkerhets- og byggekrav				**N**			**N**
Håndheving, oppdatering og tilpasning av standarder og formelle sikkhetskrav for bygge- og anleggsvirksomhet. Gå til kriterier	Minimal	X	X		X	X	
	Lav	X	X		X	X	
	Middels	X	X		X	X	
	Fremragende	X	X		X	X	
	Optimal	X	X		X	X	
	Ikke relevant	X	X		X	X	
	Vet ikke	X	X		X	X	
RR6. Forsterkning og tilpasning av privat og offentlig eiendom		**K**	**F**	**N**	**K**	**F**	**N**
Påkrevd modernisering/ombygging av viktige offentlige og private bygninger og insentiver for boligrehabilitering. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						

4. DM - Krisehåndtering

Hvordan vil du karakterisere de følgende indikatorene? Velg 1 per kolonne per indikator. Kriterier for rangering av den enkelte indikator finnes på side 71-72.

K = Kommune; **F** = Fylke; **N** = Nasjonal

		2015			2050		
DM1: Beredskaps- og kriseplanlegging		**K**	**F**	**N**	**K**	**F**	**N**
Koordinering mellom offentlige, private og samfunnsbaserte enheter/organisasjoner for akutthåndtering av nødsituasjoner og hyppighet av simuleringsøvelser for testing av beredskaps- og kriseplaner og oppdatering av operasjonelle prosedyrer. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
DM2: Informasjons- og varslingssystemer		**K**	**F**	**N**	**K**	**F**	**N**
Implementasjon av og befolkningsinformasjon om varslingssystem. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
DM3: Krisehåndtering		**K**	**F**	**N**	**K**	**F**	**N**
Etablering av krisehåndteringsplaner og tilgang på nødvendig utstyr og materiell i krisesituasjoner. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
DM4: Samfunnsberedskap og øvelser		**K**	**F**	**N**	**K**	**F**	**N**
Tilgang på og hyppighet av treningsprogram om akutthåndtering i samfunnet og i koordinasjon med andre organisasjoner og ideelle organisasjoner. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
DM5: Planlegging av rehabilitering og gjenoppbygging		**K**	**F**	**N**	**K**	**F**	**N**
Omfang og detaljering i rehabiliteringsplaner for potensiell fysisk skade og sosial gjenoppbygging/restitusjon basert på risikoscenarier i området. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						

5. FP - Ledelse og finansiell sikring

Hvordan vil du karakterisere de følgende indikatorene? Velg 1 per kolonne per indikator. Kriterier for rangering av den enkelte indikator finnes på side 73.

K = Kommune; **F** = Fylke; **N** = Nasjonal

		2015			2050		
FP1: Tverr-institusjonell organisering og styrking		**K**	**F**	**N**	**K**	**F**	**N**
Implementering, ekspertise og finansiell autonomi av risikohåndterings systemer innlemmet av mellom-institusjonell, multisektoriell og desentraliserende organisasjon. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
FP2: Budsjett allokering og mobilisering		**K**	**F**	**N**	**K**	**F**	**N**
Allokering av budsjett til lokale organisasjoner/organisasjoner i ulike steg av skred risikohåndteringssystemet, insentiver for miljøvern og sikkerhet. Gå til kriterier	Minimal						
	Lav						
	Middels						
	Fremragende						
	Optimal						
	Ikke relevant						
	Vet ikke						
FP3: Forsikring og katastrofefond				**N**			**N**
Forsikringsdekning for privat og offentlig eiendom og implementasjon av tapsoverførselsstrategier, som for eksempel reassuranse grupper, økonomiske insentiver for risikoreduksjon og masseforsikring. Gå til kriterier	Minimal	X	X		X	X	
	Lav	X	X		X	X	
	Middels	X	X		X	X	
	Fremragende	X	X		X	X	
	Optimal	X	X		X	X	
	Ikke relevant	X	X		X	X	
	Vet ikke	X	X		X	X	

6. Faktorer som må tas i betraktning for 2050

Hvilke av følgende faktorer tok du hovedsakelig med i betraktning under vurderinger gjort for 2050? (Velg opp til 3)

Vennligst beskriv valgene dine kort nedenfor i aktuell rute.

Faktorer	2050
Menneskeskapte endringer i fysisk miljø	
Klima	
Demografi	
Kunnskap og teknologi	
Samfunnsøkonomi	
Risikooppfatning	
Andre, vennligst spesifiser nedenfor:	

7. Generelle kommentarer

Hva er kommentarene dine om skredrisiko håndtering i Norge?

Hva er kommentarene dine om dette spørreskjemaet?

Vennligst klikk Send skjema-knappen (oppe til høyre)
og sende utfylt skjema til e-post: kyc@ngi.no
Takk for hjelpen!

RI - Risiko identifikasjon

RI1. Systematisert kartlegging av skredhendelser og tap

Gå til indikator

Minimal: Noen elementære eller overfladiske data om tidligere skredhendelser.

Lav: Registrering av skredhendelser; ufullstendig oversikt over noen hendelser, begrenset informasjon om tap og konsekvenser.

Middels: Det finnes noen fullstendige oversikter over skredhendelser med systematisering av faktiske skredhendelser og deres økonomiske, sosiale og miljømessige effekter.

Fremragende: Det er gjort en komplett kartlegging av skredhendelser og det finnes mange detaljerte og systematiserte oversikter over konsekvenser og tap forårsaket av skredhendelser.

Optimal: Detaljert og komplett kartlegging av alle skredhendelser og tilhørende konsekvenser.

RI2. Fareovervåkning og varsling

Gå til indikator

Minimal: Minimal/manglende instrumentering.

Lav: Grunnleggende instrumenteringsnettverk, men med teknologisk og vedlikeholdsmessig etterslep.

Middels: Noen instrumenteringsnettverk med avansert teknologi med forbedret forutsigbarhet og informasjonsprotokoller.

Fremragende: God og omfattende instrumentering; avansert teknologi basert på forskning for hoveddelen av skredtypene; noen automatiserte varslingssystemer er i drift.

Optimal: Omfattende overvåkning av skred i alle utsatte områder i form av stasjoner med nettverk av sensorer; permanent og egnet analyse av informasjon og automatisk varslingssystem som er kontinuerlig operativt.

RI3. Fareevaluering og -kartlegging

Gå til indikator

Minimal: Overflatisk evaluering og basiskart som identifiserer skredpåvirkede områder og skredfarlig terreng.

Lav: Noen beskrivende og kvalitative studier av skredutsatt terreng eller skredfare for større regioner og for noen spesifikke regioner.

Middels: Noen farekart basert på probabilistiske teknikker på lands/fylkesnivå og for noen mindre områder. Generalisert bruk av GIS for kartlegging av de viktigste skredtypene.

Fremragende: Evalueringen består av avansert metodologi med adekvat oppløsning for hoveddelen av de aktuelle skredtypene. Detaljstudier av noen områder basert på probabilistiske teknikker.

Optimal: Detaljerte studier av skredfare i hele landet/fylket. Mikrosonering og detaljert farekart på lands/fylkesnivå.

RI4. Sårbarhets- og risikovurdering

Gå til indikator

Minimal: Identifikasjon og kartlegging av de viktigste eksponerte elementene i utsatte områder.

Lav: Generelle studier om fysisk sårbarhet i forhold til de mest fremtredende skredtypene ved bruk av GIS.

Middels: Evaluering av potensielle skade- og tapsscenarier for noen skredtyper. Analyse av den fysiske sårbarheten for noen bygninger med kritiske samfunnsfunksjoner.

Fremragende: Detaljert studie av risiko ved bruk av probabilistiske teknikker som tar med i betraktning økonomiske og sosiale effekter av skred for hoveddelen av skredtypene i området. Sårbarhetsstudier for hoveddelen av bygningene med kritiske samfunnsfunksjoner og kritiske forsynings/forbindelseslinjer (life lines).
Optimal: Generalisert evaluering av risiko som tar hensyn til fysiske, sosiale, kulturelle og miljømessige faktorer. Sårbarhetsanalyse også for private bygninger og hoveddelen av kritiske forbindelses/forsyningslinjer (life lines).

RI5. Offentlig informasjon og samfunnsdeltagelse

Gå til indikator

Minimal: Sporadisk informasjon om risikohåndtering under normale forhold og oftere hvis krise inntreffer.

Lav: Presse, radio og fjernsynsdekning orientert mot kriseberedskap. Produksjon av illustrativt materiale om farlige fenomen.

Middels: Hyppige diskusjonsprogrammer om problemstillinger relatert til risikohåndtering. Retningslinjer for sårbarhetsreduksjon. Arbeid med lokalsamfunn og ideelle organisasjoner.

Fremragende: Generalisert informasjonsspredning og høy bevissthet, tilpasning av noen sosiale
Optimal: Omfattende deltagelse og støtte fra private sektorer for informasjonsspredningsaktiviteter. Sammenslutning av sosiale nettverk og betydelig deltagelse av profesjonelle og ideelle organisasjoner på alle nivå.

RI6. Kursing og utdannelse i risikohåndtering

Gå til indikator

Minimal: Innledende innlemmelse av emner om skred og risikohåndtering i formell utdannelse og program for samfunnsdeltagelse.

Lav: Produksjon av opplysningsmateriell/læremateriell om skred og risikohåndtering for lærere og lokale beslutningstakere noen steder.

Middels: Utvidelse av fagkretsen i høyere utdanningsprogram til å inkludere skred og risikohåndtering. Spesialiseringskurs om skred og risikohåndtering tilbudt på ulike universiteter. Betydelig produksjon av læremateriell og stort kurstilbud til lokale beslutningstakere.

Fremragende: Som for middels + fremadskridende innlemmelse av risikohåndtering også i grunnskolen.

Optimal: Høy teknisk kapasitet i landet/fylket/kommunen til å generere skredrisiko kunnskap. Risikohåndtering som fag på alle utdanningsnivåer. Omfattende produksjon av undervisningsmateriell. Permanenter rutiner for kursing av befolkningen.

RR - Risiko reduksjon

RR1. Arealbruk og arealplanlegging

Gå til indikator

Minimal: Noe risiko- og miljøhensyn i fysisk planlegging.

Lav: Kunngjøring av noe lokal regulering og lovgivning som betrakter skredfare som en del av arealplanleggingen.

Middels: Fremadskridende formulering av arealbruks reguleringer i ulike regioner som tar hensyn til skredfare og risiko.

Fremragende: Omfattende formulering og oppdatering av arealbruks planer med en preventiv tilnærming i hoveddelen av landet/fylket/kommunen.

Optimal: Generalisert godkjenning og kontroll av implementasjon av arealbruks planer som inkluderer risikoanalyse (inkl. skredrisiko) som en hovedfaktor.

RR2. Bevaring av miljø og tilsigssoner

Gå til indikator

Minimal: Kartlegging av bassenger og områder med alvorlig miljømessig forringelse eller de antatt mest utsatte/sårbare.

Lav: Kunngjøring av lovmessige prosedyrer på nasjonalt/fylkes/kommune nivå og noen lokale som lovfester skogfornyelse, beskyttelse av miljøet og tilsigsfelt.

Middels: Formulering av noen planer som tar hensyn til skredrisiko og sårbarhetsaspekter for organisering og inngripen i tilsigsfelt og sensitive soner.

Fremragende: Stort antall regioner og tilsigsfelt med miljøvernsplaner, konsekvens utredninger og systematisering av jordbruksområder og som betrakter skredrisiko som en faktor i prioritering av investeringer.

Optimal: Bevaring av et betydelig antall forringede tilsigsfelt, sensitive soner og strategiske økosystem. De fleste regionene har planer for bevaring og beskyttelse av miljøet.

RR3. Implementasjon av forebyggende og beskyttende tiltak

Gå til indikator

Minimal: Noen strukturelle kontroll- og stabiliseringstiltak i noen av de mest utsatte områdene.

Lav: Effektive strukturelle tiltak i eksponerte områder mot relativt hyppige hendelser (hyppigere enn hvert 50. år).

Middels: Etablering av tiltak og design og konstruksjon av forebyggende tiltak er i tråd med nasjonale/fylkesmessige/kommunemessige krav.

Fremragende: Omfattende risikobegrensning i tiltakssoner ved bruk av forebyggende tiltak og kontrolltiltak.

Optimal: Effektive fysiske tiltak og systematisk tilnærming for å beskytte liv og materielle verdier inkludert sjeldne hendelser med stor konsekvens.

RR4. Bygningsforsterkning og relokasjon i utsatte områder

Gå til indikator

Minimal: Identifikasjon og oversikt over noen få bosettinger i skredfarlige områder.

Lav: Kunngjøring av regelverk/lovverk som lovfester prioritet for risikohåndtering av urbane, skredutsatte områder.

Middels: Program for oppgradering av omgivelser, eksisterende bebyggelse og relokalisering fra skredutsatte områder i de mest kritiske områdene.

Fremragende: Progressiv intervensjon av bosetninger i skredutsatte områder i hoveddelen av regionene/områdene og adekvat håndtering av klarerte områder.
Optimal: Betydelig kontroll over skredrisiko områdene i landet/fylket og relokaliseriring av hoveddelen av bebyggelse i områder der risikoforebyggende tiltak ikke er mulig/hensiktsmessig.

RR5. Håndheving og oppdatering av sikkerhets- og byggekrav

Gå til indikator

Minimal: Frivillig bruk av standarder og sikkherhetsnormer fra andre land uten noen spesielle tilpasninger.

Lav: Tilpasning av noen krav og spesifiseringer til noen nasjonale og lokale kriterier og særegenheter.

Middels: Kunngjøring og oppdatering av lovfestede standarder/normer nasjonalt tilpasset fra internasjonale standarder/normer.

Fremragende: Teknologisk oppdatering av hoveddelen av sikkerhets og konstruksjons standarder for nye og eksisterende bygninger med spesielle krav for spesielle bygninger og kritiske forsynings/forbindelseslinjer (life lines).
Optimal: Permanent oppdatering av standarder og sikkerhetsnormer; etablering av lokale forskrifter for bygge- og anleggsvirksomhet.

RR6. Forsterkning og tilpasning av privat og offentlig eiendom

Gå til indikator

Minimal: Modernisering og sporadisk tilpasning av bygninger og kritiske forbindelseslinjer (life lines).

Lav: Kunngjøring av normer for iverksatte tiltak rettet mot sårbarhet av eksisterende bebyggelse. Forsterkning av bygninger som innehar viktige samfunnsfunksjoner, for eksempel sykehus.

Middels: Noen masse-program for evaluering av sårbarhet, rehabilitering og modernisering av sykehus, skoler og sentrale bygninger for kritiske samfunnsfunksjoner. Lovfestet modernisering.

Fremragende: Stort antall moderniserte/oppgraderte bygninger, tilpassede forbindelseslinjer, noen bygninger i privat sektor er oppgradert/modernisert uavhengig av eller som følge av skattemessige insentiver gitt av staten.

Optimal: Massiv oppgradering/modernisering av viktige offentlige og private bygninger. Permanente skattemessige fordelsprogrammer for bygninger.

DM - Krisehåndtering

DM1: Beredskaps- og kriseplanlegging

Gå til indikator

Minimal: Det eksisterer ingen planer for krisehåndtering eller krisehåndteringsplanene er ikke operative (intet trenet personell, ingen oppdatering etc.).

Lav: Elementære krisehåndteringsplaner finnes i departementene, store sykehus, offentlige institusjoner, store kommuner og større konsern.

Middels: Lovfestede krav eller insitamenter/belønningssystemer (for eksempel bruk av sertifisering) for offentlig og privat organisering for å være del av omfattende beredskaps- og kriseplaner.

Fremragende: Noe koordinering av beredskaps- og kriseplaner mellom departementene, lokale myndigheter og infrastrukturoperatører, felles simulerings øvelser blir gjennomført fra tid til annen.

Optimal: Omfattende beredskaps- og kriseplaner i offentlige og private organisasjoner; hyppig oppdatering av planer i større organisasjoner basert på resultater av felles øvelser.

DM2: Informasjons- og varslingssystemer

Gå til indikator

Minimal: Intet varslingssystem.

Lav: Enkelt varslingssystem tilgjengelig for beslutningstagere og andre som jobber med risikohåndtering.

Middels: Adekvat varslingssystem koblet med media annonsering, som når ut til hoveddelen av befolkningen forut for en hendelse.

Fremragende: Avanserte varslingssystemer koordinert med krisehåndteringsplaner for viktige kritiske samfunnsfunksjoner og infrastruktur.

Optimal: Avanserte varslingssystemer, integrert med beredskaps- og krisehåndteringsplaner.

DM3: Krisehåndtering

Gå til indikator

Minimal: Fragmentert organisering og spredte ressurser for krisehåndtering; overvekt av frivillige for akutthåndtering av kriser.

Lav: Profesjonell søk- og redningstjeneste, evakuerings- og relokaliseringsmuligheter, sentrale operasjonssentre er tilgjengelige i de mest utsatte områdene.

Middels: Nasjonal organisasjon for krisehåndtering med koordinerings myndighet; det er adekvate forsyninger av medisinsk utstyr og annet spesialisert utstyr, adekvat transport og kommunikasjon i alle viktige byer og tettsteder, også i krisesituasjoner.

Fremragende: Klar definisjon av roller og ansvar på lokalt, regionalt og nasjonalt nivå. Proporsjonal allokering av ressurser.

Optimal: Permenent koordinering mellom krisepersonell i nasjonale byråer, lokale myndigheter, ideelle organisasjoner og befolkningen. Spesialisert utstyr og velfungerende redningstjenester er tilgjengelig over hele landet.

DM4: Samfunnsberedskap og øvelser

Gå til indikator

Minimal: Informative møter en sjelden gang med befolkningen for å illustrere nødprosedyrer i kriser.

Lav: Sporadiske opplærings kurs med sivile samfunnsorganisasjoner som jobber med kriserelaterte temaer.

Middels: Samfunnsopplæringsaktiviteter tar jevnlig opp krisehåndtering i koordinering med organisasjoner som jobber med samfunnsutvikling og ideelle organisasjoner.

Fremragende: Det arrangeres ofte kurs om beredskap, forebygging og reduksjon av risiko for befolkningen i flesteparten av byene og kommunene.

Optimal: Permanente forebyggings og akutthåndteringskurs i alle kommuner i koordinering med andre organisasjoner og ideelle organisasjoner.

DM5: Planlegging av rehabilitering og gjenoppbygging

Gå til indikator

Minimal: Design og implementasjon av rehabiliterings- og rekonstruksjonsplaner skjer kun etter store katastrofer.

Lav: Planlegging av noen provisoriske gjenoppbyggingstiltak i noen byer.

Middels: Diagnostiske prosedyrer og planer for reetablering, for reparasjon av infrastruktur og for samfunnsgjenoppbygging er tilgjengelig på nasjonalt nivå og i enkelte byer.

Fremragende: Gjenoppbyggingsplaner, program og midler for å støtte fysisk og sosial gjenoppbygging er etablert i forkant i de fleste byer.

Optimal: Detaljerte rekonstruksjonsplaner som behandler fysisk skade og sosial gjenoppbygging basert på risikoscenarier. Spesiell lovgivning finnes, tiltak for reaktivering erkjent i forkant.

FP - Ledelse og finansiell sikring

FP1: Tverr-institusjonell organisering og styrking

Gå til indikator

Minimal: Basis organsisasjoner på nasjonalt nivå organisert i kommisjoner, hovedsakelig med en akutthåndteringstilnærming og avhengig av midler fra staten.

Lav: Det er etablert tverr-institusjonell(basert på samarbeid på tvers av institusjonene), multi-sektoriell organisering for integrert risikohåndtering som støttes av ressurser på nasjonalt nivå, formulering av en generell risikohåndteringsplan.

Middels: Tverr-institusjonelle risikohåndteringssystemer er aktive på lokalt nivå i ulike fylker. Arbeid på tvers av departementene i design av offentlige strategier for sårbarhetsreduksjon. Det finnes noen spredte midler for delfinansiering av risikohåndteringsporsjekter i kommunene på en tverr-institusjonell måte. Økonomisk støtte og søknad etter internasjonale midler for institusjonell utvikling og styrking av risikohåndtering i hele landet.

Fremragende: Kontinuerlig implementering av risiko håndteringsprosjekter assosiert med tilpasningsprogrammer for beskyttelse av miljø, klimaforandring og energi. Forbeholdte midler for del-finansiering av prosjekter, institusjonell styrking og gjenoppbygging ved kriser, er tilgjengelig lokalt.

Optimal: Det finnes ekspertise med bred erfaring for innlemmelse av risikohåndtering i planlegging av bærekraftig menneskelig utvikling i de største fylkene. Forbeholdte/avsatte midler for tverr-institusjonell styrking er avsatt i flesteparten av fylkene.

FP2: Budsjett allokering og mobilisering

Gå til indikator

Minimal: Begrenset allokering av nasjonalt budsjett til kompetente institusjoner for krisehåndtering.

Lav: Rettslige normer som etablerer budsjettmessige allokeringer til organisasjoner på nasjonalt nivå med risikohåndteringsformål.

Middels: Lovmessig spesifisert spesifikke allokeringer for risikohåndtering på lokalt nivå og hyppig forpliktelse av inter-administrative avtaler for utførelse av forebyggingsprosjekter.

Fremragende: Progressiv allokering av skjønnsmessige utgifter på nasjonalt og kommune nivå for sårbarhetsreduksjon, insentiver for miljøvern og sikkerhet.

Optimal: Som fremragende + Nasjonal orientering, lånestøtte fra multilaterale låner organisasjoner.

FP3: Forsikring og katastrofefond

Gå til indikator

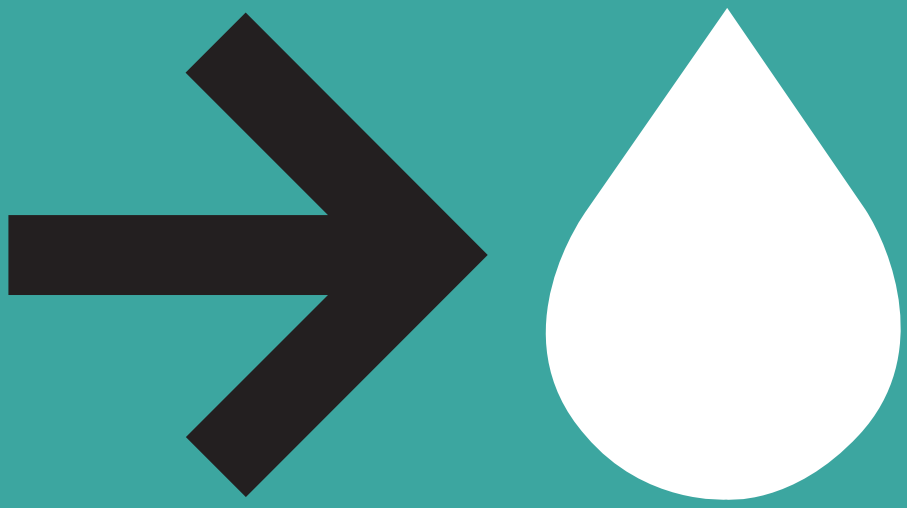
Minimal: Få eller ingen forsikringsmekanismer tilgjengelig for private eiendeler, bygninger, konsern eller lokale myndigheter.

Lav: Ad-hoc mekanismer for å støtte ofre etter tidligere katastrofer ved å overføre en betydelig andel av de finansielle tapene til staten.

Middels: Forsikring mot naturkatastrofer utvikles gradvis på basis av probabilistiske risikoevalueringer.

Fremragende: Forsikringsdekning for en andel av private og offentlige bygninger; begrensede kostnads-delings mekanismer på fylkesting/kommunestyre nivå.

Optimal: Omfattende dekning for private og offentlige bygninger, betydelig forsikringsdekning for fabrikkanlegg, utstyr og avbrudd i forretningsvirksomhet. Statlige katastrofemidler og lovgiving for å støtte kommuner rammet av katastrofer. Gode tapsoverførselsstrategier, som for eksempel reassuranse grupper, samarbeidsprogram mellom myndigheter og forsikringsselskaper for å generere økonomiske insentiver for risikoreduksjon og masse-forsikring.



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weber SAINT-GOBAIN
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Noregs vassdrags- og energidirektorat NVE
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