

PARAmount

Survey on risk awareness and perception on regional/local level

ETC Alpine Space project PARAmount No. 38-2-2-AT

European Academy Bozen/Bolzano
Institute for Regional Development and Location Management

Prof. Dr. Harald Pechlaner
Dott.ssa Sabine Pichler, MSc
Dipl.-Ing. Lisa Kofink

April, 2011

Acknowledgement: The study has been carried out in cooperation with all the project partners, especially with the Department for Natural Hazards and Timberline, BFW and Cemagref. The European Academy Bozen/Bolzano thanks all the involved partners for their kind support.

TABLE OF CONTENTS

| | |
|---|-----------|
| CHAPTER I – INTRODUCTION | 5 |
| 1. INTRODUCTION | 5 |
| 2. AIM OF THE STUDY | 5 |
| 3. METHODOLOGY | 6 |
| 3.1. <i>Qualitative survey</i> | 6 |
| 3.2. <i>Quantitative survey</i> | 8 |
| 3.3. <i>Implementation of workshops</i> | 8 |
| CHAPTER II – RESULTS OF THE QUALITATIVE SURVEY | 9 |
| 1. INTRODUCTION | 9 |
| 2. PERSONAL EXPERIENCE WITH NATURAL HAZARDS | 9 |
| 3. PROBLEM PERSPECTIVES | 9 |
| 3.1. <i>Economic impacts:</i> | 9 |
| 3.2. <i>Social impacts:</i> | 10 |
| 3.3. <i>Ecological impacts:</i> | 10 |
| 4. EFFECTS OF PAST EXPERIENCE ON DECISION MAKING | 11 |
| 5. INFORMATION ABOUT NATURAL HAZARDS | 11 |
| 6. RISK PERCEPTION | 12 |
| 7. RISK MANAGEMENT | 12 |
| 8. COMPARABLE TABLE OF RESULTS | 13 |
| CHAPTER III – RESULTS OF THE QUANTITATIVE SURVEY | 18 |
| 1. AUSTRIA | 18 |
| 1.1. <i>General information</i> | 18 |
| 1.2. <i>Personal experience</i> | 19 |
| 1.3. <i>Problem perspectives</i> | 20 |
| 1.4. <i>Perception of natural hazards</i> | 21 |
| 1.5. <i>Impacts of natural hazards</i> | 22 |
| 1.6. <i>Information about natural hazards</i> | 24 |
| 1.7. <i>Mitigation of natural hazards</i> | 26 |
| 2. FRANCE | 28 |
| 2.1. <i>General information</i> | 28 |
| 2.2. <i>Personal experience</i> | 29 |
| 2.3. <i>Problem perspectives</i> | 30 |
| 2.4. <i>Perception of natural hazards</i> | 31 |
| 2.5. <i>Impacts of natural hazards</i> | 32 |
| 2.6. <i>Information about natural hazards</i> | 34 |
| 2.7. <i>Mitigation of natural hazards</i> | 36 |
| 3. ITALY | 38 |
| 3.1. <i>General information</i> | 38 |
| 3.2. <i>Personal experience</i> | 39 |
| 3.3. <i>Problem perspectives</i> | 40 |
| 3.4. <i>Perception of natural hazards</i> | 41 |
| 3.5. <i>Impacts of natural hazards</i> | 42 |

| | | |
|--|--|-----------|
| 3.6. | <i>Information about natural hazards</i> | 44 |
| 3.7. | <i>Mitigation of natural hazards</i> | 46 |
| 4. | SLOVENIA | 48 |
| 4.1. | <i>General information</i> | 48 |
| 4.2. | <i>Personal experience</i> | 49 |
| 4.3. | <i>Problem perspectives</i> | 50 |
| 4.4. | <i>Perception of natural hazards</i> | 51 |
| 4.5. | <i>Impacts of natural hazards</i> | 52 |
| 4.6. | <i>Information about natural hazards</i> | 54 |
| 4.7. | <i>Mitigation of natural hazards</i> | 56 |
| 5. | SWITZERLAND | 58 |
| 5.1. | <i>General information</i> | 58 |
| 5.2. | <i>Personal experience</i> | 59 |
| 5.3. | <i>Problem perspectives</i> | 60 |
| 5.4. | <i>Perception of natural hazards</i> | 61 |
| 5.5. | <i>Impacts of natural hazards</i> | 62 |
| 5.6. | <i>Information about natural hazards</i> | 64 |
| 5.7. | <i>Mitigation of natural hazards</i> | 66 |
| 6. | COMPARISON OF RESULTS | 68 |
| 6.1. | <i>General information</i> | 68 |
| 6.2. | <i>Personal experience</i> | 69 |
| 6.3. | <i>Problem perspectives</i> | 71 |
| 6.4. | <i>Perception of natural hazards</i> | 72 |
| 6.5. | <i>Information about natural hazards</i> | 74 |
| CHAPTER IV – RESULTS OF THE WORKSHOPS | | 76 |
| 1. | INTRODUCTION | 76 |
| 2. | INDIRECT AND DIRECT VULNERABILITY | 76 |
| 3. | CLIMATE CHANGE | 77 |
| 4. | NATURAL HAZARDS AND THEIR IMPACT ON TRANSPORT AND MOBILITY | 77 |
| 5. | COOPERATION IN PREVENTING NATURAL HAZARDS | 77 |
| CHAPTER V – CONCLUSIONS FOR PARAMOUNT | | 78 |
| 1. | CURRENT RISK PERCEPTION | 78 |
| 2. | PROBLEMS AND FOCUS OF FUTURE ACTIONS | 78 |
| 2.1. | <i>Information about natural hazards</i> | 78 |
| 2.2. | <i>Risk management</i> | 78 |
| 3. | NEED FOR ACTIONS ON THE REGIONAL LEVEL | 79 |
| APPENDIX | | 80 |
| APPENDIX 1: INTERVIEW GUIDELINE | | 80 |
| APPENDIX 2: QUESTIONNAIRE | | 84 |

CHAPTER I – INTRODUCTION

1. Introduction

Changes in climate are influencing on natural hazards increasing their negative impacts and causing notable damage in landscapes, buildings and infrastructure. Especially transport infrastructures in the Alps suffer from vulnerability to natural hazards, since due to the special topography of mountain regions; many locations are accessible only from one direction. Because of the narrowness in most Alpine valleys train and road infrastructure are furthermore often coupled. Therefore, in case of natural hazards, be it avalanches, rock fall or debris flow, access to valleys is often completely disrupted. Accessibility and its assurance, however, is one of the most important location factors in today's economy. In a region such as the Alpine Space a comprehensive hazard management of transport infrastructures is therefore of utmost importance.

The Alpine Space project PARAMount has started in 2009 as transnational initiative. Its objectives are to analyze the vulnerability of Alpine transport to natural hazards, to improve the knowledge about hazard specific impacts and to improve hazard management procedures and tools being useful to various disciplines and sectors. Within work package 4 (SWOT & risk management state) an analysis of risk perception and risk awareness for damage in transport infrastructure due to natural hazards among various actors in the local test regions is to be realized. The report in hand covers action 4.1 in work package 4.

2. Aim of the study

The study is composed of a qualitative and quantitative survey in the Alpine Space comprising five test regions in the countries of France, Austria, Slovenia, Switzerland and Italy, as well as workshops in four test beds in Italy, Austria, Switzerland and Slovenia. The objectives of the study are to increase knowledge about risk awareness, to collect information about local risk perception and the state of the art of tools being implemented. In detail the following aspects are covered:

- Awareness of risk on behalf of the stakeholders or target groups and its perception/evaluation regarding the attractiveness of locations
- Effects on decision making
- Existing risk management and mitigation strategies
- Future improvements

As target group regional and local authorities, transport operators, economic interest groups (chambers of commerce, tourism associations etc.) and technicians from disaster management disciplines, spatial planning etc. have been identified and contacted in the course of the study.

3. Methodology

3.1. Qualitative survey

In order to gain a first insight into relevant topics and opinions among local stakeholders 21 semi-structured interviews were conducted in the five regions. In comparison to closed-ended questions this approach follows the exploratory character of the interviews. Semi-structured interviews offer topics and questions to the interviewee, but are carefully designed to elicit the interviewee's ideas and opinions on the topic of interest.

The interviews were held in the mother tongue of the interviewee to guarantee that there are no misunderstandings. They were tape-recorded, transcribed and analyzed with the MaxQDA qualitative software tool.

The interview guideline was structured in six main parts composed of sub-questions (see appendix 1).

Structure of each interview

Part A – Personal experience with natural hazards: aimed to get first insights in the personal experience with natural hazards and general risk evaluation.

Part B – Problem perspectives: aimed to gather information on the extent to which the attractiveness of the location is impaired by the risk of natural hazards and what are the consequences.

Part C – Effects of past experience on decision making: aimed to gather information on how past experiences with natural hazards and/or the awareness of natural risk affect the decision behavior.

Part D – Information about natural hazards: aimed to get insights in how information systems about natural hazards work, how they are managed and what kind of information systems are used.

Part E – Risk perception: aimed to gather information on the assessment of the probability of natural hazards and the damage probability.

Part F – Requirements and requests: aimed to gather information on further requirements and requests and the responsibility of their implementation.

Interviewpartner

| Test bed | Name | Institution | Date |
|-------------|-----------------------------------|---|------------|
| France | Olivier Marco | Service Restauration des Terrains en Montagne (RTM) | 11.05.2010 |
| France | Georges Borot | Société Française du Tunnel Routier du Fréjus (SFTRF) | 11.05.2010 |
| France | Philippe Nivelles | Carbone Savoie / Mayor of Moûtiers / President of the grouping Mayors of Tarentaise-Savoie / Former President of the Conseil Régional de Savoie | 11.05.2010 |
| France | Jean-Claude Raffin | Mayor of the municipality Modane | 12.05.2010 |
| Slovenia | Roman Medved | Development centre of the Posočje/Upper Soča valley region | 21.05.2010 |
| Slovenia | Simon Vendramin & Anton Petrovčič | Public Institution for Fire and Rescue Operations – Fire-Fighting Unit Nova Gorica | 14.05.2010 |
| Slovenia | Samuel Kosmač | Administration for civil protection and disaster relief, Nova Gorica | 18.05.2010 |
| Slovenia | Igor Podobnik | Environmental agency, department for water management, department for the Soča river basin | 21.05.2010 |
| Switzerland | Marcus Valaulta | Tiefbauamt Graubünden | 24.06.2010 |
| Switzerland | Pally Mario | Matterhorn-Gotthard Bahnen | 24.06.2010 |
| Switzerland | Rechsteiner Ralph | Rhätische Bahn | 23.06.2010 |
| Switzerland | Schmid Silvio | Bergbahnen Sedrun | 25.06.2010 |
| Austria | Stefan Siegele | ASFINAG Alpenstraßen | 05.08.2010 |
| Austria | Martin Ebster | Destination Management Organization St. Anton | 05.08.2010 |
| Austria | Helmut Mall | Major of the municipality St. Anton | 07.06.2010 |
| Austria | Robert Zach | Amt der Tiroler Landesregierung Abteilung Straßenbau | 07.06.2010 |
| Austria | Karl-Heinz Huber | Wirtschaftskammer Landeck | 08.06.2010 |
| Italy | Richard Amort | Mayor of the municipality Fortezza/Franzensfeste | 24.08.2010 |
| Italy | Albin Kofler | Mayor of the municipality Cornedo/Karneid | 25.08.2010 |
| Italy | Thomas Baumgartner | FERCAM Logistic & Transport | 25.08.2010 |
| Italy | Brigitte Salcher | Tourismusverein Brixen | 24.08.2010 |

Table 1: Interviewpartner

3.2. Quantitative survey

In order to validate the results of the qualitative interviews in quantitative terms and to gather responses in a standardized way for all test beds, an online questionnaire was developed. It consisted of 31 closed-ended questions, answerable by checking one of the predetermined answers or scales and six open-ended questions, requiring participants to answer in their own words (see appendix). For the evaluation a 5-point Likert scale was used. The questionnaire is attached in appendix 2.

In the period from 13th of September until 3rd of December 2010 a quantitative online survey was administered to the main stakeholders in the five test-beds in Italy, Austria, Switzerland, Slovenia and France. A total of 590 respondents participated in the survey.

| Test bed | Sent questionnaires | Nr. of respondents | Response rate |
|-------------|---------------------|--------------------|---------------|
| France | n.a. | 533 | n.a. |
| Slovenia | 31 | 8 | 23% |
| Switzerland | 15 | 10 | 67% |
| Austria | 43 | 17 | 40% |
| Italy | 37 | 22 | 59% |

Table 2: Number of respondents and response rate

The number of respondents in Slovenia and Switzerland was rather small. Out of that reason the results are not generalizable and only give an indication.

3.3. Implementation of workshops

After the conclusion of the qualitative and quantitative survey four workshops were conducted in January and February 2011 in Switzerland, Austria, Italy and Slovenia to discuss the results of the survey and some predefined areas of concern. The workshops took place in the test-beds and in the mother tongue to ensure the participation of the local stakeholders. The workshops had a duration of approximately 4 hours. Topics discussed were:

- Indirect and direct vulnerability
- Climate change
- Natural hazard and its impact on transport and mobility
- Cooperation in preventing natural hazards

CHAPTER II – RESULTS OF THE QUALITATIVE SURVEY

1. Introduction

In order to gain a first insight into relevant topics and opinions among stakeholders 21 semi-structured interviews were conducted in five test beds. The results presented in this chapter display the responses of the interviewees.

2. Personal experience with natural hazards

All actors have experiences with natural hazards, also on a personal level. The most important factor in managing natural hazards is the level of preparedness. To react to natural hazards it is important that the needed resources are available, that there exists an action plan and that responsible actors know what to do. This means also, that there is a need of information and activity machinery, which should be in place. Moreover communication, internal but also external, is crucial in case of natural disaster. Communication channels for the crisis management should be secured. In addition, also the local population, visitors and guests need to be informed about the situation and the most important aspects regarding natural hazards.

3. Problem perspectives

Natural hazards impact the local population. But also roads and transport networks are concerned. Furthermore, the regional economy and especially tourism is highly affected by natural hazards. Natural hazards differently impact on locations. These can be divided into economic, social and ecological impacts.

3.1. Economic impacts:

Natural hazards have negative and positive influence on the regional economy. On one side they lead to economic losses. This affects the local population in terms of damages caused by natural hazards. Local authorities are affected by the investment needed for construction and maintenance of barriers and other facilities. Also the economy as a whole is affected. Due to natural disasters the employment-related attractiveness is reduced. Moreover it has impact on the different sectors. For example the tourism sector is affected by natural disasters in two ways. First, there is a financial loss if guests cannot

arrive or leave because of closed streets. Second, after natural hazards or an increase in risk, bookings can be cancelled, which impacts not only the economical situation of the businesses but also the overall reputation of the region. In general it can be said, that the influences of natural hazards on tourism and the booking behavior of guests are only short-term. The degree of impact depends on the communication and management in the specific situation.

Positive economic impacts of natural hazards can be seen in the investments made in protection, construction and maintenance. In locations with high potential of natural hazards there are specialized companies, which offer working places to local inhabitants and contribute to the regional economy.

3.2. Social impacts:

Social impacts mainly refer to the quality of life of the local population. One of the most important factors is the accessibility of the location. It is crucial for the inhabitants and also for visitors and guests to have the possibility to leave the location when they need. For the inhabitants this is often linked to their daily routine such as going to work. Another important aspect is safety. Inhabitants, who have experienced natural hazards, do not feel secure, especially when the potential of natural hazards is high. The fear of natural hazards is always present. This is often also linked to psychological issues, such as living with the potential of natural risks. Another important issue is the insurance of supply with food, water and energy.

Nevertheless only few inhabitants leave their home or the region after a natural hazard, even when they have been directly affected. People learn to live with the risk of natural hazards.

3.3. Ecological impacts:

Ecological impacts of natural disasters are considered to be not that important. It is a trade-off between the nature, which needs space and the space needed by the population. Constructions and barriers impede the landscape but they are necessary to protect the settlement areas and infrastructures.

4. Effects of past experience on decision making

Experiences with natural hazards impact the decision behavior and have consequences for local authorities, but also for the local population. In consequence to natural hazards local authorities elaborated or changed their development plans. They are more careful in approving the construction of buildings for privates and businesses in risky areas. Furthermore regional experts started to analyze and collect more data and to develop new computation models. Moreover they integrated their experiences in action plans and tried to improve actions, which did not work in the case of natural hazard. Another consequence is the risen attention given to the implementation of mitigation strategies but also to the maintenance of systems and barriers.

Also businesses and inhabitants have drawn consequences from natural hazards. They are willing to invest for more security, even though there are legal barriers to do so.

5. Information about natural hazards

Information and information systems on natural hazards work very well. Most areas have several information sources and use the information as basis for their decisions. All locations have early warning systems and get information by the most important local and regional institutions. Especially the internet is considered to be an important means of information. Therefore it would be important to improve the online-services of the local institutions. The access to data bases should be facilitated and information of different institutions should be better coordinated.

Concerning information there are three main problems, which can arise. First, information is provided on a daily basis, but mostly on a regional level. As conditions can vary in the single location due to micro-climates, it would be very important to offer frequent information also on a local level. Second, information should be elaborated and limited. It is not the amount of information but the quality of information, which is important for the decision process. If decision makers receive too much information they are not able to manage them accordingly and the decision making process takes longer. Therefore information should be provided in elaborated form. Third, the stakeholders have problems in interpreting the available information and in taking appropriate decisions, due to the high level of uncertainty.

6. Risk perception

Risk perception and risk awareness increased over the last years, especially among the local population. Natural hazards are perceived as a disadvantage for the location, especially in terms of security, financial burden and damages caused by natural hazards. Over the last years inhabitants became more sensitive to natural hazards. The risk is perceived as high, although constructions and the different measures taken to prevent natural hazards are perceived very positively. In general the frequency and intensity of natural hazards increased and adaptation is seen as a major challenge.

In contrast, the awareness of visitors and guests is not considered to have changed. They are aware of climate change and also of the extreme climate conditions of the last years but don't link it to natural hazards in the different locations.

7. Risk management

An effective and good risk management is characterized by:

- a clear organizational structure
- clear guidelines for the different stakeholders
- the availability of needed resources, such as manpower and machinery
- a clear allocation of power and responsibility

Moreover it is important that the responsible persons perfectly know the risk and know how to react in the situation. Therefore it is important to define strategies of precaution and to elaborate action plans.

The most important actors in case of natural hazards are the mayor and the local authorities, energy providers, water suppliers, managers of transport infrastructures, civil protection as well as the chief of the fire department, the rescue crew and the police.

In the past investments were made mainly into protective constructions, which are rather expensive. Moreover it is difficult to anticipate what will happen and therefore to geographically allocate investments. In the future more importance should be given to preventive activities, awareness raising activities, education, more accurate information systems and the necessary equipment on site.

8. Comparable Table of results

| | Austria | France | Italy | Slovenia | Switzerland |
|--|--|---|--|--|--|
| Personal experiences with natural hazards <i>Type and frequency of natural hazards</i> | <p>The region is affected by debris flows, avalanches and rockfalls.</p> <ul style="list-style-type: none"> Avalanches are the most frequent natural hazards (Big events in 1984, 1988, 1999 and 2005) Floods in 2002 and 2005 Debris flows and rockfalls occur every year | <p>The region is affected by:</p> <ul style="list-style-type: none"> Avalanches Debris flows Rockfalls Floods | <p>In the last years many natural hazards occurred. As nearly 90% of the territory is steep terrain, debris flows and rockfalls are the most frequent natural hazards.</p> <ul style="list-style-type: none"> Debris flows (in the years 1964, 1965, 1998, 2000, 2001 and 2007) Rockfalls (in the years 1998, 2001 and 2009) | <p>In general the mountainous area with the prevalence of torrential floods and the lowlands with lowland floods have to be distinguished.</p> <ul style="list-style-type: none"> Floods are frequent and occur every year (March and December 2009). Landslides are quite frequent, especially smaller ones. Landslides occur on average once every two years. Avalanches Earthquakes (There were three earthquakes in the last 30 years). Storms and strong winds affect the region for few days a year. Bora occurs once a year, usually during winter. Forest fires occur once in 5 years. <p>Hazards are getting more frequent.</p> | <p>The most frequent natural hazards are debris flows, rockfalls in summer and avalanches in winter.</p> <ul style="list-style-type: none"> Debris flows are mainly caused by strong rain falls (in the year 2001). Rockfalls are very frequent (last big events in 2007, 2008 and 2009) Avalanches are very frequent each winter Floods in 2002 |
| <i>Damages</i> | <p>Natural hazards cause damages. Mainly affected are the traffic infrastructures, the local population, bridges, as well as the landscape.</p> <p>In 1984 houses were destroyed. Also the avalanche in 1988 caused damages at houses and public infrastructures. In addition there were seven victims.</p> <p>Natural hazards do not only cause material damages, but can also damage the touristic image of a destination.</p> | <p>Natural hazards cause damages, especially on transport infrastructures, such as roads, railroads and highways.</p> <p>But also private houses and public institutions are concerned.</p> | <p>Damages mostly affect the highway, the railroad and the local streets.</p> <p>Nearly every event causes high damages. Debris flows in 2009 caused 300.000-400.000 Euro of direct damages.</p> <p>The worst scenario is when people are affected. In 1998 there were five victims, caused by rockfalls and debris flows.</p> | <p>The damage is high. All natural hazards in this area led to high damages. This relates either to floods, winds, landslides or to earthquakes.</p> <p>Floods don't cause a lot of direct damage on road infrastructures by erosion, but they cause more indirect damages, e.g. they make transport impossible. The damages are higher when settlements are flooded.</p> <p>Torrential floods are small and short-time events. The damage is high but spatially limited.</p> <p>Natural hazards can affect the electric power supply system, waterworks and sewage systems.</p> <p>Droughts affect the lowland agrarian regions.</p> <p>Strong winds cause several problems because houses are not adapted.</p> <p>Natural hazards can damage long-distance electric transmissions.</p> <p>The two earthquakes, in 1998 and 2004, caused several millions of Euro (only) direct economic damage. This does not include damage on the buildings or indirect commercial or business damage.</p> | <p>In general natural hazards cause high damages, but a distinction between rockfalls and debris flows or avalanches has to be made.</p> <p>Debris flows and avalanches do not cause high damages. They can block infrastructures for a certain time but the financial expenses are not that high.</p> <p>Rockfalls usually cause higher damages. In January 2007 a rockfall affected the railroad. Also streets were affected. In 2009 there were two events (20th of January and 28th of January).</p> <p>Damages amounted to 6 million Swiss Franc.</p> |

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| Impacts of natural hazards <i>Economic impacts</i> | <p>Limited accessibility has a negative impact on the economy, as well as on the general attractiveness of a location.</p> <p>Accessibility is closely linked to employment opportunities and the availability of skilled workers.</p> <p>With the elaboration of new development plans and the identification of new red zones, it is possible that the building sites in a region lose their value. This can be seen as a negative impact.</p> <p>Natural hazards have an impact on tourism. If guests cannot arrive or leave the attractiveness of the region will decrease and less investments will be made.</p> <p>The most important impact is certainly the financial burden.</p> <p>Certainly there are also positive impacts of natural hazards on the economy. Because of reconstruction and prevention there is a transfer of public funding in the region.</p> | <p>Limited accessibility has a negative impact on the economy, the attractiveness of the location and the competitiveness of the region.</p> <p>Accessibility is closely linked also to employment opportunities.</p> <p>Natural hazards and their prevention have financial impacts, because the costs for prevention and reconstruction are high.</p> | <p>Accessibility is important for every region and can have impact on the economy as a whole, especially for the industry and for tourism.</p> <p>If transport infrastructures are damaged, natural hazards can cause traffic jams. Especially the highway (Brenner) is an important traffic way between South and Nord Europe.</p> <p>Because of natural hazards a lot of investments have to be made in both, prevention and reconstruction.</p> | <p>Natural hazards influence economy. They do mostly due to road deviations in case of natural events and by economic losses due to limited access.</p> <p>Local economy is usually not directly affected except the effect of closed roads when people, for example cannot reach their jobs.</p> <p>A lot of damages are also caused on small, local roads, where many investments are needed by local people to bring things back to some normality. There is a double economic loss: a lot of material is needed for recovery and additional time and energy are required for the damage to be repaired.</p> <p>Only one such natural disaster can literally throw down, and push back the whole economy in a region for a couple of years.</p> <p>If a landslide destroys a house or a road it worsens the attractiveness of the location for some time.</p> <p>Natural hazards also affect public services, such as the medical service.</p> <p>If in a particular area the quality of life lowers people tend to emigrate. This means that there are less employment opportunities and there are less skilled workers available.</p> <p>The economy becomes also more expensive. The investment in reconstruction and the time lost have to be included in the price of the final product. This leads to a loss of competitiveness in the market.</p> | <p>Natural hazards have only a small impact on the economy of a region. Surely natural hazards cause damages which have to be repaired or prevented. But in general this financial loss does not impact the economy.</p> <p>There are also enterprises and public institutions which operate because of natural hazards (construction companies...). These companies create jobs and generate revenues, which can be seen as a positive influence on the economy.</p> |
| <i>Impacts on the quality of life</i> | <p>There are no impacts of natural hazards on the quality of life. People are used to natural hazards and see them as part of their life.</p> <p>When people experience natural hazards, they become more sensitive and aware of the risk. It causes psychological issues. People do not feel that safe anymore.</p> <p>Another issue is the provision of food, water and electricity.</p> <p>Accessibility is also important for the quality of life of the local population. If there is no access to a certain location it has negative influences.</p> | <p>Accessibility is also very important for the quality of life of the local population.</p> <p>If public institutions, such as schools or hospitals are affected, it has also an impact on the quality of life.</p> <p>To live with natural hazards is often difficult for people who are not used to. But for the local population the impact is rather small.</p> | <p>Natural hazards impact the quality of life of the local population. There are two kinds of impacts: psychological impacts and economic impacts.</p> <p>Overall it has psychological impacts. People are always aware of the risk of natural hazards. Especially in times of rain fall some tend to be anxious.</p> <p>If accessibility cannot be guaranteed it impacts the quality of life.</p> <p>There are financial impacts for the population. Insurances become more expensive and if the own property is damaged, people have to invest in reconstruction.</p> | <p>Quality of life is not worsened because of natural hazards. People are adapted to nature and natural hazards.</p> <p>If an event destroys a house, its influence is high. But it is high only for the people who are affected. Looking at the whole area the impact of the quality of life is rather low.</p> <p>It also produces psychological pressure, when people don't know if and when it will happen again. People are constantly aware of potential natural hazards. People think and act differently.</p> <p>It influences the quality of life by changing the level of accessibility.</p> <p>It also increases the possibility of an injury at a hazardous event which would not happen in safer places. Also the property can be demolished.</p> | <p>Certainly natural hazards have impact on the quality of life of the local population. Even if they are used to natural hazards, some get anxious when the risk increases.</p> <p>An important point is the accessibility. People are used to move freely. If roads are closed in impairs the quality of life.</p> <p>Another impact can be seen in the provision of water and food, when roads are closed.</p> |

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|---|--|---|--|--|--|
| <i>Ecological impacts</i> | <p>Agriculture as well as forests are affected by natural hazards.</p> <p>Natural hazards have a rather small ecological impact.</p> | <p>Natural events, especially debris flows have a negative impact on the ecosystem.</p> <p>The ecological impacts are very low.</p> | <p>Natural hazards don't have ecological impacts.</p> <p>A negative impact of natural hazards is that constructions, such as barriers can affect the landscape.</p> | <p>Ecological impacts can be seen in water or air pollution due to natural hazards, as well as in damaged harvests.</p> <p>Natural hazards have impact on sewage systems. People have underground oil reservoirs; if they live near water streams it is possible that streams are polluted.</p> <p>There has not been a major ecological disaster in the region.</p> | <p>Natural hazards have no ecological impacts.</p> <p>The only impact can be seen in damaged landscapes, but these are only short-term effects.</p> |
| Effects of past experiences with natural hazards | <p>New spatial plans have been elaborated, where risky areas are indicated.</p> <p>The information system has been improved. Information are analyzed each day and provided to the most important stakeholders.</p> <p>Action plans and scenarios were elaborated to improve the coordination in case of natural events. They include resources needed, responsibilities and actions to be taken.</p> <p>The local authorities started programs to increase the sensitivity of the local population, for example in schools.</p> <p>There are new calculation models for barriers and constructions.</p> <p>Trainings for risk scenarios are implemented to prevent problems in case of natural hazards.</p> | <p>New spatial plans have been elaborated as a consequence of natural hazards.</p> <p>Furthermore studies on natural risks are encouraged.</p> <p>More protective constructions are build.</p> <p>Activities were adapted to the potential risks.</p> <p>Past experiences with natural hazards had impact on long-term, but also on short-term decisions.</p> | <p>Cooperation between civil protection, police and fire departments are encouraged.</p> <p>A comprehensive crisis management was elaborated.</p> <p>Awareness-raising activities for guests and in schools are done.</p> <p>The municipalities elaborated a risk plan for the location.</p> <p>When new infrastructures are planned also protective measures and the potential risk is discussed.</p> | <p>Riverbeds are permanently and systematically cleaned (especially from the accumulations of hydro-power plants).</p> <p>Preventive measures are encouraged which lead to lower future damages. This is also the cheapest way in the long run as financing in case of natural events is rather low.</p> <p>There is a national spatial plan which gives directions for elaboration of municipal spatial plans.</p> <p>Changes in formal acts are made. If the bora wind will continue to be so strong, the construction regulations, for example regarding roof inclination and type, have to be changed.</p> <p>Geological research has been encouraged and hazard maps have been elaborated.</p> <p>Several changes regarding the reconstruction after the event (esp. earthquakes) have been made.</p> <p>Important changes have been made in the area of communication and cooperation between different institutions in the last years.</p> <p>The rescue units and the civil protection have been reorganized. The number of employees has been increased and new equipment has been provided.</p> <p>Every intervention brings experience. On this basis future actions are planned.</p> | <p>In the planning process of new infrastructures information on natural risk is included. In consequence infrastructures are located in safer places or protective measures are taken.</p> <p>Natural events are registered since 2007. It covers also all protective measures and their status. This leads to better control of potential risks.</p> <p>Discussions between all important institutions are encouraged.</p> <p>Furthermore studies on natural hazards are made to better control funding.</p> |
| Information about natural hazards <i>Level of information</i> | <p>The respondents feel informed about natural hazards. Only about debris flows there is only little information.</p> <p>In general the respondents indicate that they have too many information, which makes is hart to keep track of all information.</p> <p>Everybody is responsible to inform himself about potential natural hazards.</p> | <p>The respondents feel informed about natural hazards and potential risks.</p> <p>A problem is that the information are very complex and that it is difficult to understand and to take decision on the basis of such information.</p> <p>The most important stakeholders are informed periodically.</p> | <p>The level of information is high.</p> <p>The important stakeholders are periodically informed about potential natural hazards.</p> <p>A problem faced is the high amount of information. It is difficult to distinguish important and not important information and to react accordingly.</p> | <p>The respondents are well informed.</p> <p>The information flow is fast and sufficient and different and overlapping communication systems are used.</p> <p>The respondents are not only informed about potential natural hazards but know also what consequences they can expect.</p> <p>Regarding the potential risk the forecasts are questionable because events cannot be foreseen long in advance. But in the last years storms and floods can be predicted rather well.</p> | <p>The respondents indicate that they are very well informed about potential natural hazards.</p> <p>The most important stakeholders and experts work together and try to exchange all relevant information.</p> <p>It exists a list of dangerous areas, which is periodically checked. Information about these areas is available for all relevant stakeholders.</p> |

| | | | | | |
|--|--|--|--|---|--|
| <i>Information sources</i> | <p>The most important information sources are:</p> <ul style="list-style-type: none"> • Different local institutions, such as civil protection, cable cars, avalanche commission, fire department • Internet • Austro-Control (location-specific weather information) • ZAMG weather server | <p>The most important information sources are:</p> <ul style="list-style-type: none"> • IMRA (Institut des risqué majeurs de Grenoble) • Météo France • Internet • Civil protection | <p>The most important information sources are:</p> <ul style="list-style-type: none"> • Provincial hydrographic office • Civil protection • Traffic center • Department of geology of the province • Internet • Managers of the traffic infrastructures, especially of the highway | <p>The most important information sources are:</p> <ul style="list-style-type: none"> • Environmental agency (data about meteorological and hydrological events) • Civil protection • Information systems at national, regional and local level • National and regional communication centers • Media and internet | <p>The most important information sources are:</p> <ul style="list-style-type: none"> • Military institutions • Avalanche commission • Local authorities • Foresters <p>Important are also the experiences made in the last years.</p> |
| <i>Further required information</i> | <p>There should be elaborated a central system, where all institutions can enter information and also get all information of other institutions.</p> <p>Information should be provided also on a local level.</p> <p>Furthermore it is not only important to provide information, but also a consultation how this information can be implemented in practice.</p> | <p>More studies on natural risk and natural hazards should be encouraged.</p> <p>A central database should be established and the information flows should be better coordinated.</p> | <p>Further information is needed on a local level. Often data is available only on a regional level.</p> <p>Also cooperation should be improved. Data collected by the managers of roads, railroad, highway and the municipalities should be available for exchange.</p> | <p>Additional data about events is needed. Also more expert studies, as well as studies on natural phenomena and organization of society in space are needed.</p> <p>More effort should be put in the control of the information flows.</p> <p>Information should be monitored in an organized way in order to react properly.</p> | <p>There is only little information, which is needed in addition. It would be important to collect data in a central database, where all stakeholders can search for information.</p> |
| Risk perception and awareness <i>Risk perception</i> | <p>In general risk increased over the last years, especially in winter. In summer the risk stayed rather stable.</p> <p>The risk increased due to the more extreme weather conditions which lead to natural hazards.</p> <p>It is not the number of natural hazards which increased. In comparison to the past people move to locations, where events are more frequent and therefore also the risk increases.</p> | <p>The risk of natural hazards increased over the last years.</p> <p>The problem is that the local population and the number of infrastructures increase. Therefore also the risk is higher than in the past.</p> | <p>In general risk stayed stable of the last years. Only rockfalls have become more frequent in the region.</p> <p>But the risk is perceived as more present in the minds of the local authorities and the local population.</p> | <p>The risk of natural hazards increased over the last years. This is due to several factors, such as climate or land use.</p> <p>Weather-related events are more extreme than in the past.</p> <p>There are really visible changes.</p> <p>Based on past experience it can be said that the probability of such events is rather high in the region.</p> | <p>In general the risk of natural hazards increased over the last years.</p> <p>This is due to climate change and the increased land use of the local population.</p> |
| <i>Awareness</i> | <p>In general the awareness increased due to the last events. But there are differences between the local population and guests.</p> <p>The local population is more aware of natural hazards. They are more sensitive for the topic.</p> <p>The local population and local authorities are concerned. They think about potential risks and their prevention.</p> | <p>The awareness of stakeholders, who are directly involved in risk management, is very high.</p> <p>The awareness of the local population and also of local authorities is low. They do not think about the potential risk.</p> | <p>The awareness of natural hazards of the local population increased over the last years.</p> <p>Although the population is used to natural hazards they become more sensitive for this topic.</p> <p>The awareness of tourists did not change. They are not aware of the risk and don't think about consequences.</p> | <p>The awareness in the population is low and has not increased. People tend to forget natural hazards.</p> <p>The awareness of responsables and public authorities increased, because natural hazards have become more frequent and also new situations have been experienced in the last years (e.g. strong earthquakes) which led to new understanding.</p> <p>Stakeholders who are directly involved in risk management, are more aware of possible, potential natural hazards, while others only focus on them when necessary, for some time after the events.</p> | <p>The awareness for natural hazards did not increase over the last years.</p> <p>Due to protective constructions and clear communications the population, but also tourists feel save and are not aware of the risk of natural hazards.</p> |

| | | | | | |
|-----------------------|--|--|--|---|--|
| Affected groups | <div>Groups affected by natural hazards:</div> <ul style="list-style-type: none">Local populationTransport infrastructures (especially railroad)Other infrastructuresTourism | <div>Groups affected by natural hazards:</div> <ul style="list-style-type: none">Local authoritiesManagers of infrastructures, especially of transport infrastructuresLocal populationTourism | <div>Groups affected by natural hazards:</div> <ul style="list-style-type: none">Local populationLocal authorities and municipalitiesTransport infrastructures (roads, railroads and highways)TourismPublic infrastructures | <div>Groups affected by natural hazards:</div> <ul style="list-style-type: none">Managers of transport, energy and water infrastructuresAuthorities (state and regions)Local populationInfrastructuresTourismAgriculturePublic institutions, such as hospitals and schoolsMunicipalitiesCultural heritage | <div>Groups affected by natural hazards:</div> <ul style="list-style-type: none">Local populationTransport infrastructuresOther infrastructuresTourismMunicipalities |
| Mitigation strategies | <div>Mitigation strategies are:</div> <ul style="list-style-type: none">Disaster scenariosAction plansEarly warning systemsHazard zone plansTraining of hazard scenariosBarriers and constructionsRisk dialogue groupsInformation plans | <div>Mitigation strategies are:</div> <ul style="list-style-type: none">Hazard mapping toolsEarly warning systemsEarly alert systemsTraining of hazard scenariosRisk plansDecision support systemsRisk dialogue groups | <div>Mitigation strategies are:</div> <ul style="list-style-type: none">Barriers and other protective buildingsHazard zone plansCrisis managementTraining of hazard scenariosRisk plansDocumentation of eventsEarly warning systemsAction plans | <div>Mitigation strategies are:</div> <ul style="list-style-type: none">Hazard mapsRisk mapsNational spatial plansHazard mapping toolsEarly warning systemsEarly alert systemsDecision support systems (Environmental agency)Educational activitiesRisk dialogue groupsRegional action plansTraining for hazard scenariosOperative plans | <div>Mitigation strategies are:</div> <ul style="list-style-type: none">Action plansTraining for hazard scenariosRegister of natural hazardsEarly warning systemsHandbooksEducational activitiesRisk dialogue groups |

Table 3: Comparison of results of qualitative interviews

CHAPTER III – RESULTS OF THE QUANTITATIVE SURVEY

1. Austria

1.1. General information

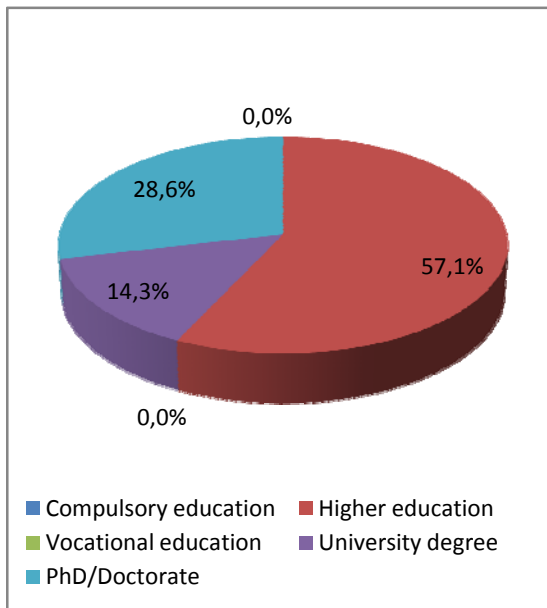


Figure 1: Highest education of the respondents

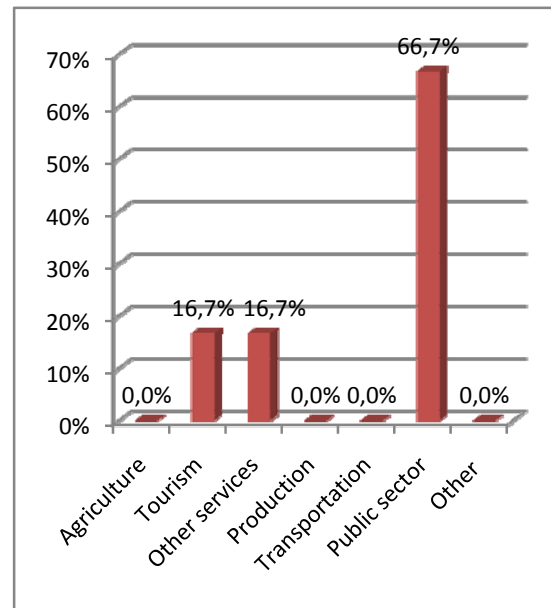


Figure 2: Sector, in which the respondents operate

In Austria 17 stakeholders participated in the online-survey, which gives a response rate of 40%.

Regarding the highest education 57,1% indicate to have higher education, 28,6% have a PhD or doctorate and 14,3% indicate to have a university degree (see figure 1).

Most of respondents (66,7%) indicate to operate in the public sector. 16,7% operate in tourism and other 16,7% indicated other services (see figure 2).

1.2. Personal experience

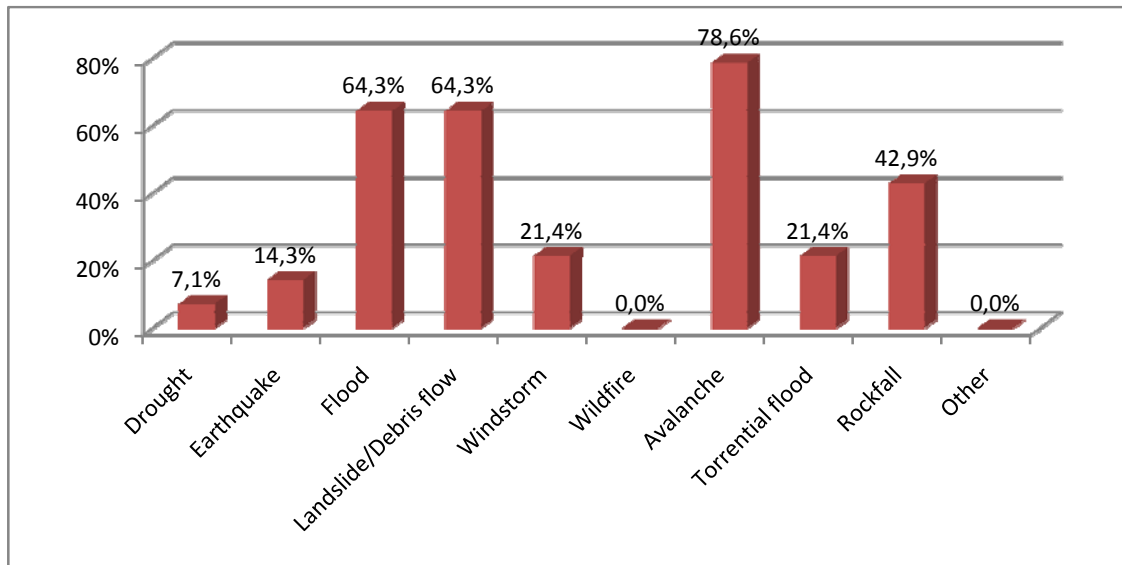


Figure 3: Type of natural hazards experienced (more answers possible)

94,1% of the respondents indicate that their institution or enterprise experienced a natural hazard in the past five years. In average they experienced 2,41 natural hazards over the indicated time.

Nearly 79% experienced avalanches. 64,3% indicate that they were affected by floods and landslides or debris flows. 42,9% experienced rockfalls. The respondents have no or only little experience with earthquakes (14,3%), droughts (7,1%) and wildfire (0%) (see figure 3).

91,7% of the natural hazards over the last five years caused damages. 33,3% of the damages were primary or direct damages, 25% were secondary or indirect damages. 33,3% of the natural hazards caused both primary and secondary damages (see figure 4).

In average these damages are estimated to a cost of Euro 506.176,47 per damage (minimum value: 0 €; maximum value: 10 Mio.).

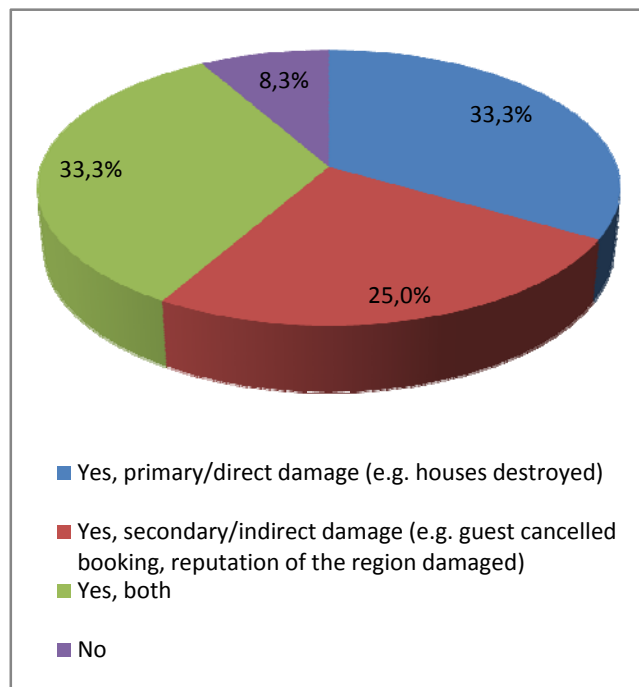


Figure 4: Damages caused by these natural hazards

1.3. Problem perspectives

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents state that avalanches (2,5), landslides or debris flows (2,9) and rockfalls (3,1) are the most worrying natural hazards in the region (see figure 5).

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According the respondents landslides and debris flows (2,22), as well as floods (2,33) and avalanches (2,44) have a high degree of damage. Moderate degrees of damage have torrential floods (2,88), windstorms (3,14), rockfalls (3,22) and earthquakes (3,33). A low degree of damages have droughts (4,86) and wildfires (3,86) (see figure 6).

When confronting the results especially avalanches and landslides or debris flows seem to have a high impact on the location, because the rating is high in terms of concern and vulnerability.

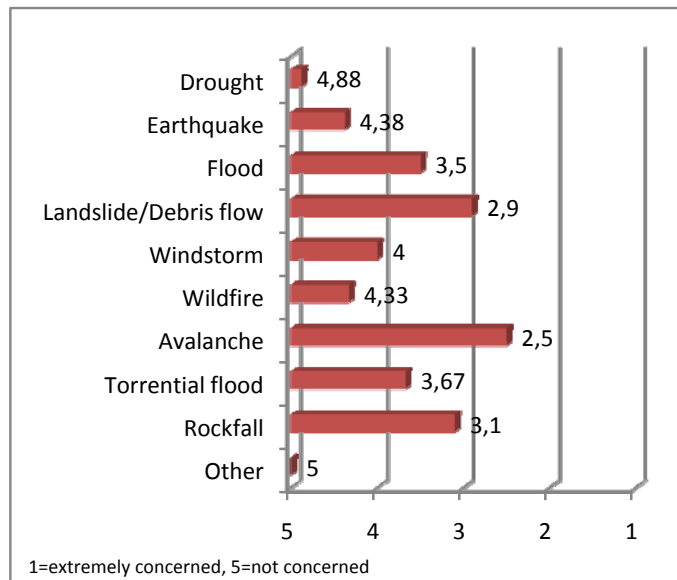


Figure 5: Degree of concern about natural hazards affecting the location

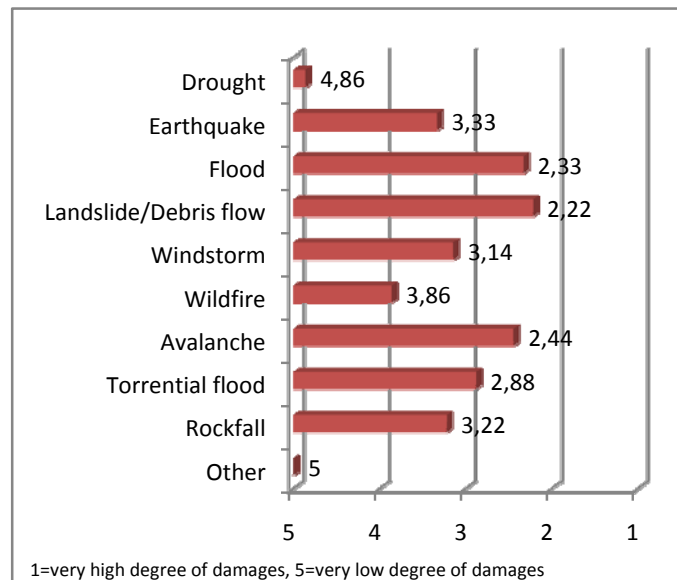


Figure 6: Degree of potential damages related to natural hazards

1.4. Perception of natural hazards

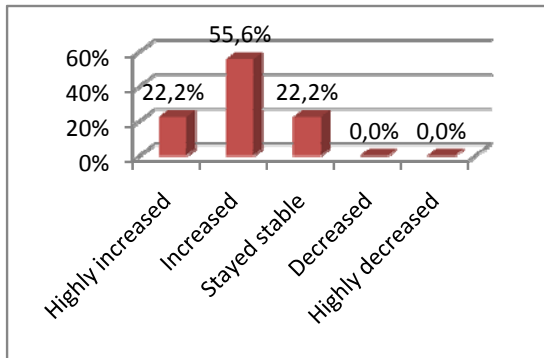


Figure 7: Development of awareness of natural hazards

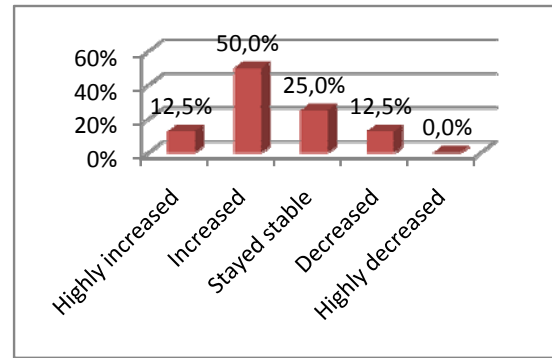


Figure 8: Development of natural risk

According to the respondents the natural risk increased over the last ten years (figure 8). Also the awareness of natural hazards increased over the same time period (figure 7).

According to the respondents the municipalities or local authorities (2,33) and the population (2,44) are very affected by natural hazards. Also managers of transport infrastructures (2,78) and private businesses (2,89) are affected by natural hazards. The least affected are public institutions (3), energy provider (3) and water suppliers (3,11) (see figure 9).

The respondents do rather agree with the statement 'Natural hazards are seen as a major problem in the location'. They are indifferent about the statements 'The potential of natural hazards is a disadvantage for the location' and 'Natural hazards impair the general attractiveness of the location' (see figure 10).

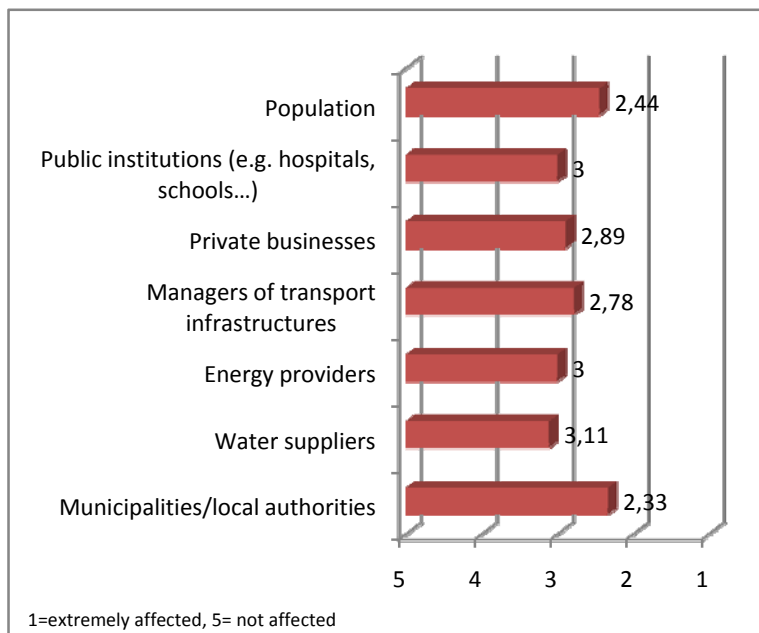


Figure 9: Groups affected by natural hazards

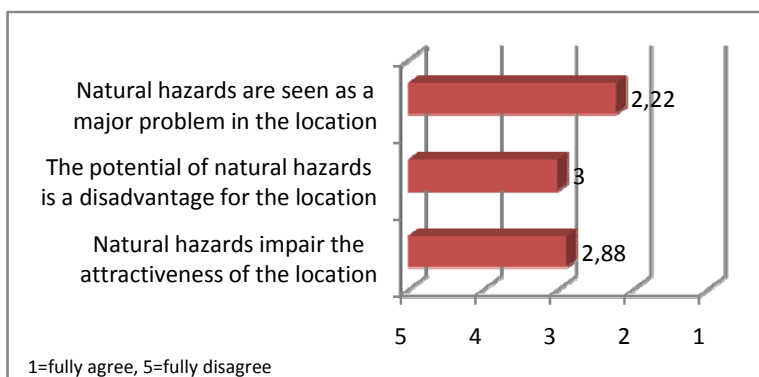


Figure 10: General perception of natural hazards

1.5. Impacts of natural hazards

To assess the impacts of natural hazards four different aspects were evaluated by the respondents: the impact on the regional economy, the impact on the quality of life of the local population, the ecological impact, as well as the impact on the decision behavior of the respondents. In all aspects the respondents were asked to rate the impact on a 5-point Likert scale from 1, meaning very strong impact to 5, meaning no impact.

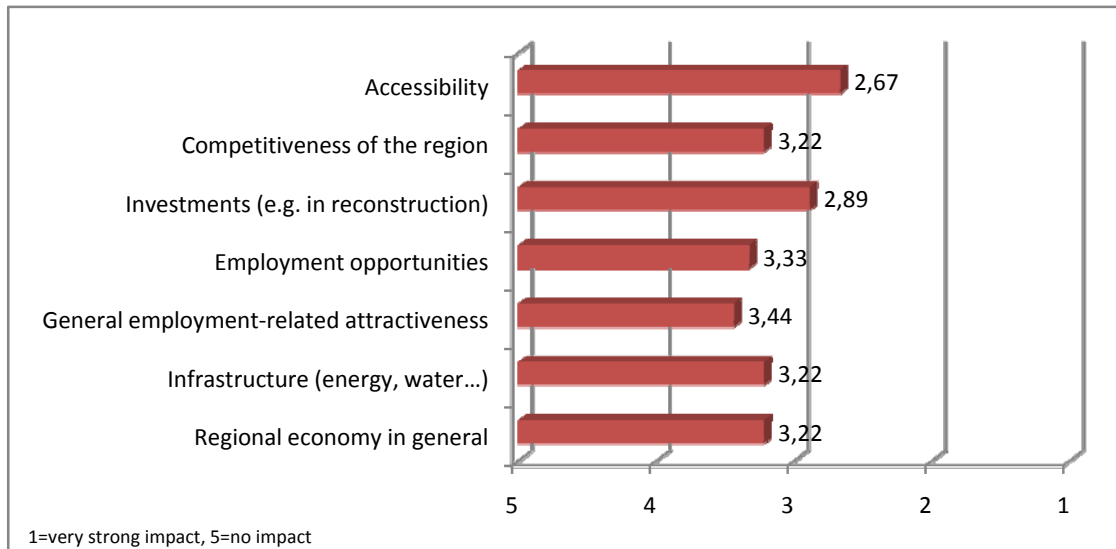


Figure 11: Impacts on the regional economy

In general the impact of natural hazards on the regional economy is rather medium. The most important impacts affected by natural hazards are seen in the accessibility of a region (2,67) as well as the investments (2,89), for example in reconstruction (see figure 11).

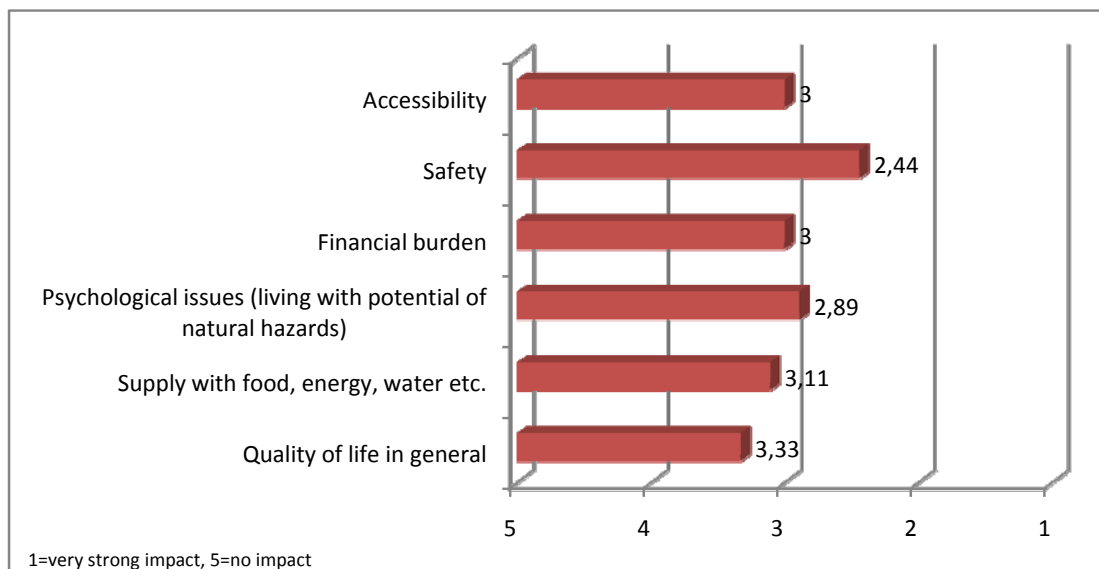


Figure 12: Impacts on the quality of life

Also the impact of natural hazards on the quality of life of the local population is rated moderately. According to the respondents natural hazards impact the safety (2,44), the accessibility (3) and the psychological wellbeing (2,89) of the locals (see figure 12).

The impact on the environment is rated as low. Impacts are seen on foresting (2,89) and landscape (2,78). According to the respondents natural hazards do rather not affect natural heritage and water cleanliness (see figure 13).

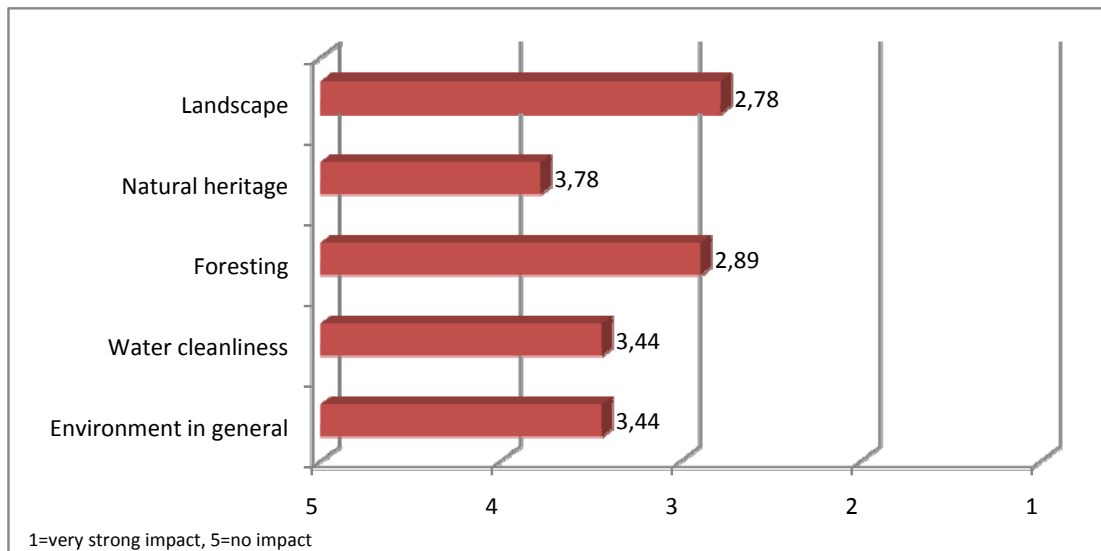


Figure 13: Ecological impacts

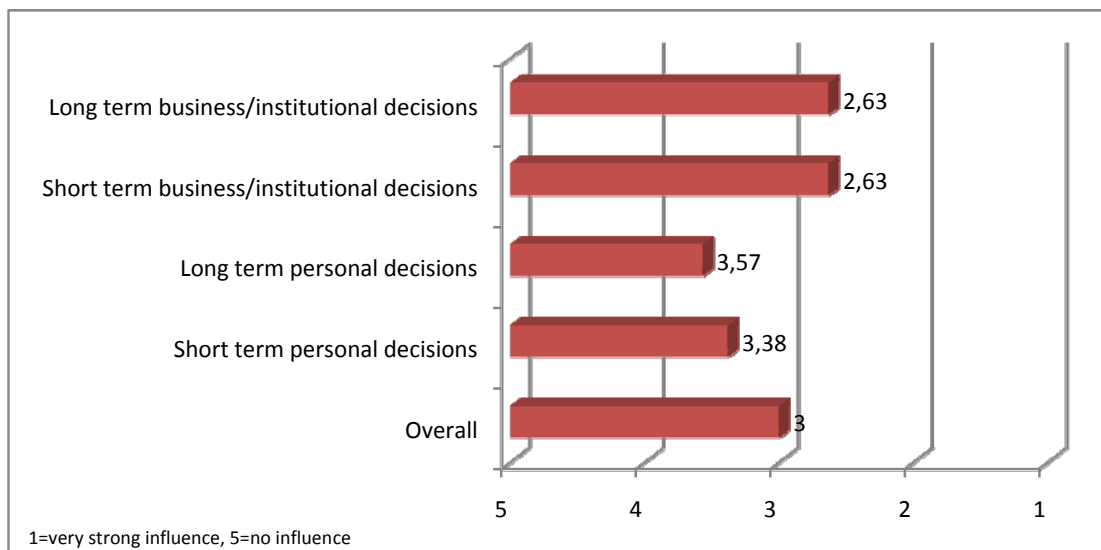


Figure 14: Impact of past experiences on the general decision behavior

Past experiences with natural hazards have impact on the general decision behavior of the respondents. The influence on business or institutional decision is higher than the influence on personal decisions, concerning both long term and short term decisions (see figure 14).

1.6. Information about natural hazards

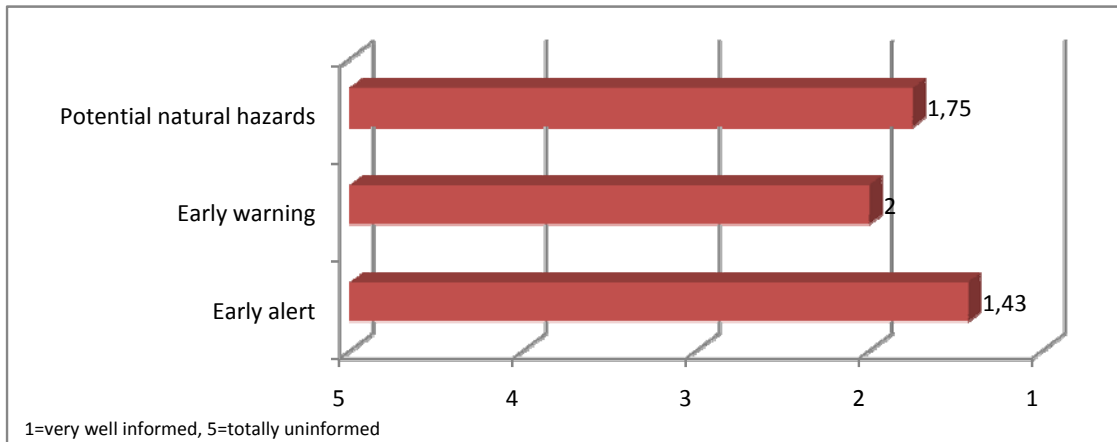


Figure 15: Information level of respondents regarding ...

The respondents are very well informed about early alert and well informed about potential natural hazards and early warning (see figure 15). Nevertheless they would need more or better information for certain locations, for example via SMS or email.

In overall 75% of the respondents receive information on natural hazards. The most important information source is the local government (62,5%). Half of the respondents also use information provided by the own institution or enterprise and the regional government. 37,5% of respondents use information of local private institutions or enterprises. 12,5% of respondents indicate regional private institution and the national government as information source (see figure 16).

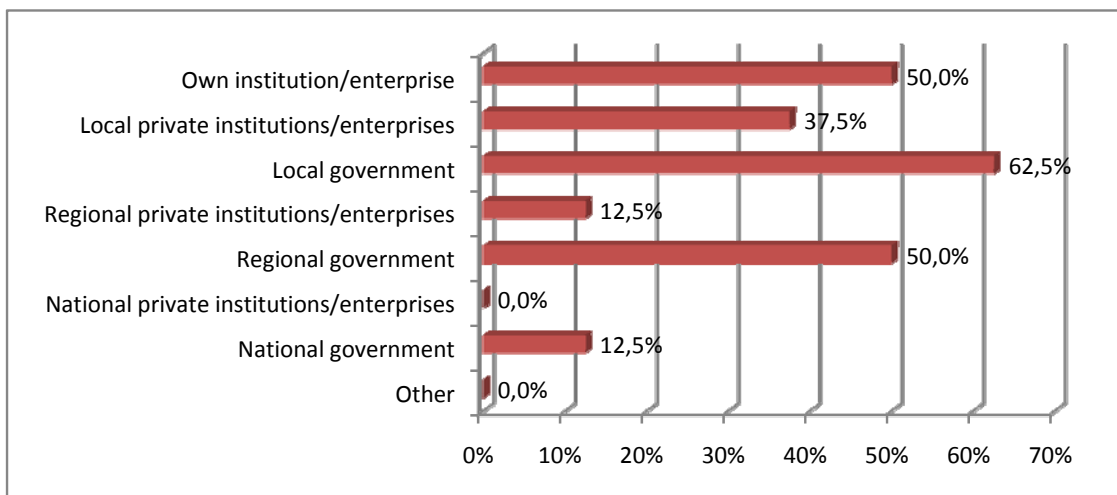


Figure 16: Information sources (more answers possible)

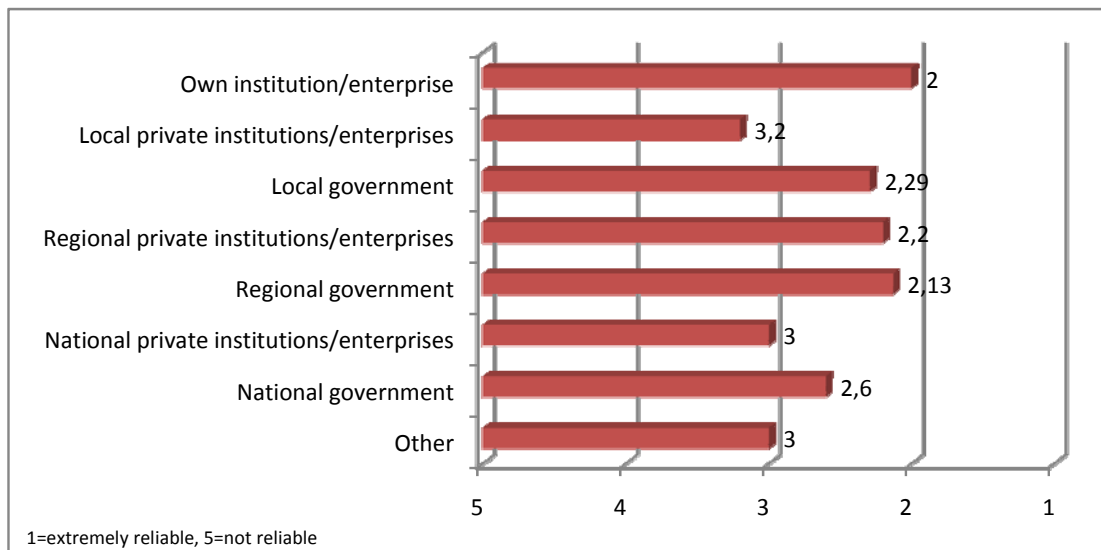


Figure 17: Reliability of information sources

The reliability of information sources in general is rated rather high. Information from the own institution (2), the regional government (2,13) regional private institutions or enterprises (2,2) and the local government (2,29) are rated as very reliable (see figure 17).

As indicated in figure 18 information uncertainty has influence on decisions. Therefore the reliability of information is of high importance.

Greater availability of data (1,88), more accurate warnings (1,75) and better telecommunication (2,12) are seen as important factors to improve the warning services (see figure 19).

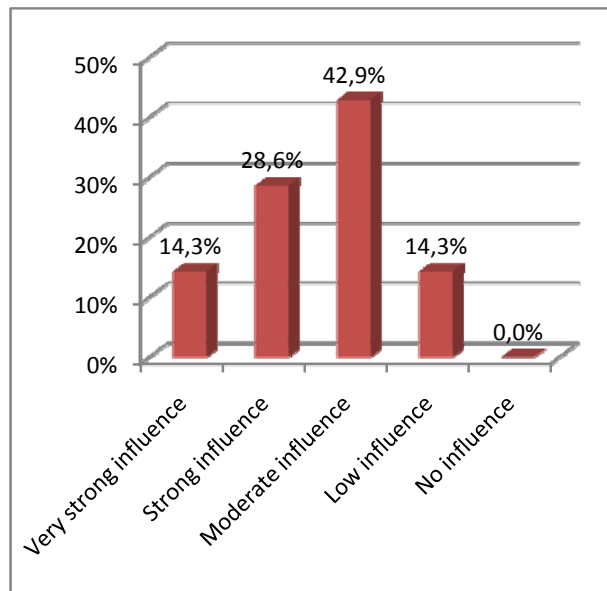


Figure 18: Influence of information uncertainty on decisions

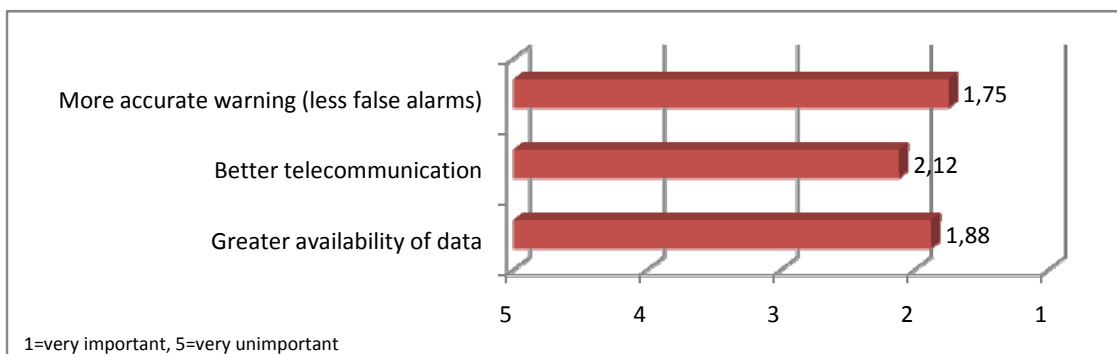


Figure 19: Factors to improve the warning system

1.7. Mitigation of natural hazards

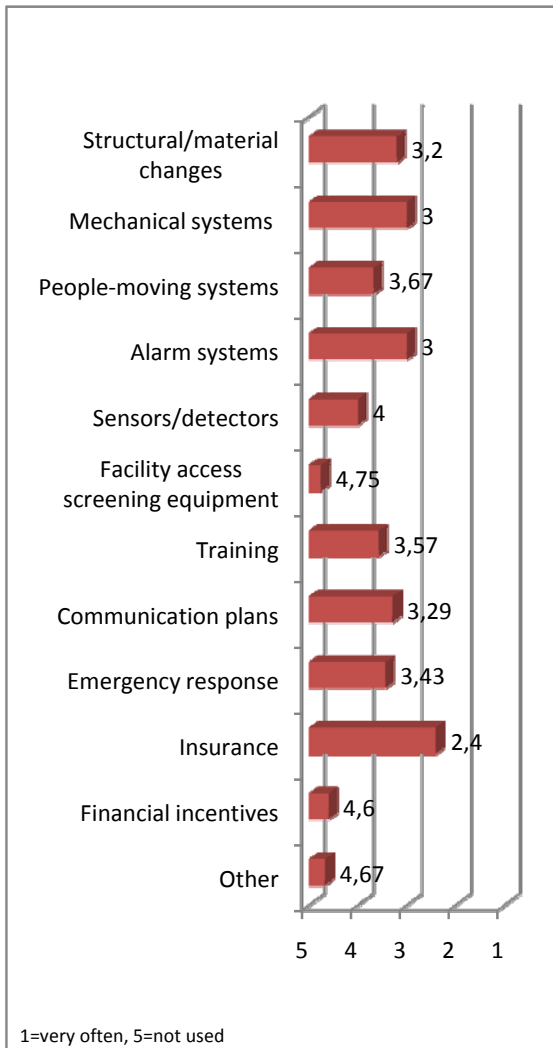


Figure 20: Usage of mitigation strategies

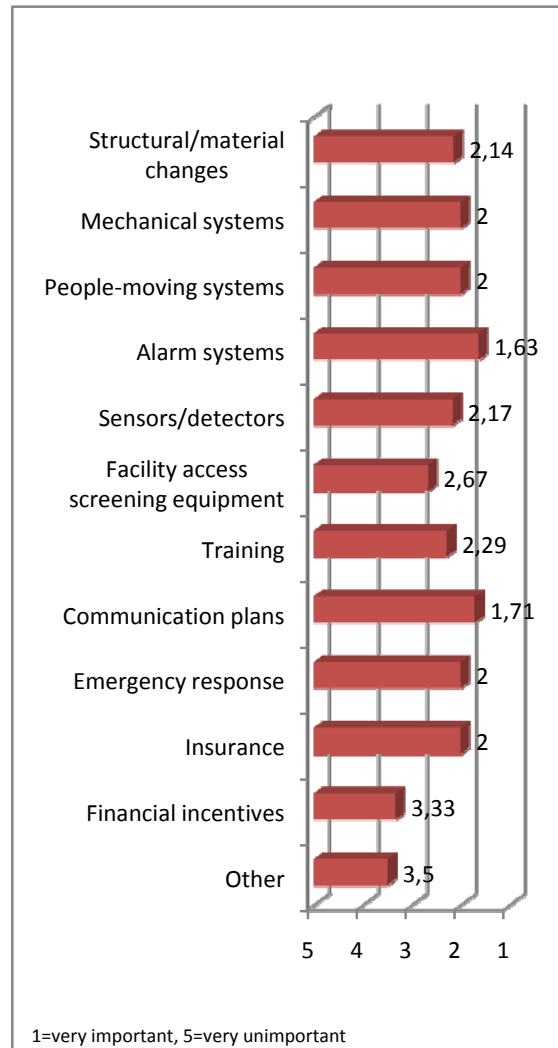


Figure 21: Importance of mitigation strategies

In general the respondents feel prepared to mitigate natural hazards. To assess the usage of certain mitigation strategies the respondents were asked to rate their usage on a scale from 1, meaning used very often to 5, meaning not used in the location.

In general it can be stated that the degree of usage of mitigation strategies is rather low. The respondents indicate that they primarily use insurance (2,4) to mitigate natural hazards. Alarm systems (3), mechanical systems (3), structural or material changes (3,2) and communication plans (3,29) are used rather rarely. Not used are facility access screening equipments (4,75) and financial incentives (see figure 20).

Rating the mitigation strategies according to their importance for the respondents, alarm systems (1,63) as well as communication plans (1,71) are seen as very important. Rather unimportant are financial incentives (see figure 21).

| | |
|----------------|-------------------------------------|
| Rank 1 | Alarm systems |
| | Mechanical systems |
| | People-moving systems |
| | Emergency response |
| | Communication plans |
| | Structural/material changes |
| | Insurance |
| | Sensors/detectors |
| | Training |
| | Facility access screening equipment |
| | Financial incentives |
| Rank 12 | Other |

The respondents were asked to rate the mitigation strategies according to their feasibility from 1, indicating the most feasible strategy to 5, indicating the least feasible strategy.

The most feasible mitigation strategies are alarm systems and mechanical systems. Least feasible are facility access screening equipment and financial incentives (see table 4).

Table 4: Feasibility of mitigation strategies

| | Own organization | Local level | Regional level |
|--------------------------------------|------------------|-------------|----------------|
| Hazard mapping tools | 16,7% | 16,7% | 66,7% |
| Early warning systems | 16,7% | 33,3% | 50% |
| Early alert systems | 16,7% | 50% | 33,3% |
| Decision support systems | 0% | 50% | 16,7% |
| Risk dialogue groups | 50% | 16,7% | 0% |
| Action plans | 33,3% | 50% | 16,7% |
| Training for hazard scenarios | 33,3% | 16,7% | 50% |

Table 5: Level at which risk management tools are used

Analyzing the usage of risk management tools at different levels it can be stated that in the own organization 50% of the respondents have implemented risk dialogue groups. On the local level early alert systems, decision support systems and action plans are used. On the regional level 66,7% of respondents indicate that hazard mapping tools are used. 50% indicate that on regional level also training for hazard scenarios and early warning systems are established (see table 5).

2. France

2.1. General information

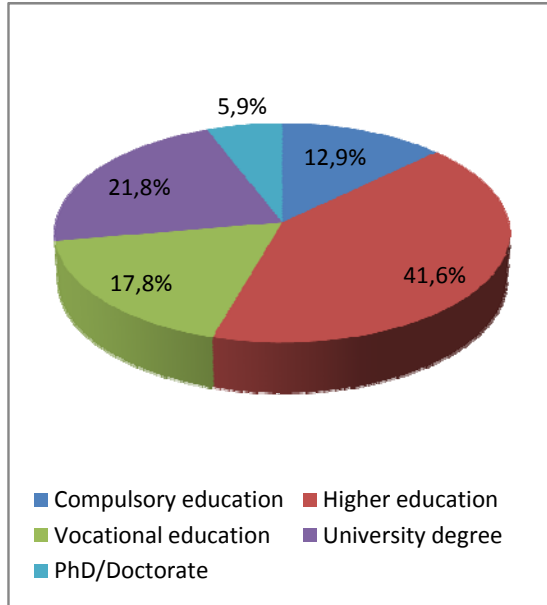


Figure 22: Highest education of the respondents

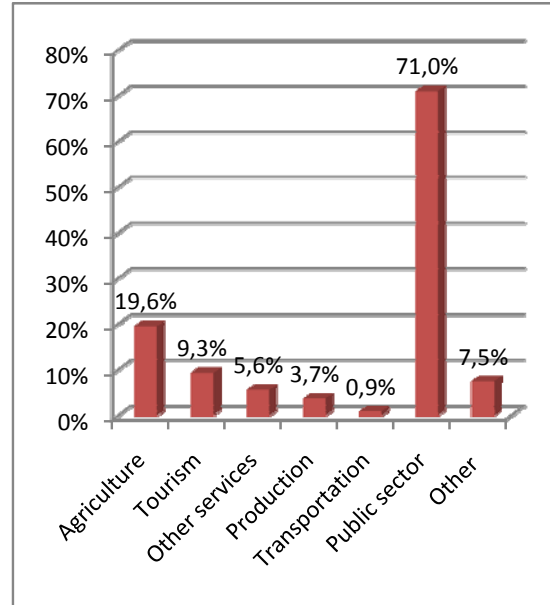


Figure 23: Sector, in which the respondents operate

In France 533 stakeholders participated in the online-survey.

Regarding the highest education 41,6% indicate to have higher education, 17,8% have vocational education and 12,9% have a compulsory education. 5,9% have a PhD or doctorate and 21,8% of the respondents indicate to have a university degree (see figure 22).

Most of respondents (71%) indicate to operate in the public sector. 19,6% operate in agriculture and 9,3% indicated tourism as field of activity (see figure 23).

2.2. Personal experience

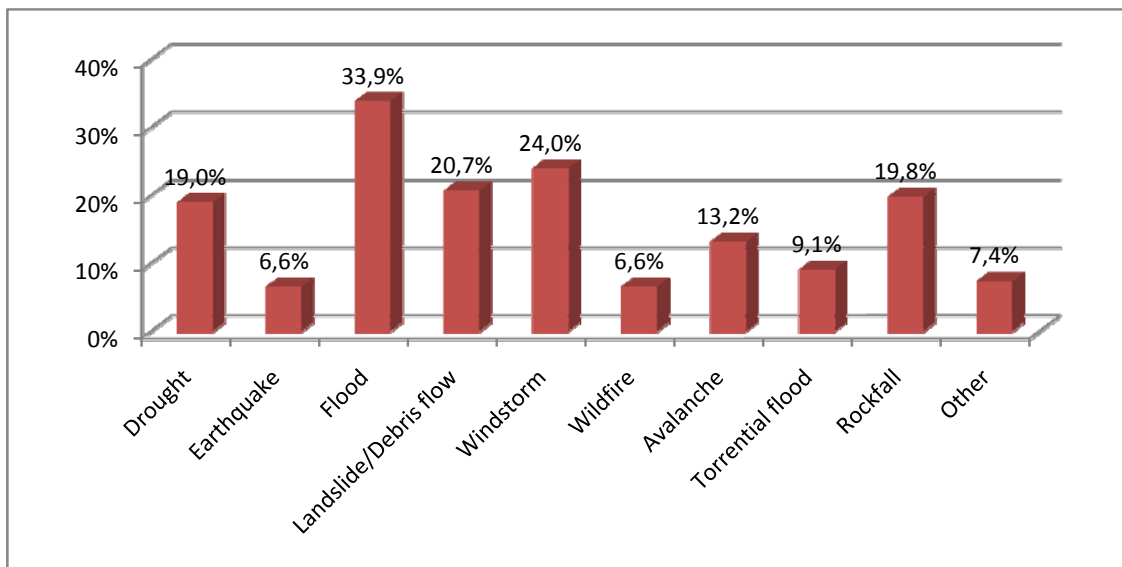


Figure 24: Type of natural hazards experienced (more answers possible)

24,6% of the respondents indicate that their institution or enterprise experienced a natural hazard in the past five years. In average they experienced 0,85 natural hazards over the indicated time.

Nearly 34% experienced floods. 24% indicate that they were affected by windstorms and 20,7% by landslides or debris flows. 19,8% experienced rockfalls and 19% were affected by droughts. The respondents have only little experience with earthquakes, wildfire and torrential floods (see figure 24).

74,7% of the natural hazards over the last five years caused damages. 50,7% of the damages were primary or direct damages. 13,3% were secondary damages. 10,7% of the natural hazards caused both primary and secondary damages (see figure 25).

In average these damages are estimated to a cost of Euro 83.684,27 per damage (minimum value: 0 €; maximum value: 25 Mio.).

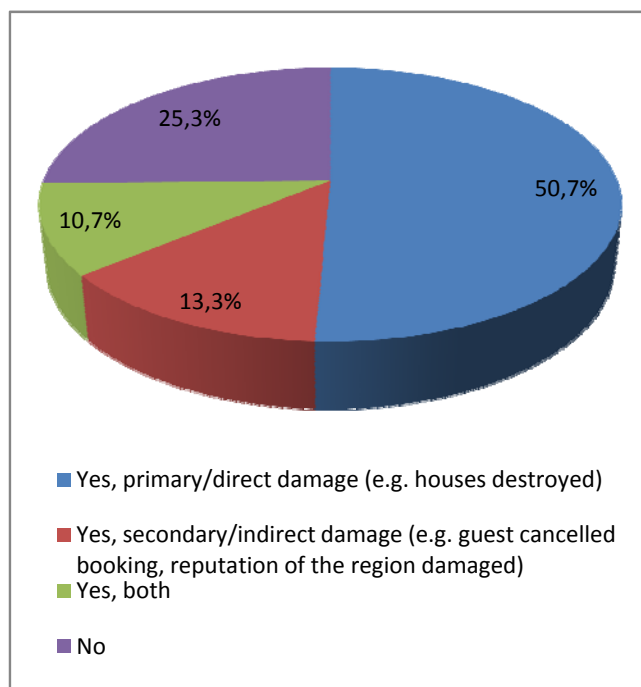


Figure 25: Damages caused by these natural hazards

2.3. Problem perspectives

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents are concerned about windstorms (3,46). Also droughts (3,68), wildfires (3,9), landslides or debris flows (3,99) cause some concern. The respondents are not concerned about avalanches (4,7) and torrential floods (4,72). In general the concern about natural hazards is rather low (see figure 26).

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According the respondents windstorms (3,07), floods (3,42) and droughts (3,48) have a moderate degree of damage. A low degree of damages have avalanches (4,38) and torrential floods (4,39) (see figure 27).

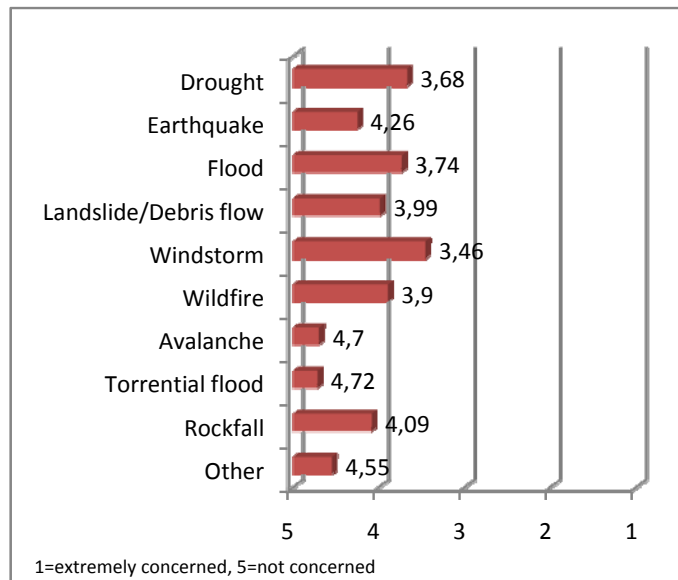


Figure 26: Degree of concern about natural hazards affecting the location

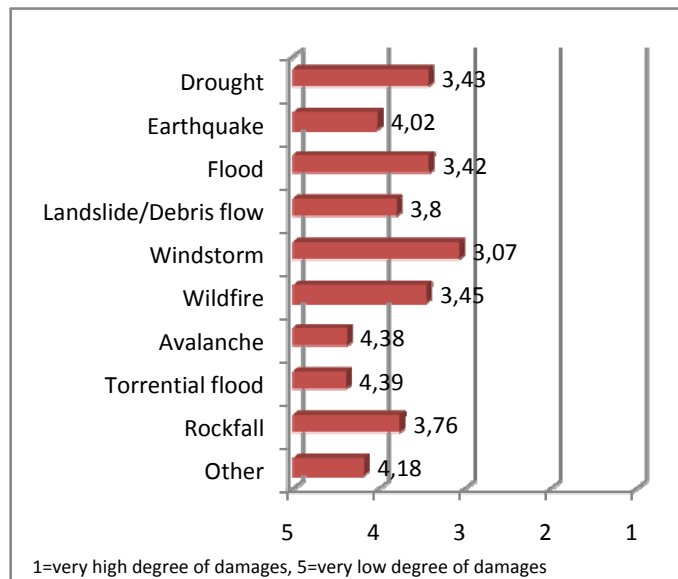


Figure 27: Degree of potential damages related to natural hazards

2.4. Perception of natural hazards

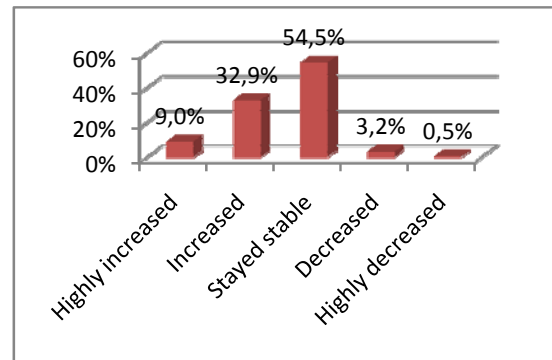
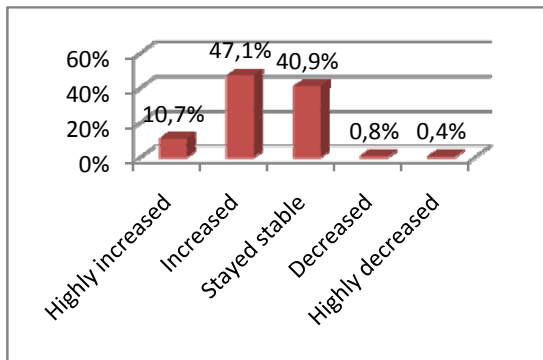


Figure 28: Development of awareness of natural hazards Figure 29: Development of natural risk

According to the respondents the natural risk stayed rather stable over the last ten years (figure 29). The awareness of natural hazards increased over the same time period (figure 28).

According to respondents the municipalities or local authorities (3,02), the population (3,21) and the energy providers (3,21) are affected by natural hazards. Also water suppliers (3,02) and managers of transport infrastructures (3,43) are affected by natural hazards. Somewhat affected are public institutions (3,6) and private businesses (3,57) (see figure 30).

The respondents are rather indifferent about the statements 'Natural hazards are seen as a major problem in the location', 'The potential of natural hazards is a disadvantage for the location' and 'Natural hazards impair the general attractiveness of the location' (see figure 31).

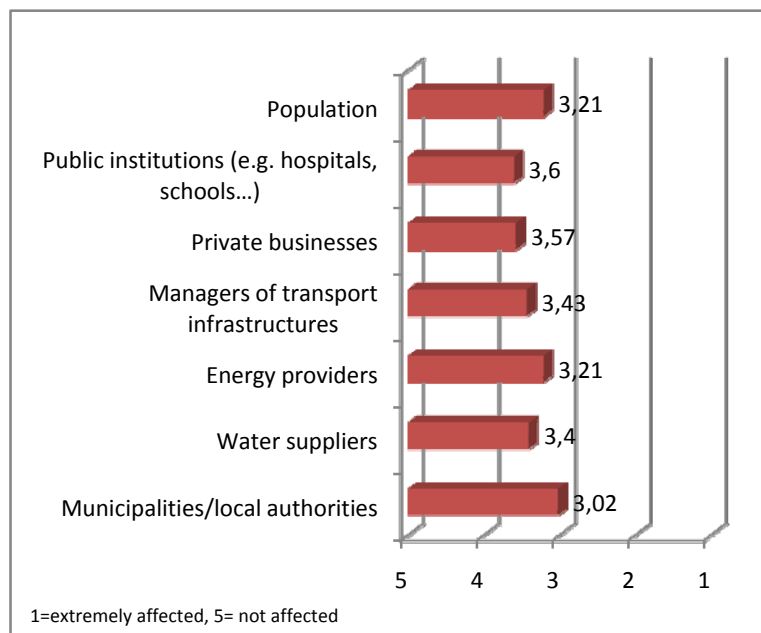


Figure 30: Groups affected by natural hazards

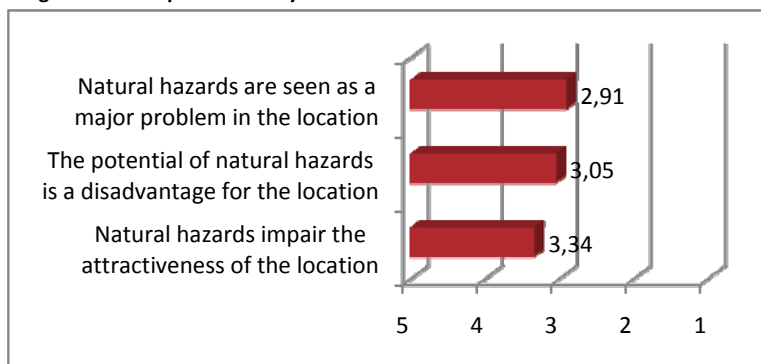


Figure 31: General perception of natural hazards

2.5. Impacts of natural hazards

To assess the impacts of natural hazards four different aspects were evaluated by the respondents: the impact on the regional economy, the impact on the quality of life of the local population, the ecological impact, as well as the impact on the decision behavior of the respondents. In all aspects the respondents were asked to rate the impact on a 5-point Likert scale from 1, meaning very strong impact to 5, meaning no impact.

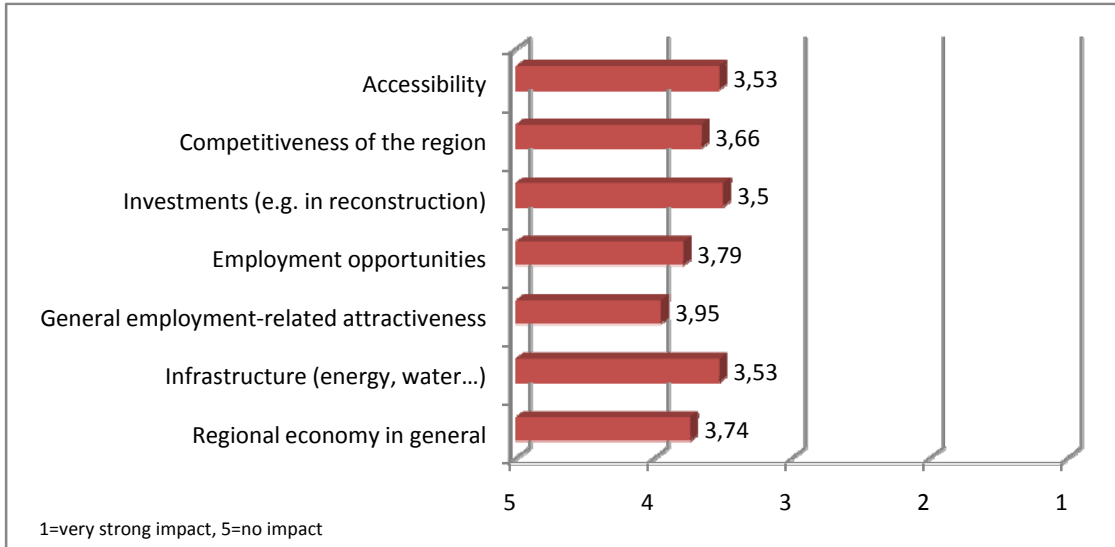


Figure 32: Impacts on the regional economy

In general the impact of natural hazards on the regional economy is rather low. The most important factors affected by natural hazards are the accessibility of a region (3,53) as and the infrastructure (3,53) (see figure 32).

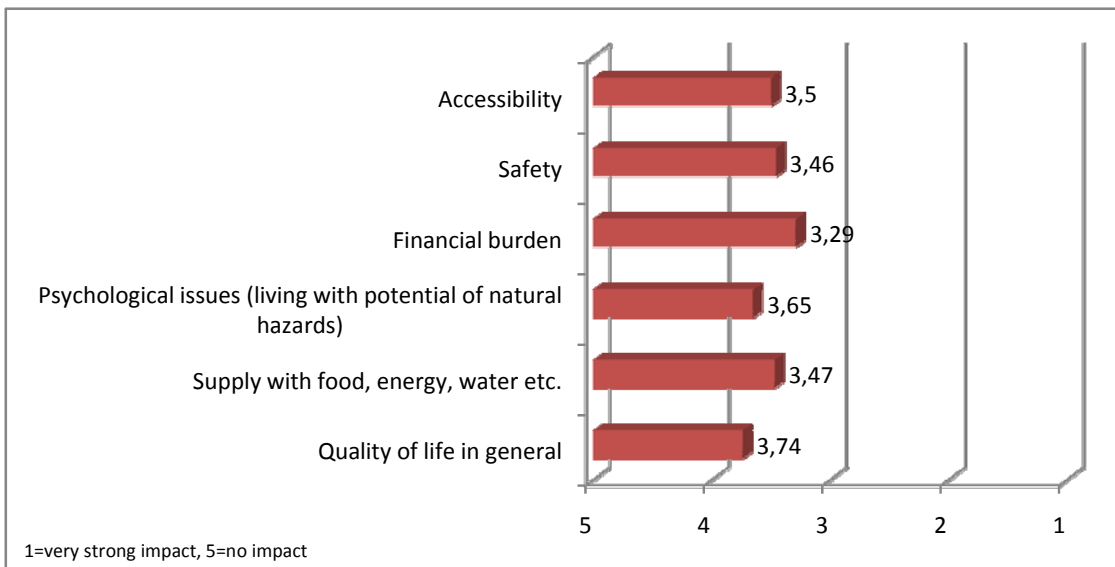


Figure 33: Impacts on the quality of life

The impact of natural hazards on the quality of life of the local population is rated moderately. According to the respondents natural hazards impact the financial burden (3,29), the supply with food, energy and water (3,47) and the safety (3,46) of the locals (see figure 33).

The impact on the environment is rated as moderate. Impacts are seen on forestry (3,15) and water cleanliness (3,42) (see figure 34).

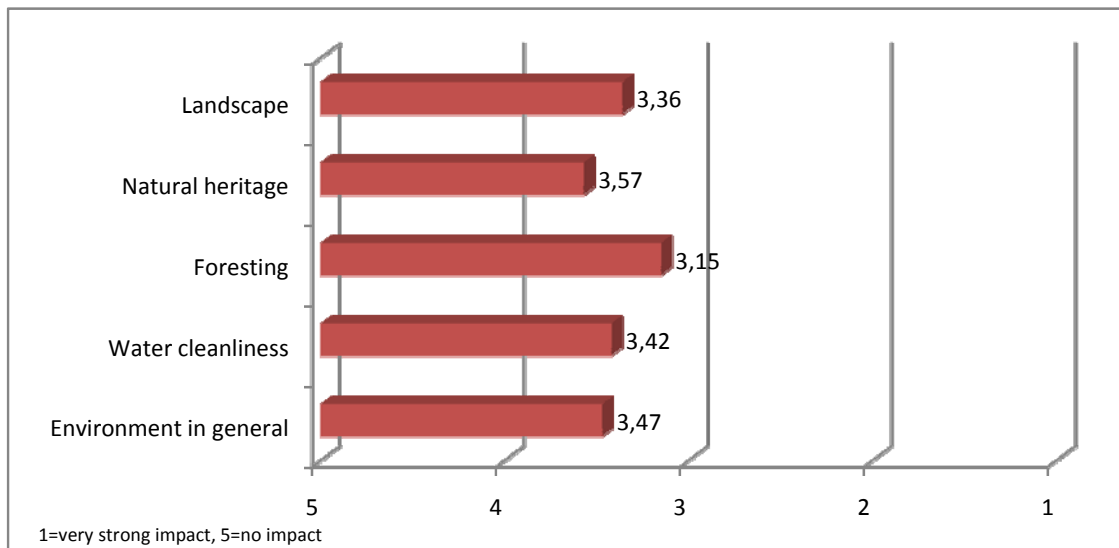


Figure 34: Ecological impacts

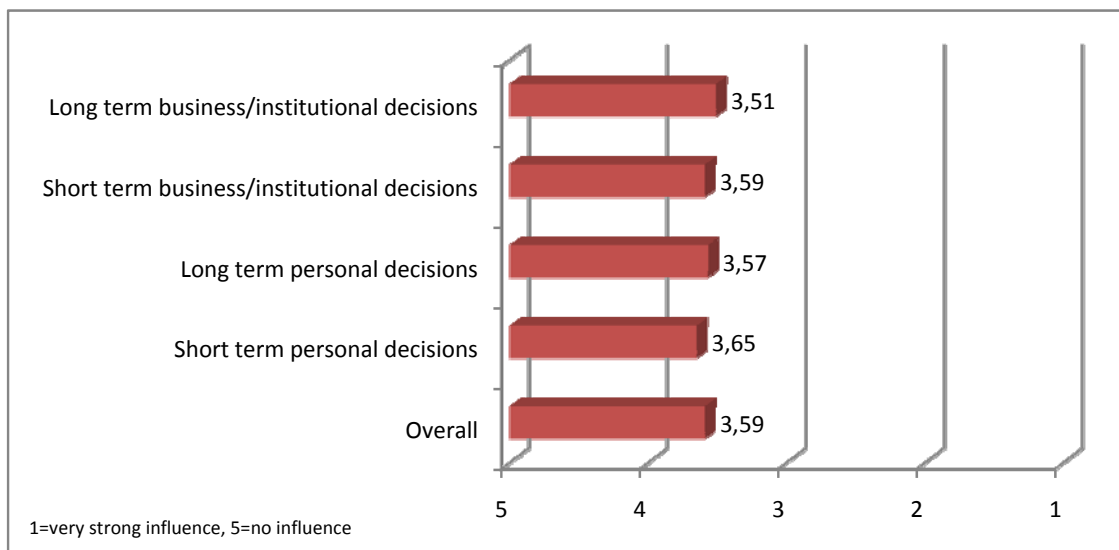


Figure 35: Impact of past experiences on the general decision behavior

Past experiences with natural hazards have a moderate impact on the general decision behavior of the respondents. The influence on business or institutional decision is higher than the influence on personal decisions, concerning both long term and short term decisions (see figure 35).

2.6. Information about natural hazards

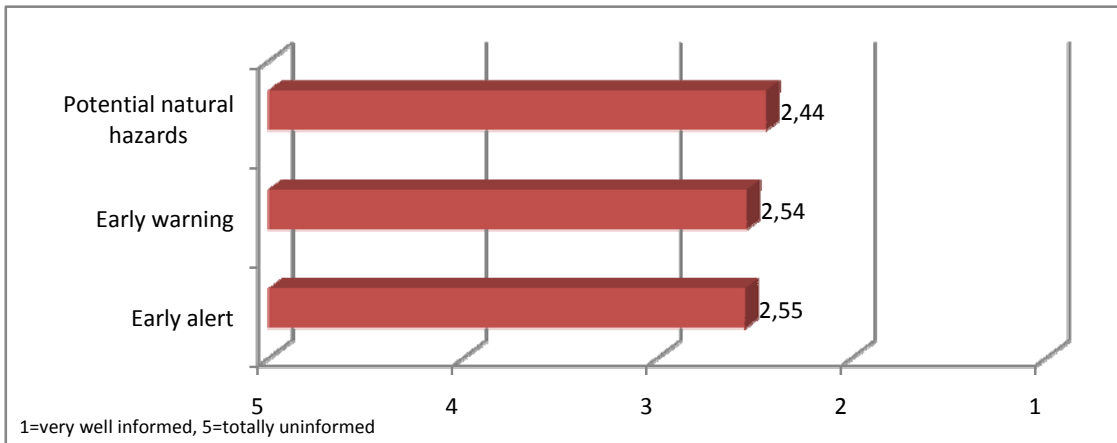


Figure 36: Information level of respondents regarding...

The respondents are well informed about potential natural hazards, early warning and early alert (see figure 36). Nevertheless they would need more or better information by the municipal police, the state, the prefecture, as well as by the local and national weather service.

In overall 43% of the respondents have information systems about natural hazards. The most important information source is the local government (68,6%) and the national government (42,3%). Private institutions or enterprises are not seen as important information sources (see figure 37).

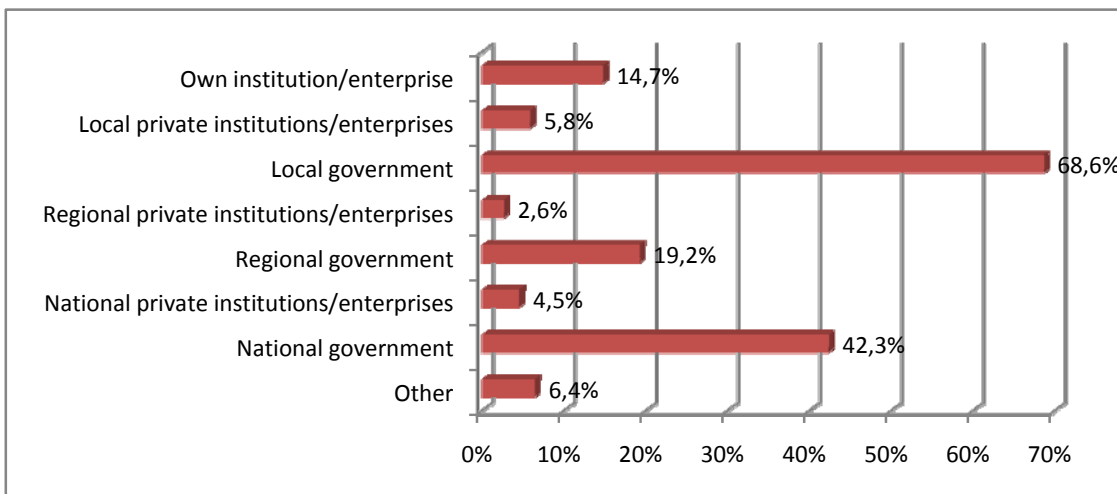


Figure 37: Information sources (more answers possible)

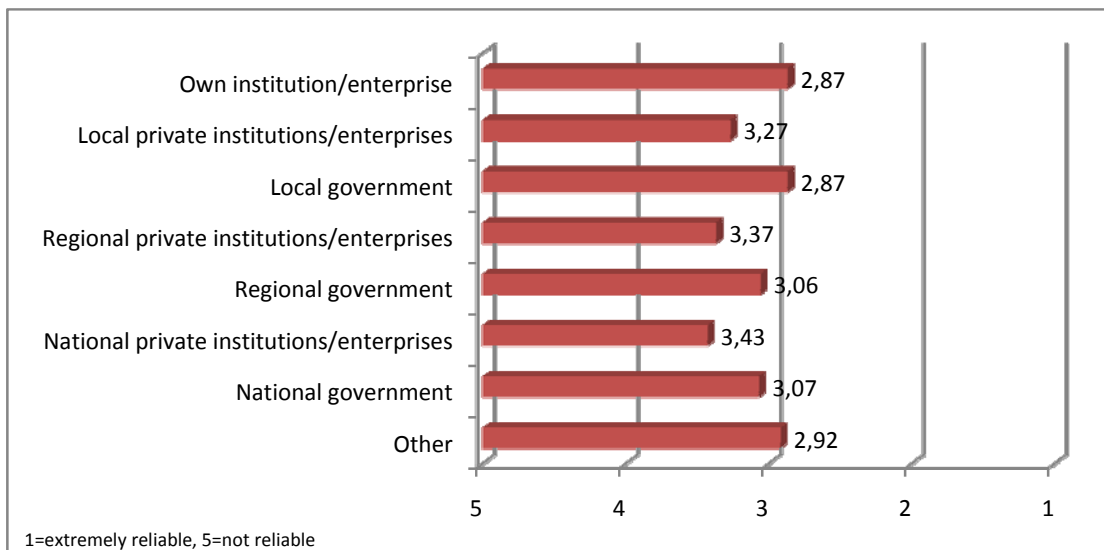


Figure 38: Reliability of information sources

The reliability of information sources in general is rated as rather moderate. Information from the own institution (2,87), the local government (2,87) are rated as very reliable (see figure 38).

As indicated in figure 39 information uncertainty has influence on decisions. Therefore the reliability of information is of high importance.

Better telecommunication (2,31), more accurate warnings (2,47) and greater availability of data (2,47) are seen as rather important factors to improve the warning services (see figure 40).

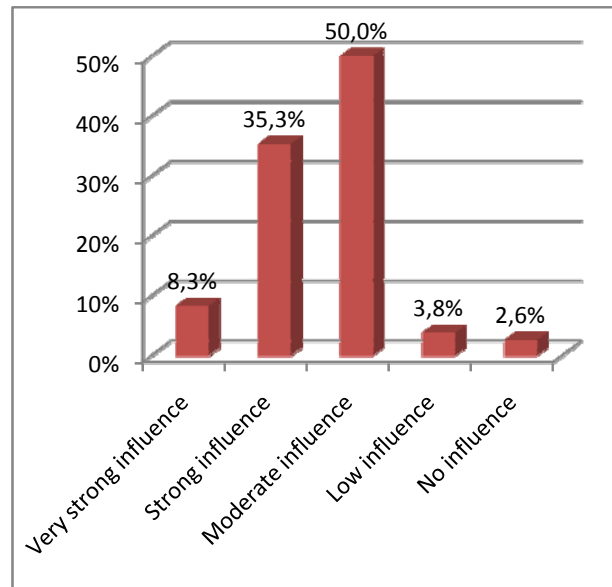


Figure 39: Influence of information uncertainty on decisions

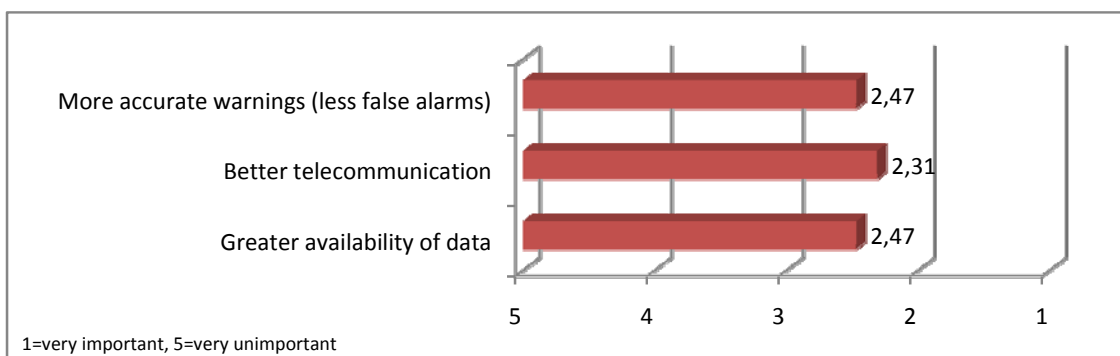


Figure 40: Factors to improve the warning system

2.7. Mitigation of natural hazards

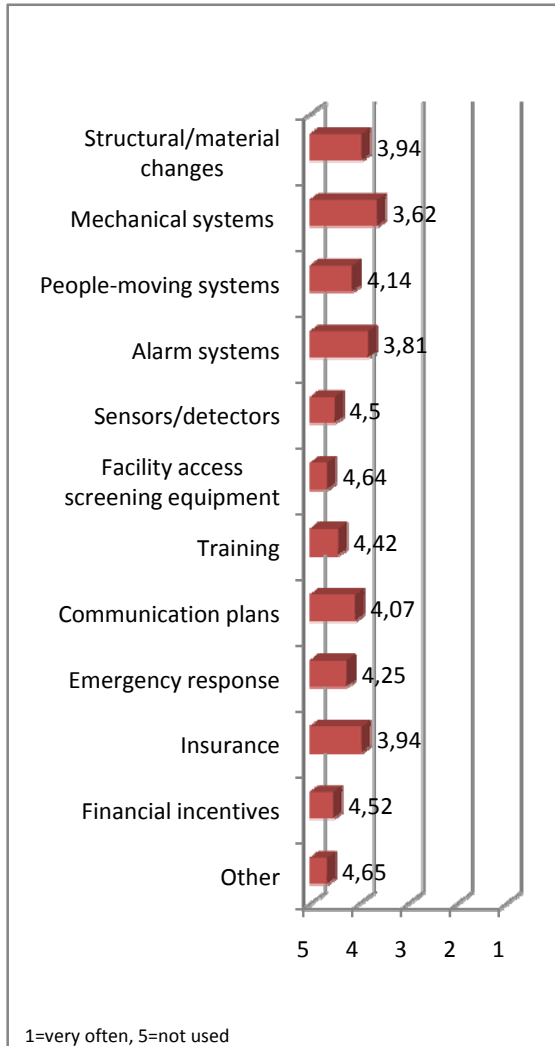


Figure 41: Usage of mitigation strategies

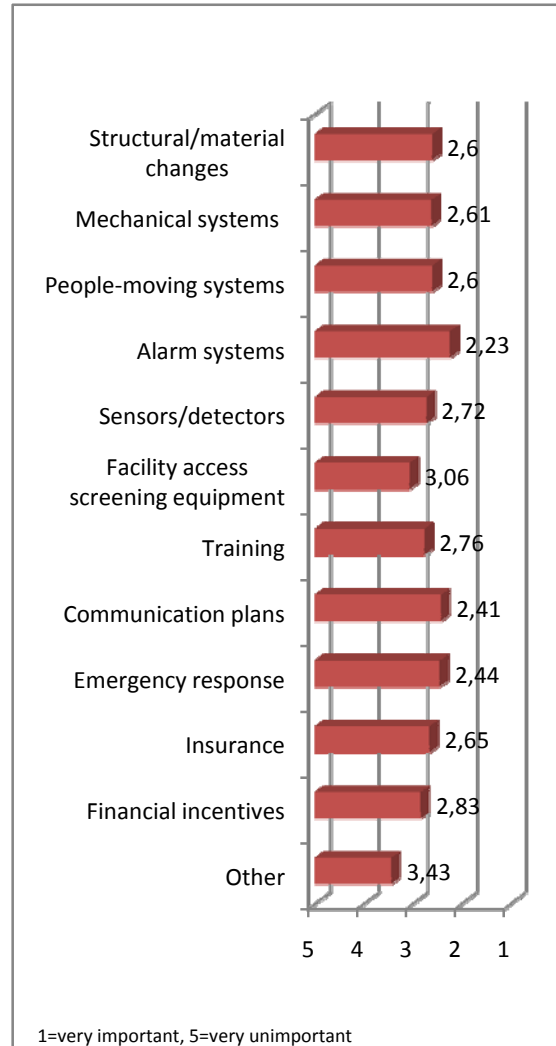


Figure 42: Importance of mitigation strategies

In general the respondents feel prepared to mitigate natural hazards. To assess the usage of certain mitigation strategies the respondents were asked to rate their usage on a scale from 1, meaning used very often to 5, meaning not used in the location.

In general it can be stated that the degree of usage of mitigation strategies is low. The respondents indicate that they primarily use mechanical systems (3,62) to mitigate natural hazards. Financial incentives (4,52), facility access screening equipment (4,64), sensors and detectors (4,5) and trainings (4,42) are used rather rarely (see figure 41).

Rating the mitigation strategies according to their importance for the respondents, alarm systems (2,23), communication plans (2,41) as well as emergency response (2,44) are seen as important (see figure 42).

| | |
|----------------|-------------------------------------|
| Rank 1 | Communication plans |
| | Alarm systems |
| | Emergency response |
| | Mechanical systems |
| | People-moving systems |
| | Insurance |
| | Training |
| | Structural/material changes |
| | Sensors/detectors |
| | Financial incentives |
| | Other |
| Rank 12 | Facility access screening equipment |

The respondents were asked to rate the mitigation strategies according to their feasibility from 1, indicating the most feasible strategy to 5, indicating the least feasible strategy.

The most feasible mitigation strategies are communication plans, alarm systems and emergency response. Least feasible are facility access screening equipment and financial incentives (see table 6).

Table 6: Feasibility of mitigation strategies

| | Own organization | Local level | Regional level |
|--------------------------------------|------------------|-------------|----------------|
| Hazard mapping tools | 7,9% | 39,6% | 21,8% |
| Early warning systems | 4% | 27,7% | 22,8% |
| Early alert systems | 5% | 19,8% | 24,8% |
| Decision support systems | 2% | 15,8% | 10,9% |
| Risk dialogue groups | 3% | 13,9% | 9,9% |
| Action plans | 0% | 7,9% | 22,8% |
| Training for hazard scenarios | 1% | 13,9% | 6,9% |

Table 7: Level at which risk management tools are used

Analyzing the usage of risk management tools at different levels it can be stated that in the own organization only few respondents have implemented risk management tools. On the local level mainly hazard mapping tools and early warning systems are used. On the regional level 24,8% of respondents indicate that early alert systems are used. 22,8% indicated that on regional level also early warning systems and action plans are in place (see table 7).

3. Italy

3.1. General information

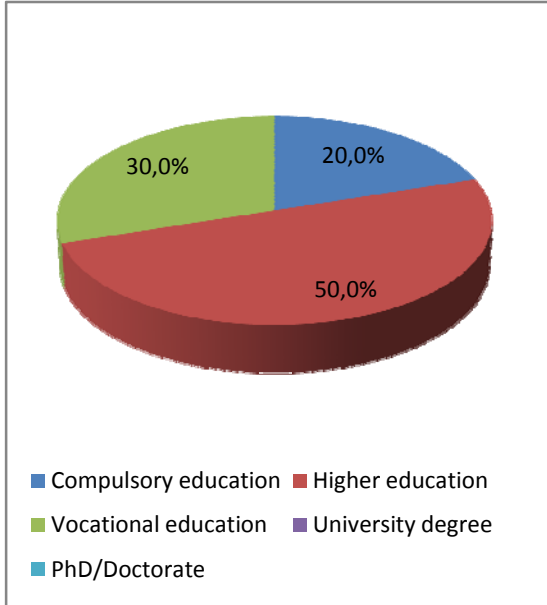


Figure 43: Highest education of the respondents

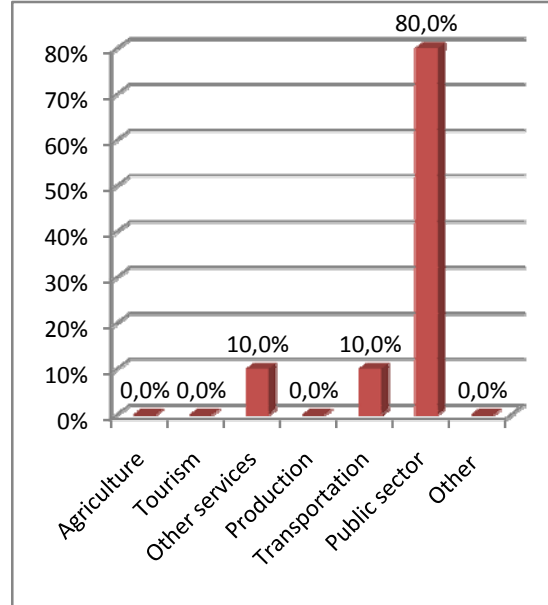


Figure 44: Sector, in which the respondents operate

In Italy 22 stakeholders participated in the online-survey.

Regarding the highest education 50% indicate to have higher education, 30% have vocational education and 20% have a compulsory education (see figure 43).

Most of respondents (80%) indicate to operate in the public sector. 10% operate in transportation and 10% indicated other services (see figure 44).

3.2. Personal experience

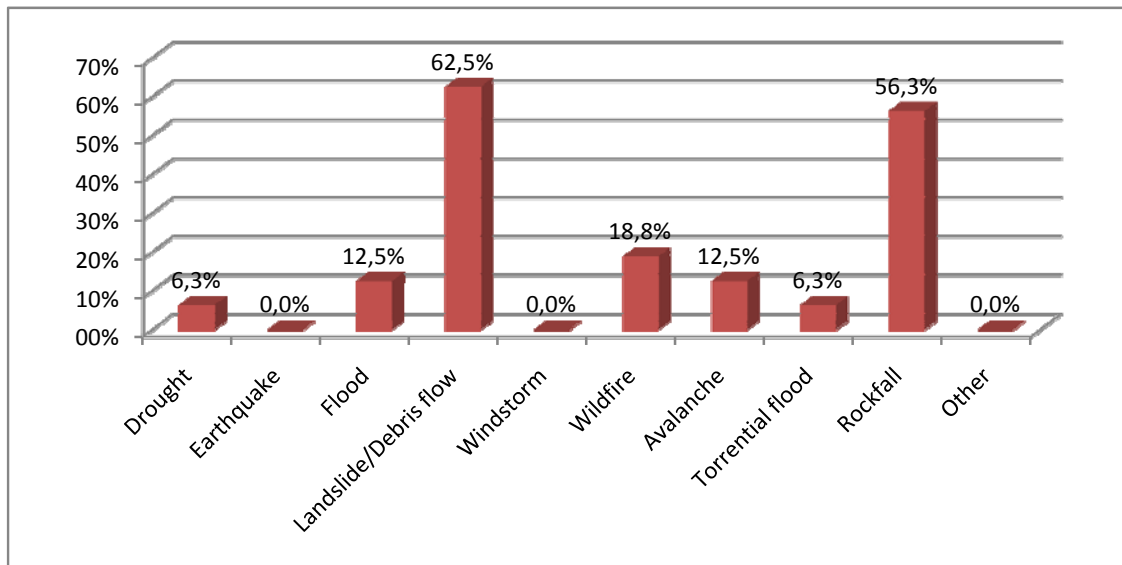


Figure 45: Type of natural hazards experienced (more answers possible)

89,5% of the respondents indicate that their institution or enterprise experienced a natural hazard in the past 5 years. In average they experienced two natural hazards over the indicated time.

62,5% experienced landslides or debris flows. 56,3% indicate that they were affected by rockfalls. The respondents have only little experience with wildfire (18,8%), avalanches (12,5%), floods (12,5%) and droughts or torrential floods (6,3%) (see figure 45).

90% of the natural hazards over the last 5 years caused damages. 60% of the damages were primary or direct damages. 30% of the damages caused both primary and secondary damages (see figure 46).

In average these damages are estimated to a cost of Euro 273.650 per damage (minimum value: 0 €; maximum value: 5 Mio.).

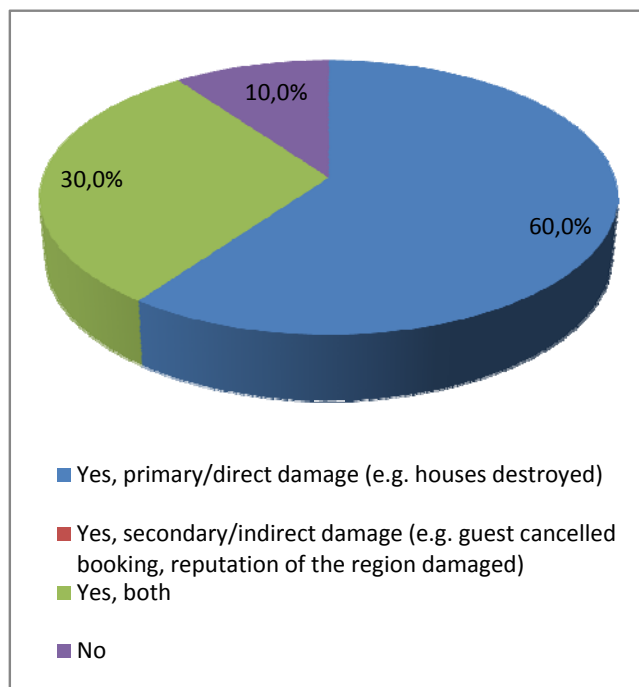


Figure 46: Damages caused by these natural hazards

3.3. Problem perspectives

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents are concerned about rockfalls (2,73) and landslides or debris flows (2,8). The respondents are not concerned about earthquakes (4,57), avalanche (4,2) or drought (4,29). In general the degree of concern is rather low (see figure 47).

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According to the respondents floods (2,17), landslides or debris flows (2,2), as well as rockfalls (2,73) have a high degree of damage. A low degree of damages have earthquakes (4), avalanches (3,78) as well as windstorms (3,71) and wildfires (3,71) (see figure 48).

When confronting the results especially rockfalls and landslides or debris flows seem to have a high impact on the location, because the rating is high in terms of concern and vulnerability.

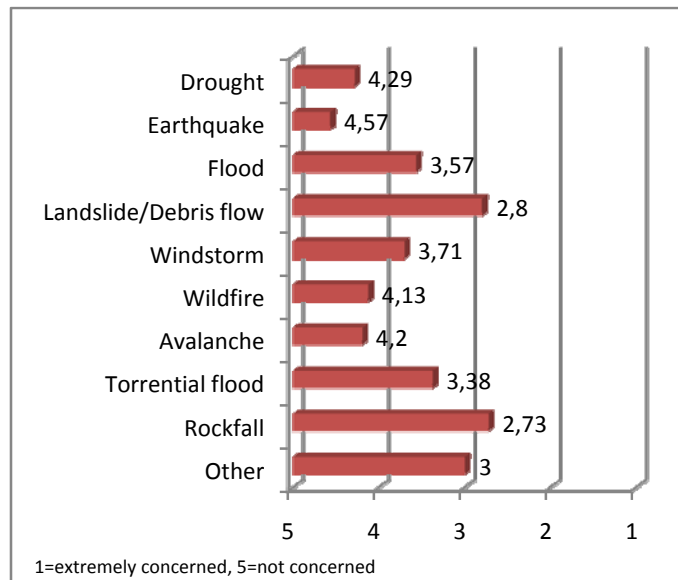


Figure 47: Degree of concern about natural hazards affecting the location

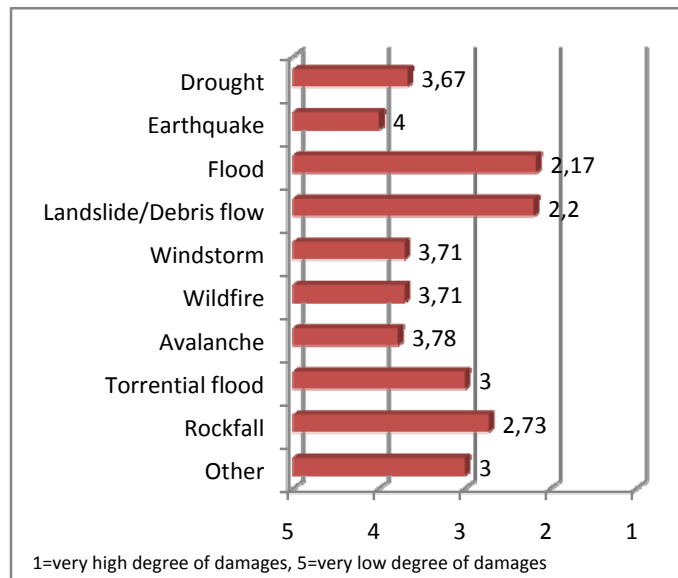


Figure 48: Degree of potential damages related to natural hazards

3.4. Perception of natural hazards

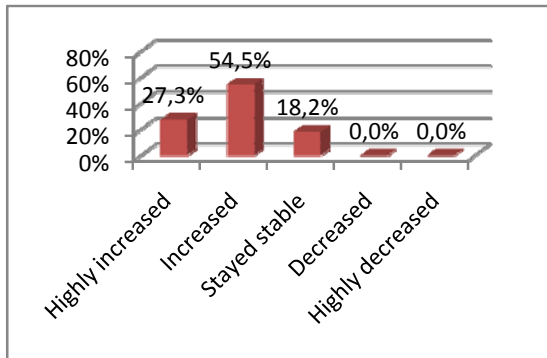


Figure 49: Development of awareness of natural hazards

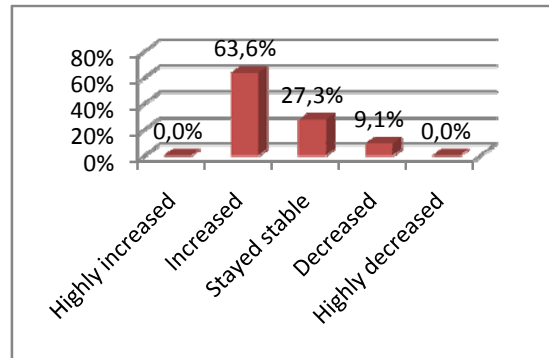


Figure 50: Development of natural risk

According to the respondents the natural risk increased over the last 10 years (figure 50). Also the awareness of natural hazards increased over the same time period (figure 49).

According to the respondents the municipalities or local authorities (2,5), the population (2,5) and the managers of transport infrastructure (2,78) are affected by natural hazards. Also private businesses (2,88) and energy providers (3) are affected by natural hazards. Water suppliers (3,38) and public institutions (3,11) are somewhat affected (see figure 51).

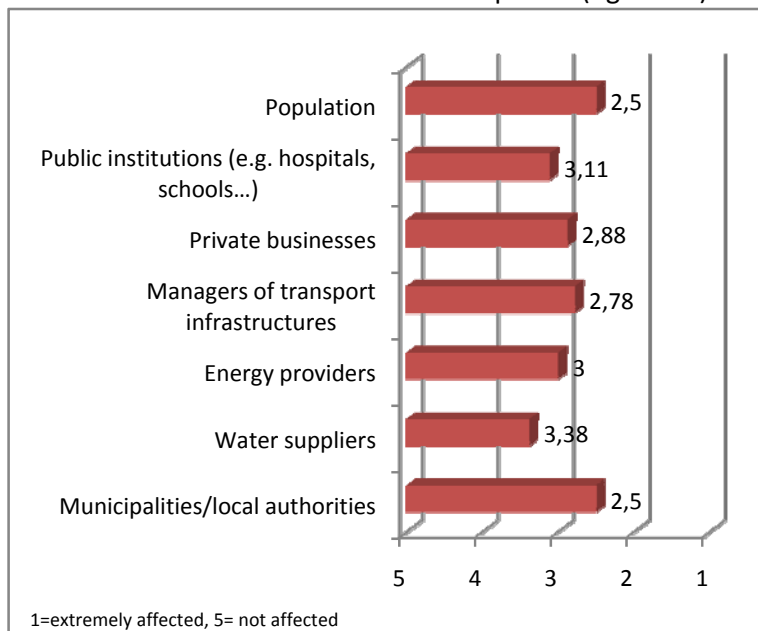


Figure 51: Groups affected by natural hazards

The respondents do rather agree with the statement 'Natural hazards are seen as a major problem in the location'. They are indifferent about the statement 'The potential of natural hazards is a disadvantage for the location' and 'Natural hazards impair the general attractiveness of the location' (see figure 52).

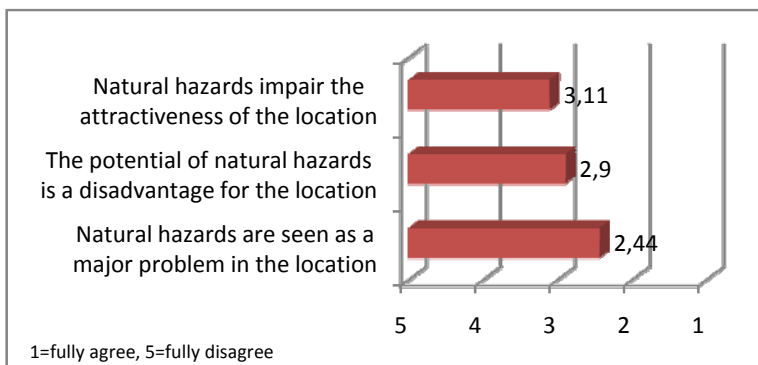


Figure 52: General perception of natural hazards

3.5. Impacts of natural hazards

To assess the impacts of natural hazards four different aspects were evaluated by the respondents: the impact on the regional economy, the impact on the quality of life of the local population, the ecological impact, as well as the impact on the decision behavior of the respondents. In all aspects the respondents were asked to rate the impact on a 5-point Likert scale from 1, meaning very strong impact to 5, meaning no impact.

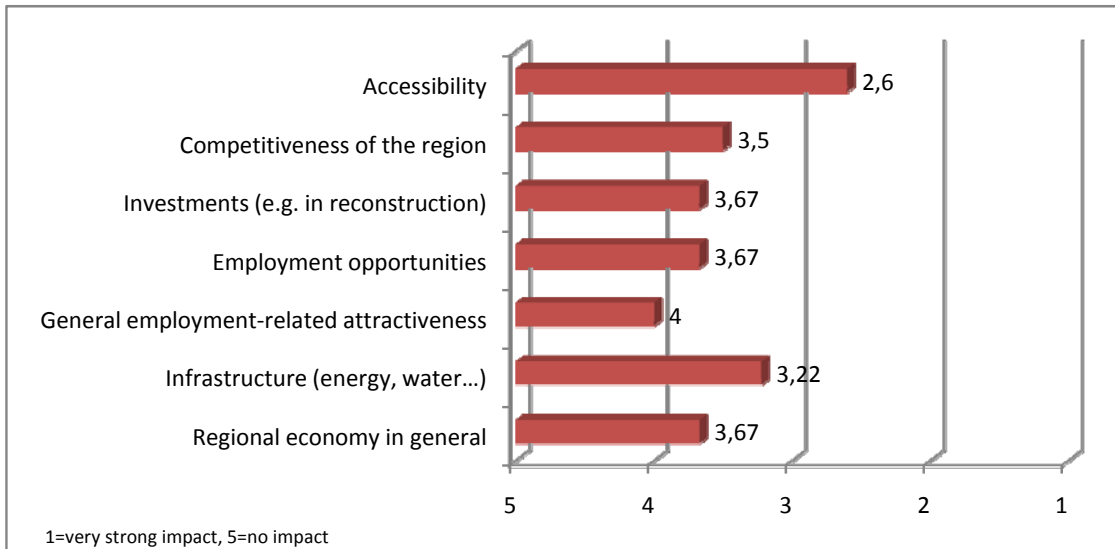


Figure 53: Impacts on the regional economy

In general the impact of natural hazards on the regional economy is valued rather medium. The most important aspects affected by natural hazards are the accessibility of a region (2,6) as well as the infrastructure (3,22) (see figure 53).

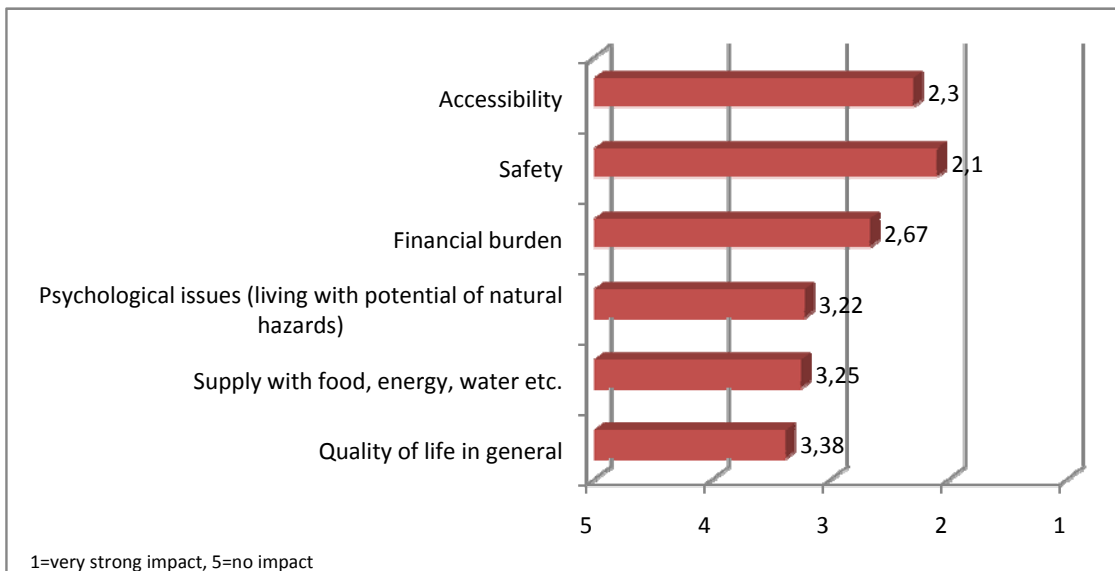


Figure 54: Impacts on the quality of life

Also the impact of natural hazards on the quality of life of the local population is rated moderately. According to the respondents natural hazards impact the safety (2,1), the accessibility (2,3) and are seen as a financial burden (2,67) (see figure 54).

The impact on the environment is rated as moderate. Impacts are seen on landscape (2,3), natural heritage (2,4) and foresting (2,5) (see figure 55).

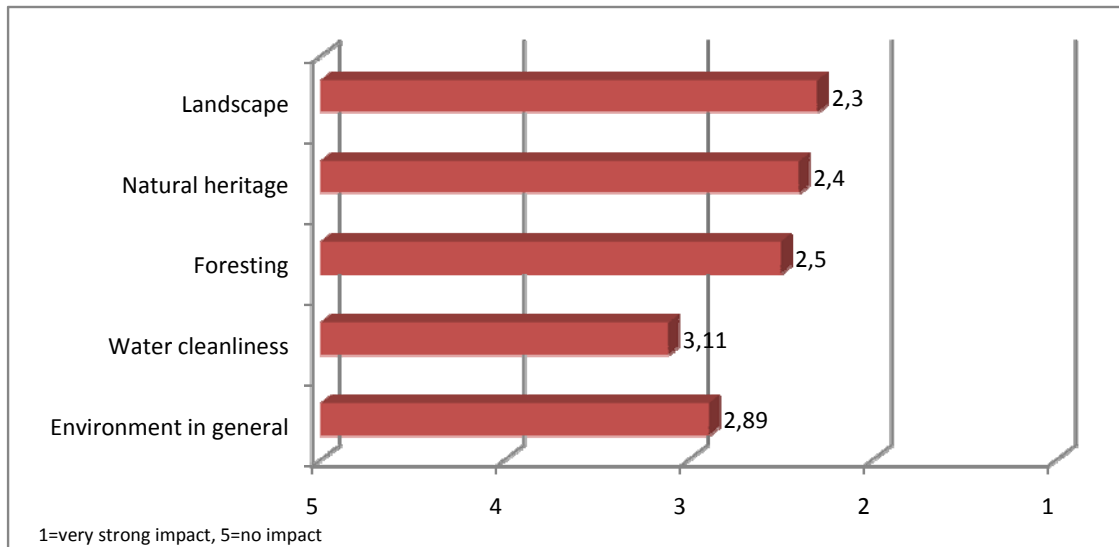


Figure 55: Ecological impacts

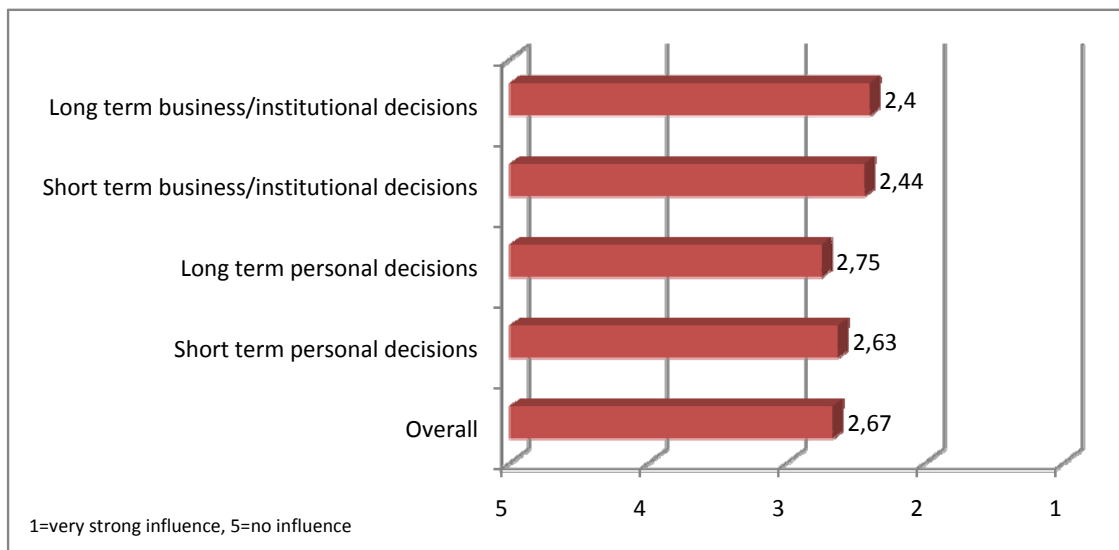


Figure 56: Impact of past experiences on the general decision behavior

Past experiences with natural hazards have impact on the general decision behavior of the respondents (see figure 56).

3.6. Information about natural hazards

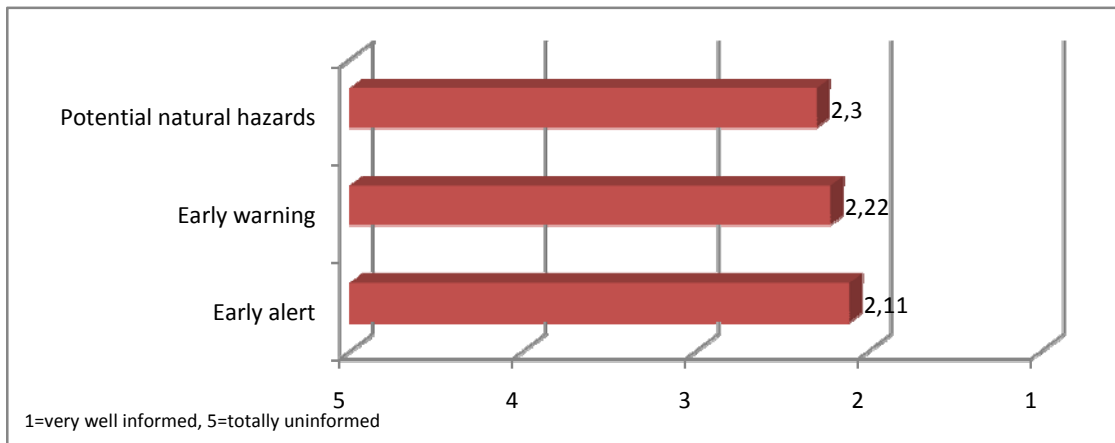


Figure 57: Information level of respondents regarding...

The respondents are well informed about potential natural hazards, early warning and early alert (see figure 57). Nevertheless they would need more or better information by the center for civil protection and scientific institutions.

In overall 80% of the respondents receive information on natural hazards. The most important information source is the own institution or enterprise (50%), the local government (40%) and the regional government (30%). Other information sources are local private institutions or enterprises (10%) and other organizations (10%) (see figure 58).

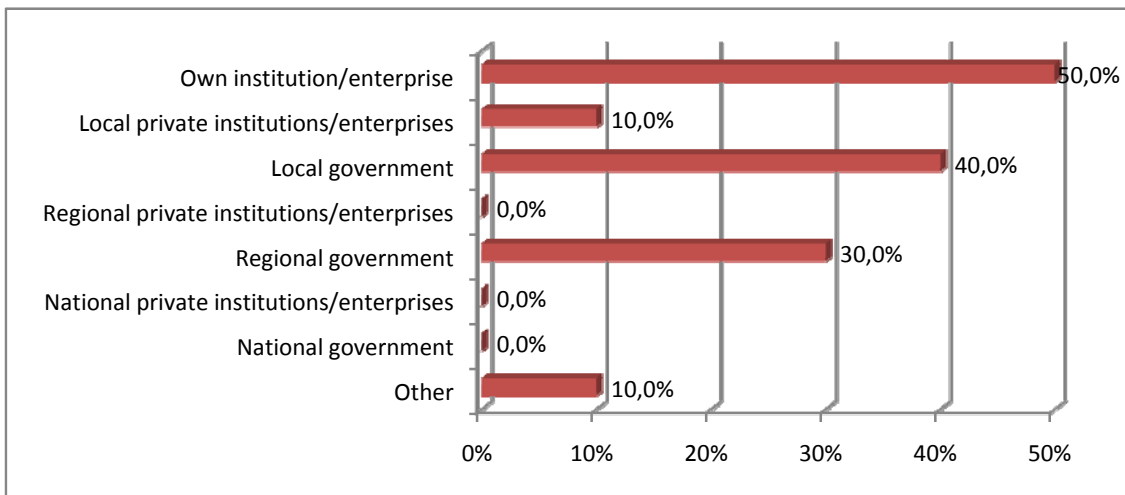


Figure 58: Information sources (more answers possible)

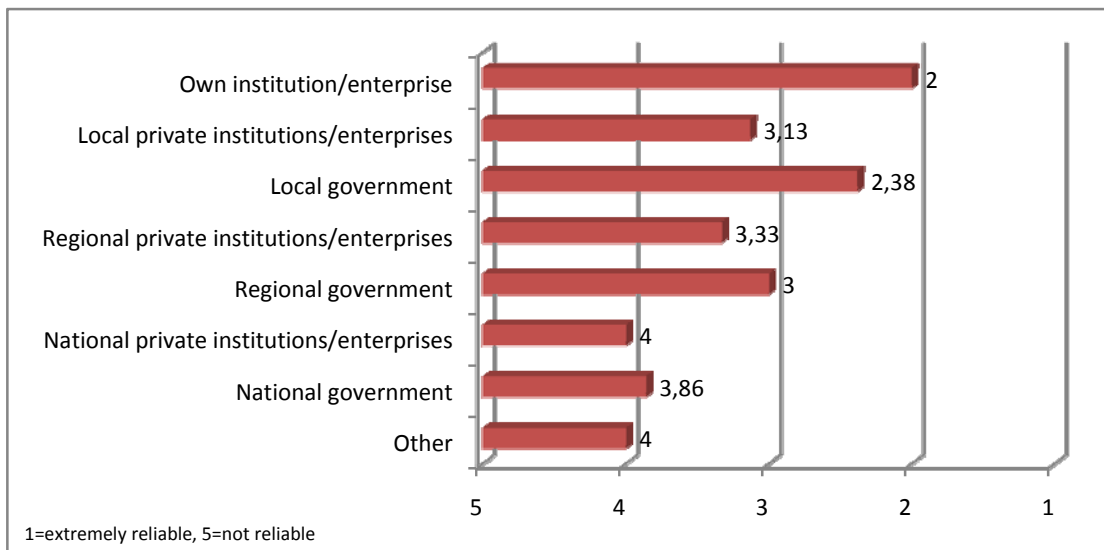


Figure 59: Reliability of information sources

The reliability of information sources in general is rated rather high. Information from the own institution (2), the local government (2,38), regional government (3) and local private institutions or enterprises (3,13) are rated as very reliable (see figure 59).

As indicated in figure 60 information uncertainty has influence on decisions. Therefore the reliability of information is of high importance.

Better telecommunication (2), more accurate warnings (2,11) and greater availability of data (2,1) are seen as important factors to improve the warning services (see figure 61).

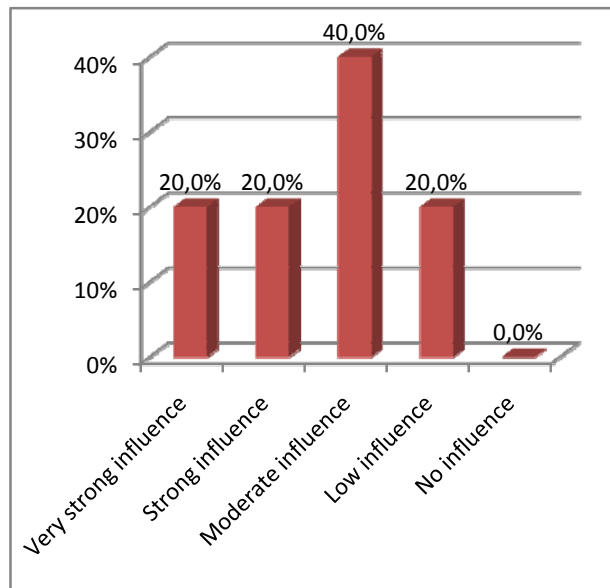


Figure 60: Influence of information uncertainty on decisions

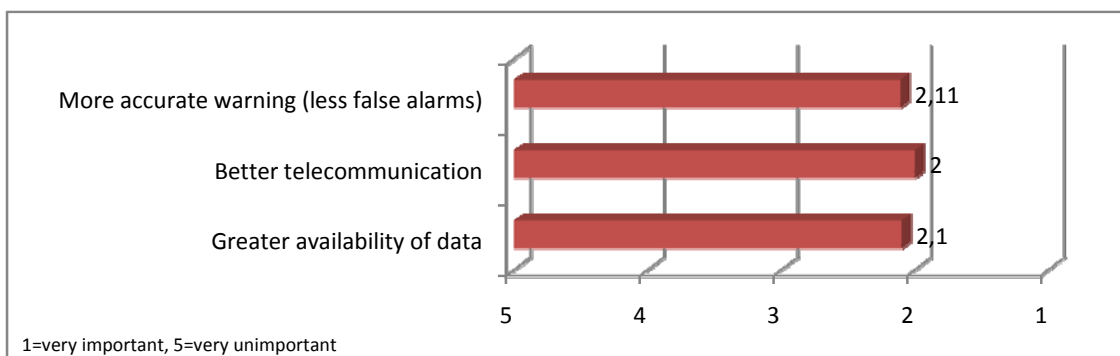


Figure 61: Factors to improve the warning system

3.7. Mitigation of natural hazards

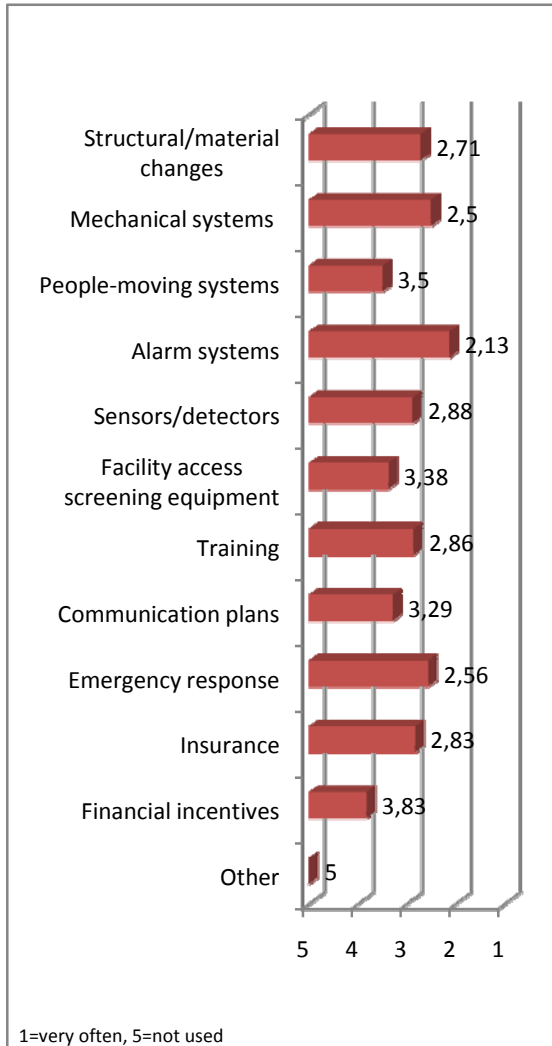


Figure 62: Usage of mitigation strategies

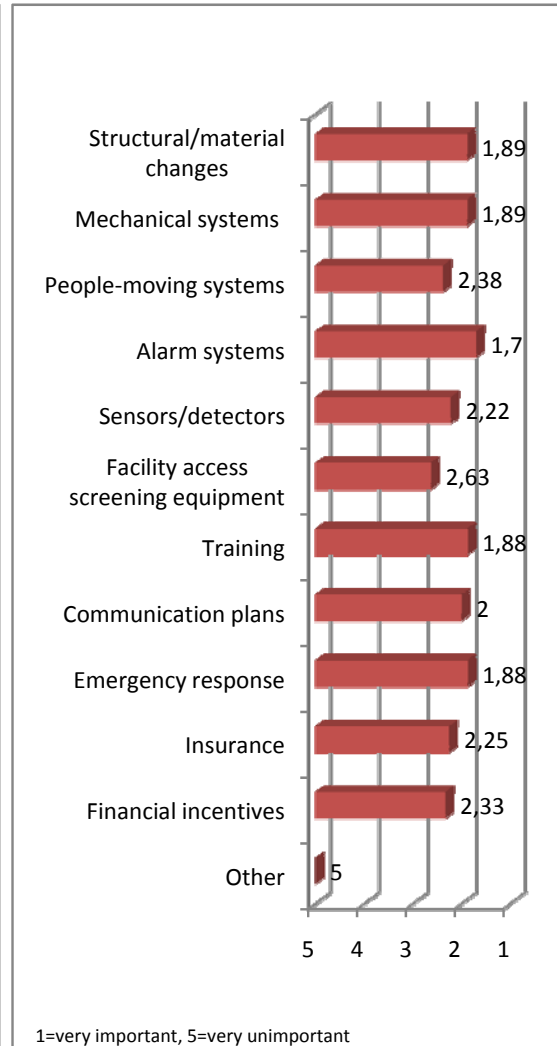


Figure 63: Importance of mitigation strategies

In general the respondents feel prepared to mitigate natural hazards. To assess the usage of certain mitigation strategies the respondents were asked to rate their usage on a scale from 1, meaning used very often to 5, meaning not used in the location.

In general it can be stated that the degree of usage of mitigation strategies is rather frequent. The respondents indicate that they primarily use alarm systems (2,13) to mitigate natural hazards. Also mechanical systems (2,5), emergency response (2,56) and structural or material changes (2,71) are used frequently (see figure 62).

Rating the mitigation strategies according to their importance for the respondents, training (1,88), emergency response (1,88), structural or material changes (1,89) and mechanical systems (1,89) are seen as very important (see figure 63).

| | |
|----------------|-------------------------------------|
| Rank 1 | Alarm systems |
| | Mechanical systems |
| | Communication plans |
| | Training |
| | Structural/material changes |
| | Sensors/detectors |
| | People-moving systems |
| | Emergency response |
| | Facility access screening equipment |
| | Insurance |
| | Financial incentives |
| Rank 12 | Other |

The respondents were asked to rate the mitigation strategies according to their feasibility from 1, indicating the most feasible strategy to 5, indicating the least feasible strategy.

The most feasible mitigation strategies are alarm systems and mechanical systems. Least feasible are financial incentives, insurances and facility access screening equipment (see table 8).

Table 8: Feasibility of mitigation strategies

| | Own organization | Local level | Regional level |
|--------------------------------------|------------------|-------------|----------------|
| Hazard mapping tools | 40% | 30% | 10% |
| Early warning systems | 40% | 30% | 10% |
| Early alert systems | 20% | 60% | 0% |
| Decision support systems | 20% | 40% | 30% |
| Risk dialogue groups | 20% | 30% | 20% |
| Action plans | 20% | 20% | 30% |
| Training for hazard scenarios | 10% | 40% | 10% |

Table 9: Level at which risk management tools are used

Analyzing the usage of risk management tools at different levels it can be stated that in the own organization 40% of the respondents have implemented hazard mapping tools and early warning systems. On the local level especially early alert systems, decision support systems and training for hazard scenarios are used. On the regional level 30% of respondents indicate that decision support systems and action plans are used. 20% indicate that also risk dialogue groups are in place (see table 9).

4. Slovenia

4.1. General information

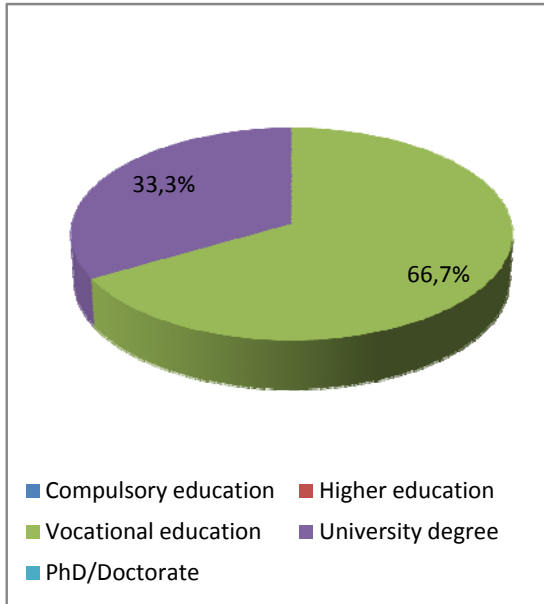


Figure 64: Highest education of the respondents

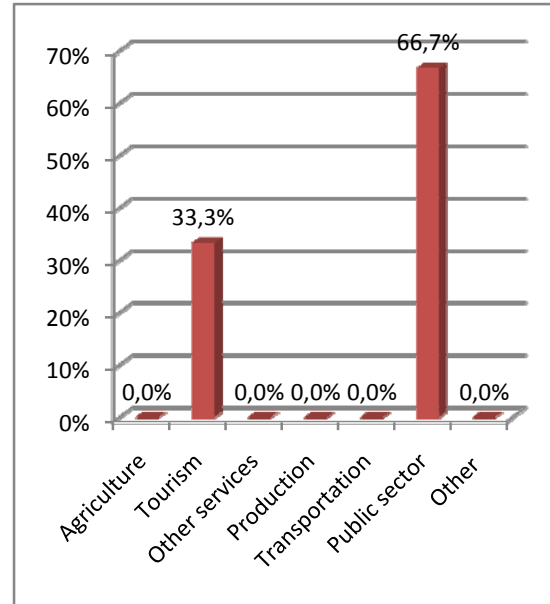


Figure 65: Sector, in which the respondents operate

In Slovenia 8 stakeholders participated in the online-survey.

Regarding the highest education 66,7% indicate to have vocational education and 33,3% have a university degree (see figure 64).

Most of respondents (66,7%) indicate to operate in the public sector. 33,3% operate in tourism (see figure 65).

4.2. Personal experience

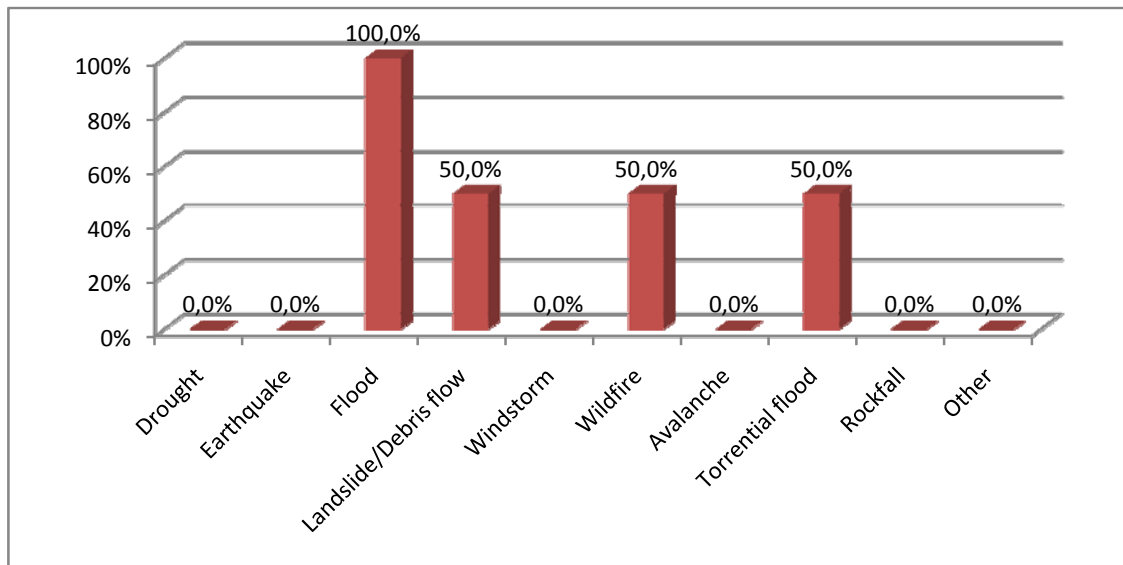


Figure 66: Type of natural hazards experienced (more answers possible)

50% of the respondents indicate that their institution or enterprise experienced a natural hazard in the past 5 years. In average they experienced 2,5 natural hazards over the indicated time.

All respondents experienced floods. 50% indicate that they were affected by landslides or debris flows, wildfire and torrential floods. The respondents have no experience with droughts, earthquakes, windstorms, avalanches and rockfalls (see figure 66).

All the natural hazards over the last 5 years caused damages. Half of damages were primary or direct damages. 50% of the damages caused both primary and secondary damages (see figure 67).

In average these damages are estimated to a cost of Euro 250.000 per damage (minimum value: 0 €; maximum value: 1 Mio.).

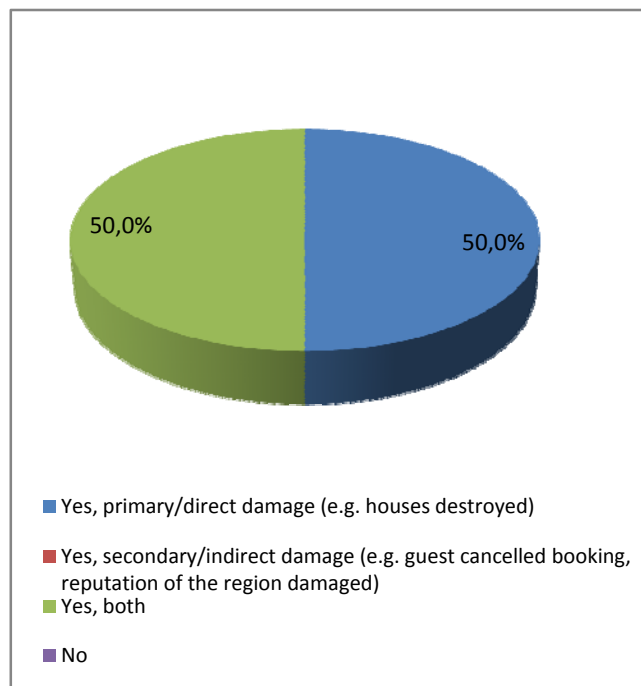


Figure 67: Damages caused by these natural hazards

4.3. Problem perspectives

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents are concerned about floods (2,67), earthquake (3), landslides or debris flows (3) and torrential floods (3). The respondents are less concerned about droughts (3,5) and windstorms (3,5). In general the degree of concern about natural hazards is medium to low (see figure 68).

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According the respondents torrential floods (1,5), earthquakes (2), floods (2) and landslides or debris flows (2) have a high degree of damage. A moderate degree of damage have droughts (3), windstorms (3), avalanches (3) and rockfalls (3) (see figure 69).

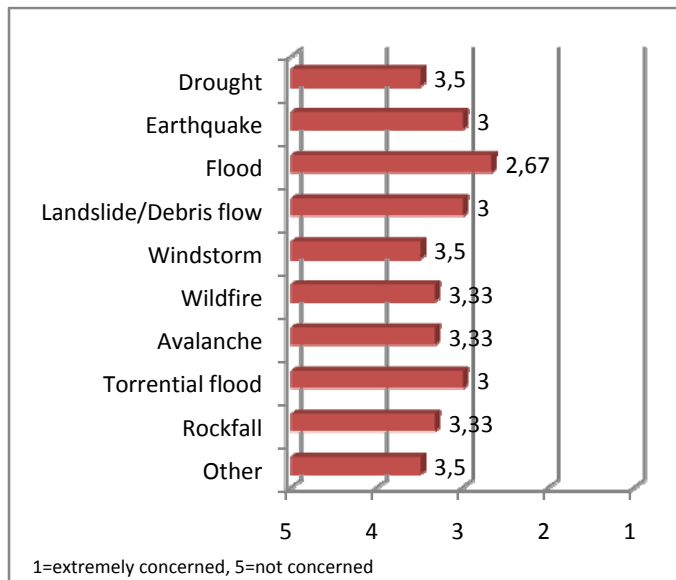


Figure 68: Degree of concern about natural hazards affecting the location

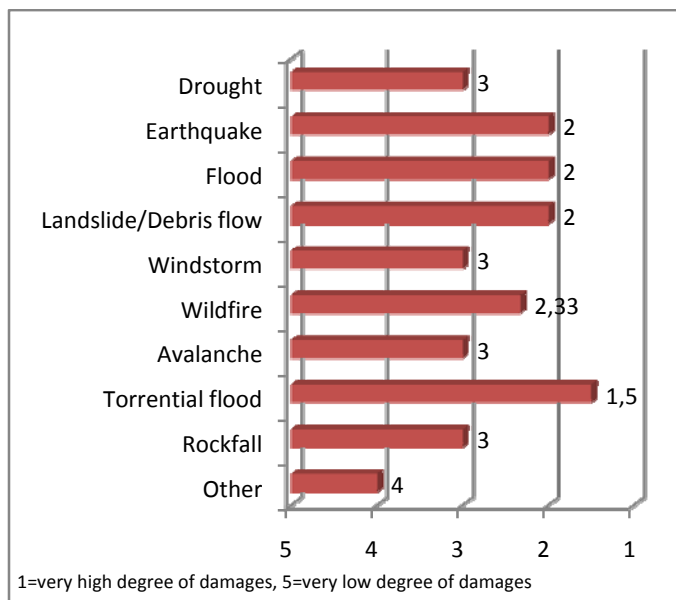


Figure 69: Degree of potential damages related to natural hazards

4.4. Perception of natural hazards

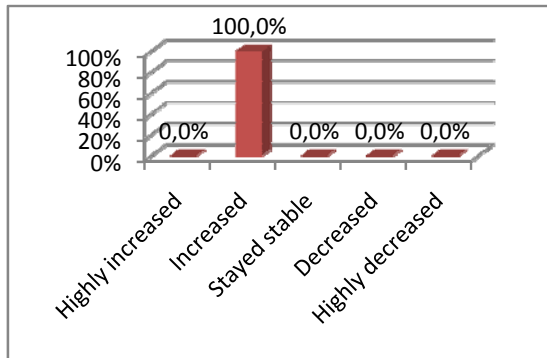


Figure 70: Development of awareness of natural hazards

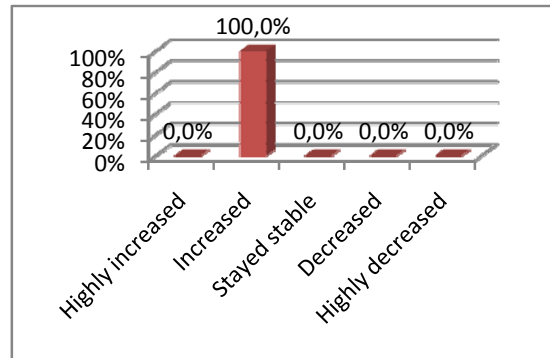


Figure 71: Development of natural risk

According to the respondents the natural risk increased over the last ten years (figure 71). Also the awareness of natural hazards increased over the same time period (figure 70).

According to the respondents the municipalities or local authorities (2) and water suppliers (2,5) are very affected by natural hazards. Also managers of transport infrastructures (2,67) and energy providers (2,67) are affected. The least affected are public institutions (3), private businesses (3) and the population (3) (see figure 72).

The respondents do agree with the statements 'Natural hazards are seen as a major problem in the location', 'The potential of natural hazards is a disadvantage for the location' and 'Natural hazards impair the general attractiveness of the location' (see figure 73).

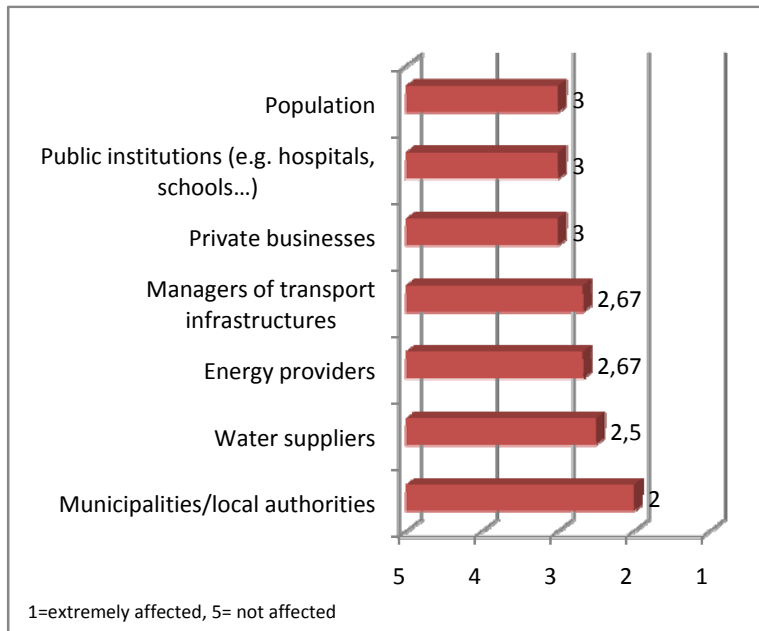


Figure 72: Groups affected by natural hazards

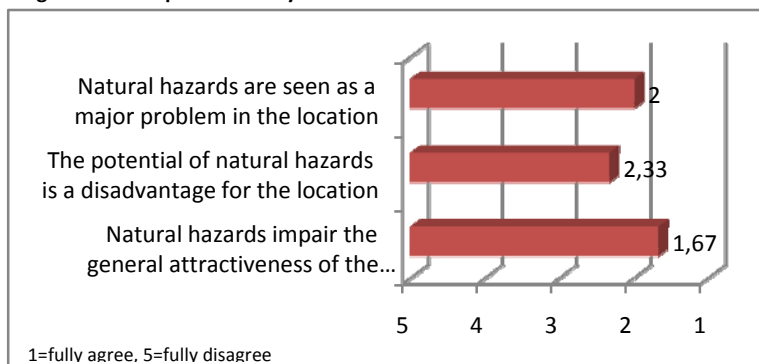


Figure 73: General perception of natural hazards

4.5. Impacts of natural hazards

To assess the impacts of natural hazards four different aspects were evaluated by the respondents: the impact on the regional economy, the impact on the quality of life of the local population, the ecological impact, as well as the impact on the decision behavior of the respondents. In all aspects the respondents were asked to rate the impact on a 5-point Likert scale from 1, meaning very strong impact to 5, meaning no impact.

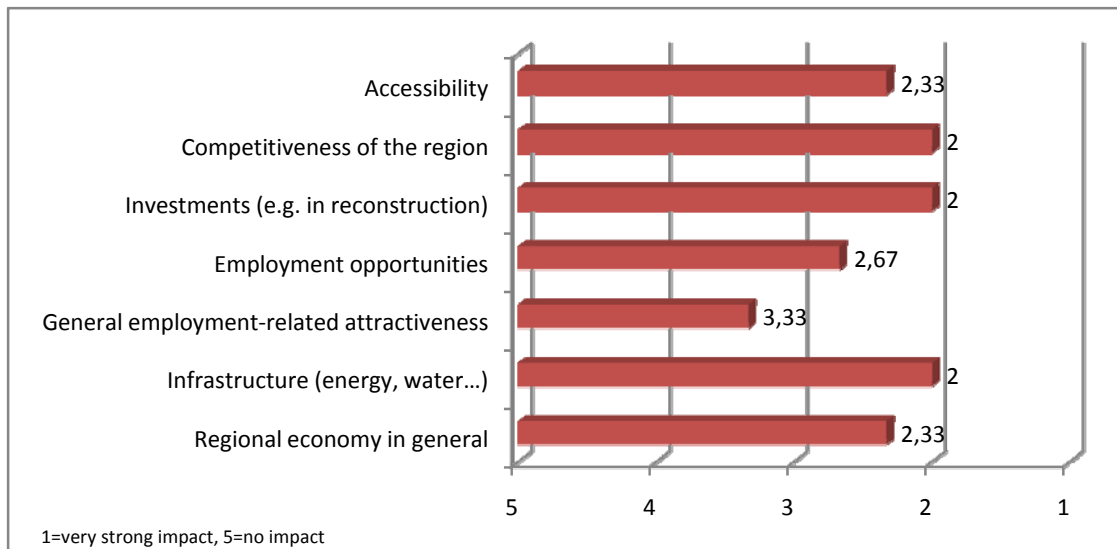


Figure 74: Impacts on the regional economy

In general the impact of natural hazards on the regional economy is evaluated as rather medium. The most important aspects affected by natural hazards are the competitiveness of the region (2), investments (2) and infrastructure (2) (see figure 74).

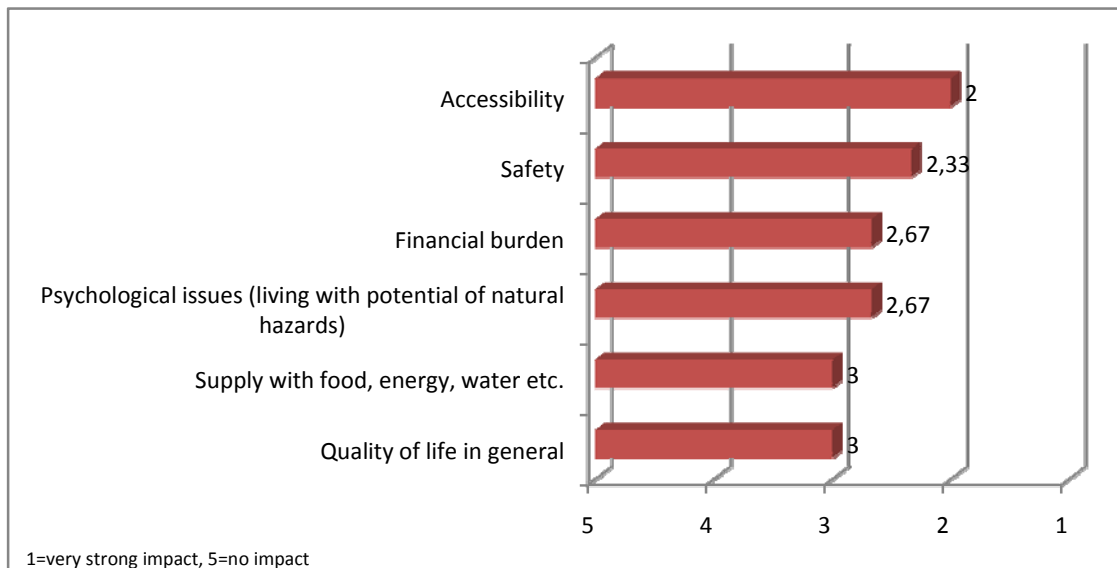


Figure 75: Impacts on the quality of life

Also the impact of natural hazards on the quality of life of the local population is rated moderately. According to the respondents natural hazards impact the accessibility(2) and the safety (2,33) of the locals (see figure 75).

The impact on the environment is rated as moderate. Impacts are seen on the water cleanliness (2,67) and the environment in general (2,33) (see figure 76).

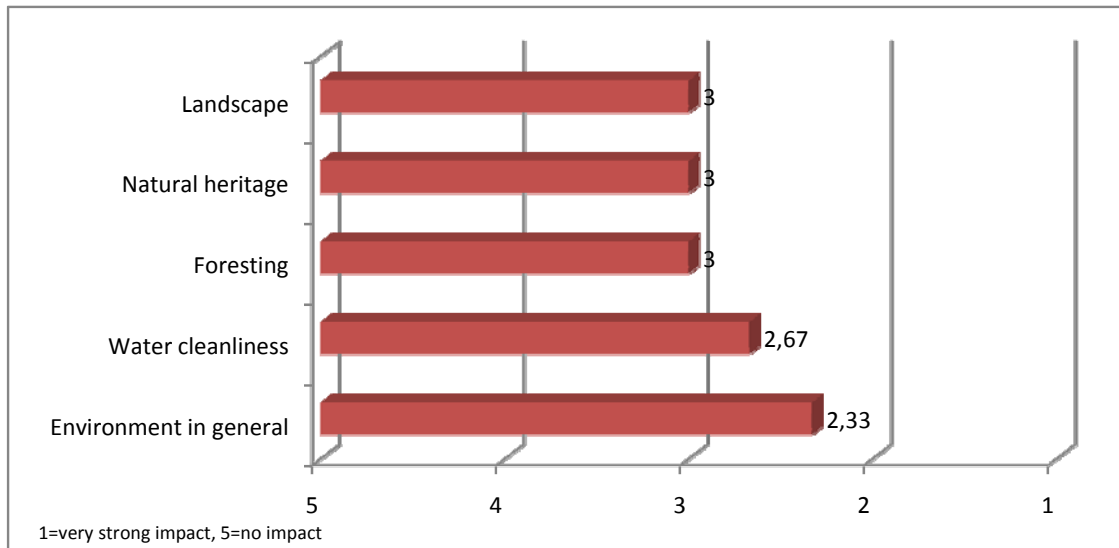


Figure 76: Ecological impacts

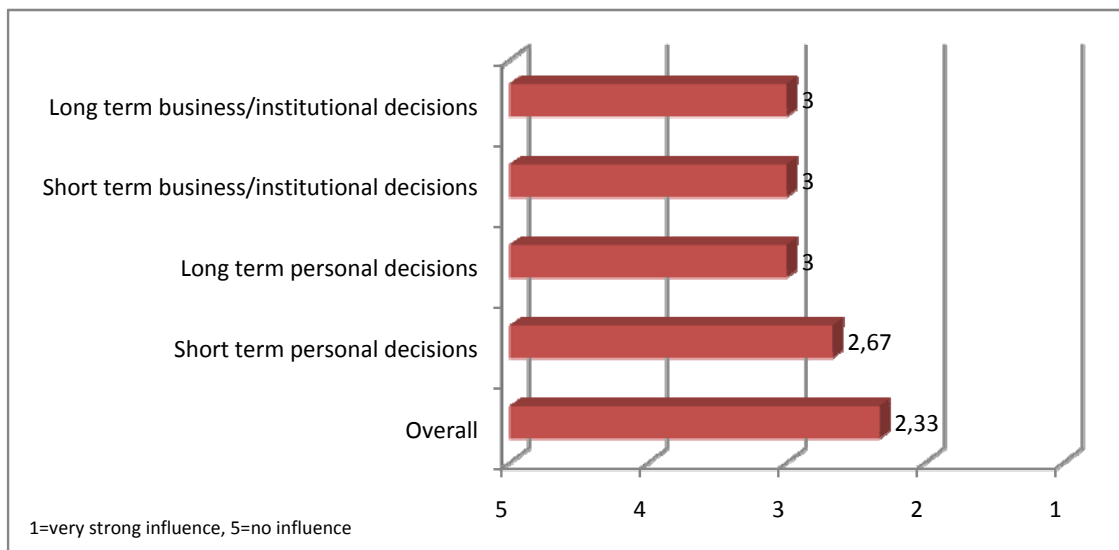


Figure 77: Impact of past experiences on the general decision behavior

Past experiences with natural hazards have some impact on the general decision behavior of the respondents. The influence on short term personal decision is slightly higher than the influence on business decisions or long term personal decisions (see figure 77).

4.6. Information about natural hazards

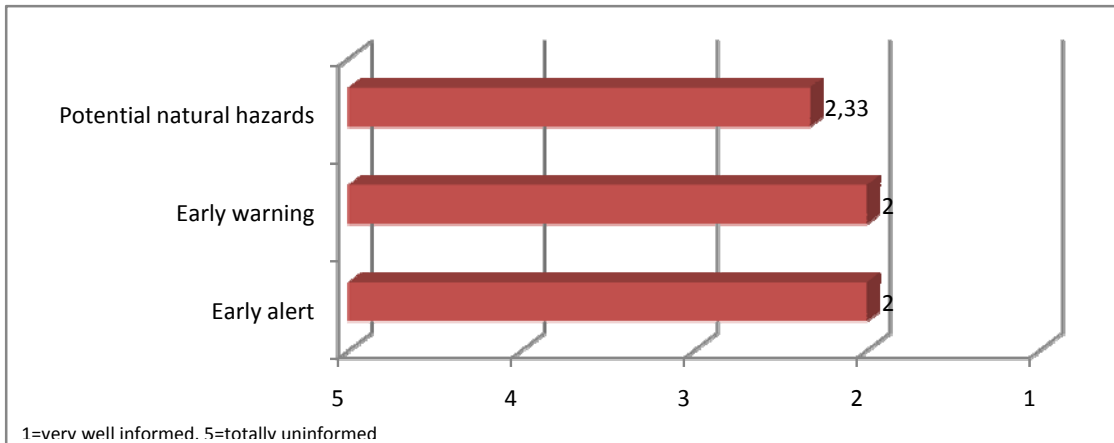


Figure 78: Information level of respondents regarding...

The respondents are well informed about potential natural hazards, early warning and early alert (see figure 78). Nevertheless they would need more or better information from the Office of Seismology.

In overall 66,7% of the respondents receive information on natural hazards. The most important information source is the own institution or enterprise (66,7%). Also local private institutions or enterprises, the local government, national private institutions or enterprises and the national government are information sources (see figure 79).

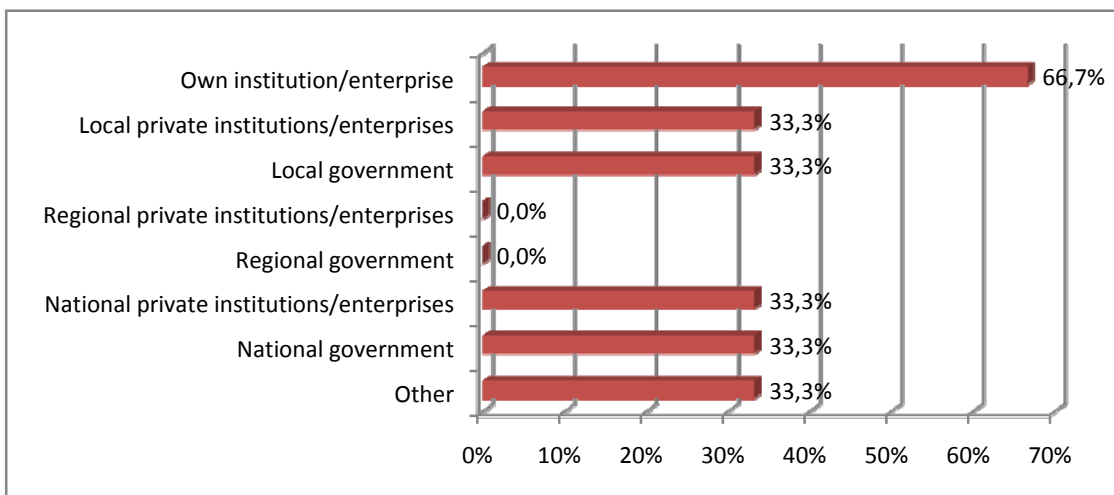


Figure 79: Information sources (more answers possible)

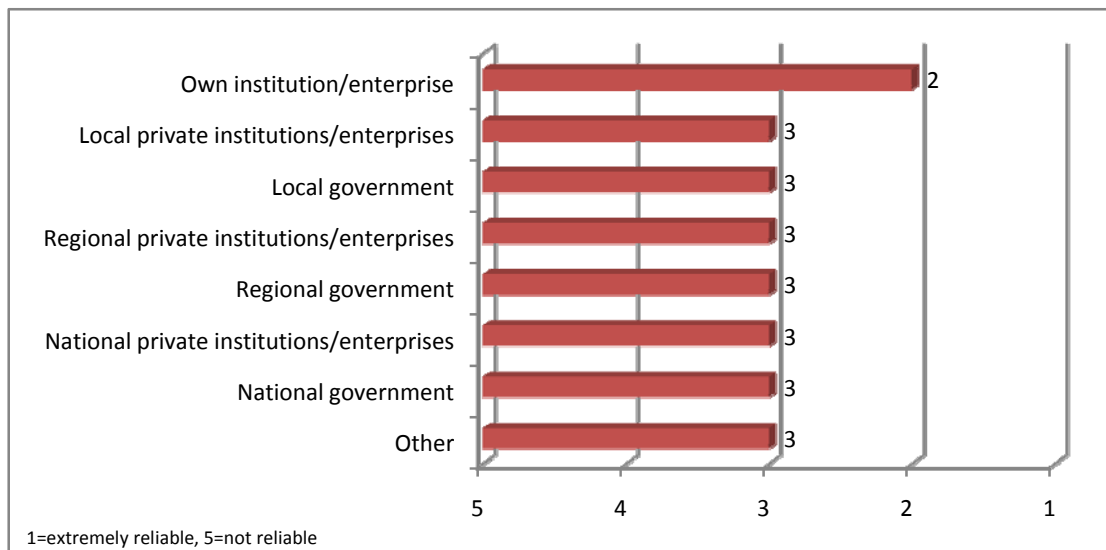


Figure 80: Reliability of information sources

The reliability of information sources in general is rated as rather moderate. Information from the own institution (2) is rated as very reliable. But also the other information sources are seen as reliable (see figure 80).

As indicated in figure 81 information uncertainty has influence on decisions. Therefore the reliability of information is of high importance.

More accurate warnings (1,33) is seen as a very important factor to improve the warning services. Better telecommunication (1,67) and greater availability of data (1,67) are seen as important factors to improve the warning services (see figure 82).

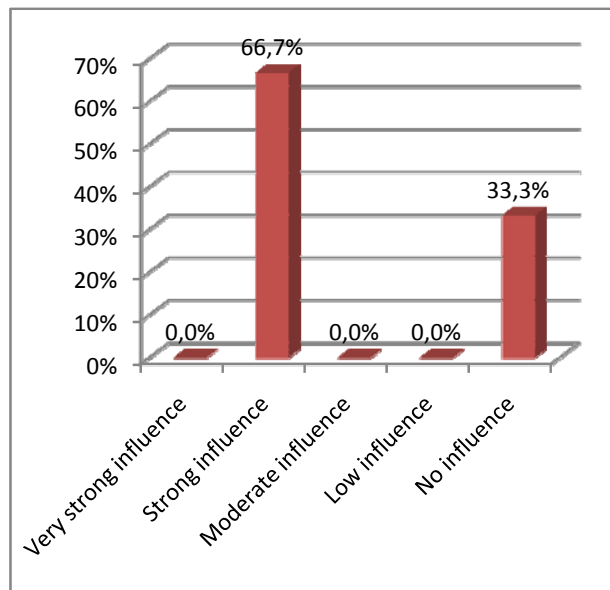


Figure 81: Influence of information uncertainty on decisions

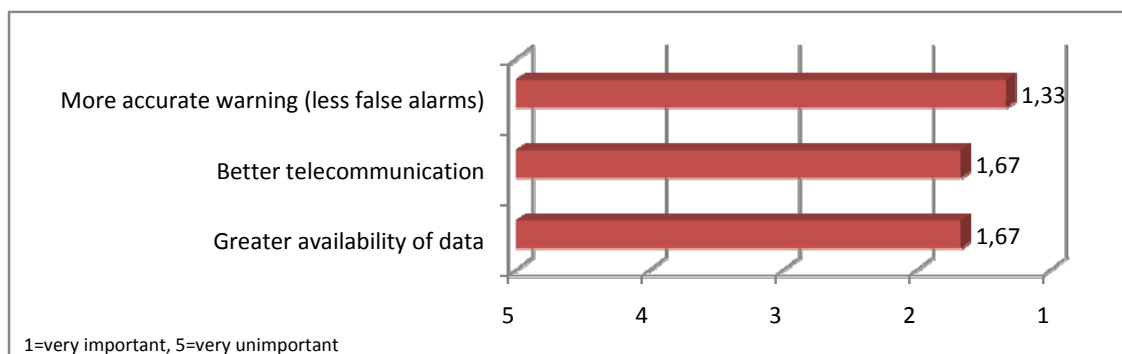


Figure 82: Factors to improve the warning system

4.7. Mitigation of natural hazards

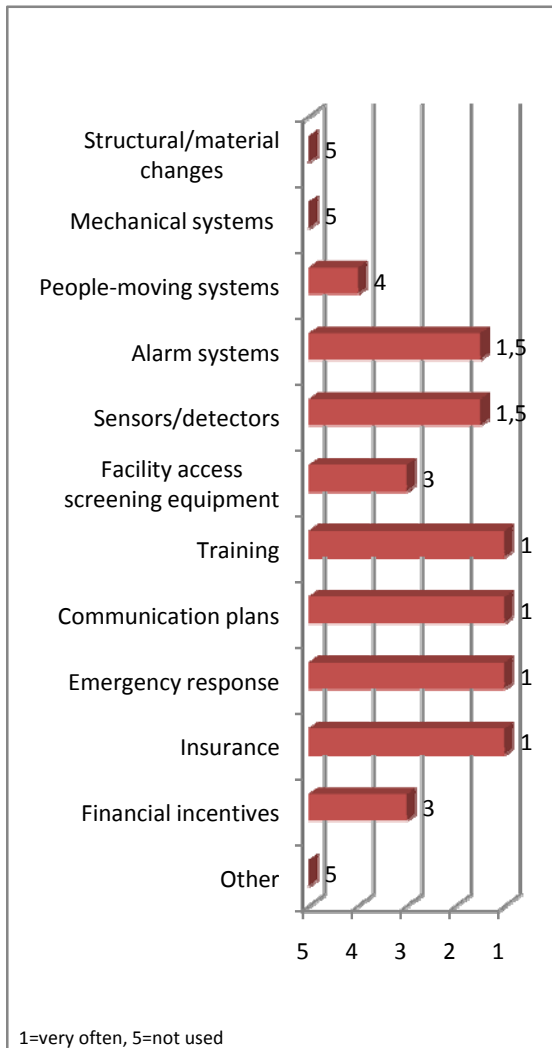


Figure 83: Usage of mitigation strategies

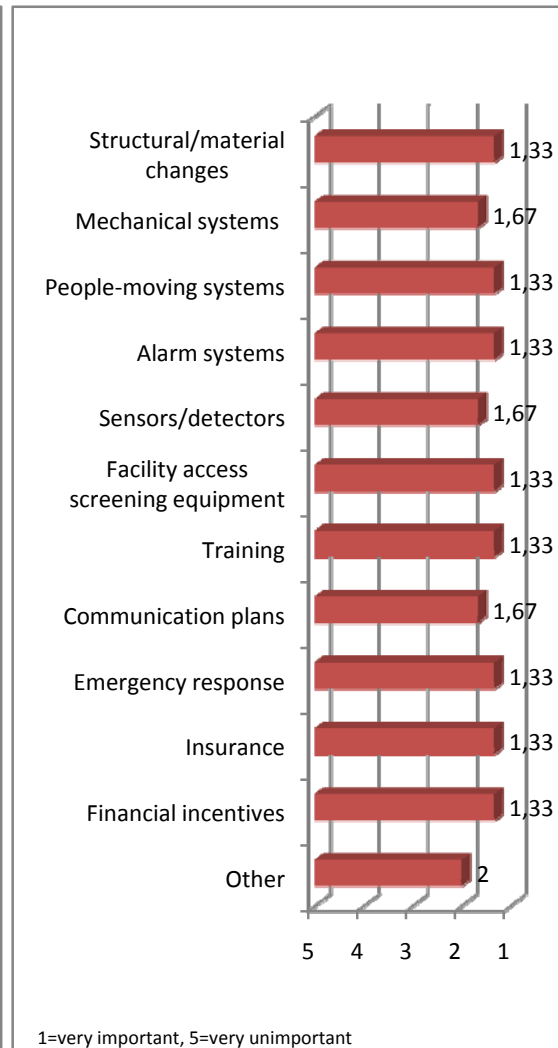


Figure 84: Importance of mitigation strategies

In general the respondents feel prepared to mitigate natural hazards. To assess the usage of certain mitigation strategies the respondents were asked to rate their usage on a scale from 1, meaning used very often to 5, meaning not used in the location.

In general it can be stated that the degree of usage of mitigation strategies is rather high. The respondents indicate that they primarily use training (1), communication plans (1), emergency response (1) and insurances (1). Not used are structural or material changes (5) and mechanical systems (5) (see figure 83).

Rating the mitigation strategies according to their importance for the respondents, structural or material changes, people-moving systems, alarm systems, facility access screening equipment, training, emergency response, insurance and financial incentives are seen as very important (see figure 84).

| | |
|----------------|-------------------------------------|
| Rank 1 | Financial incentives |
| | Communication plans |
| | Training |
| | Insurance |
| | Mechanical systems |
| | Structural/material changes |
| | Alarm systems |
| | Sensors/detectors |
| | People-moving systems |
| | Emergency response |
| | Facility access screening equipment |
| Rank 12 | Other |

The respondents were asked to rate the mitigation strategies according to their feasibility from 1, indicating the most feasible strategy to 5, indicating the least feasible strategy.

The most feasible mitigation strategies are communication plans, financial incentives and training. Least feasible are emergency response and facility access screening equipment (see table 10).

Table 10: Feasibility of mitigation strategies

| | Own organization | Local level | Regional level |
|--------------------------------------|------------------|-------------|----------------|
| Hazard mapping tools | 0% | 0% | 66,7% |
| Early warning systems | 0% | 0% | 66,7% |
| Early alert systems | 0% | 0% | 66,7% |
| Decision support systems | 0% | 0% | 33,3% |
| Risk dialogue groups | 33,3% | 0% | 33,3% |
| Action plans | 0% | 0% | 66,7% |
| Training for hazard scenarios | 0% | 0% | 66,7% |

Table 11: Level at which risk management tools are used

Analyzing the usage of risk management tools at different levels it can be stated that in the own organization 33,3% of the respondents have implemented risk dialogue groups. On the local level no risk management tools are used. On the regional level 66,7% of respondents indicate that hazard mapping tools, early warning systems, early alert systems, action plans and training for hazard scenarios are used (see table 11).

5. Switzerland

5.1. General information

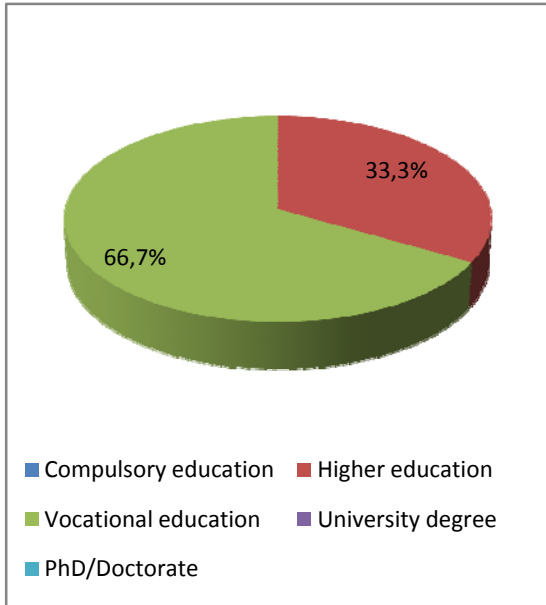


Figure 85: Highest education of the respondents

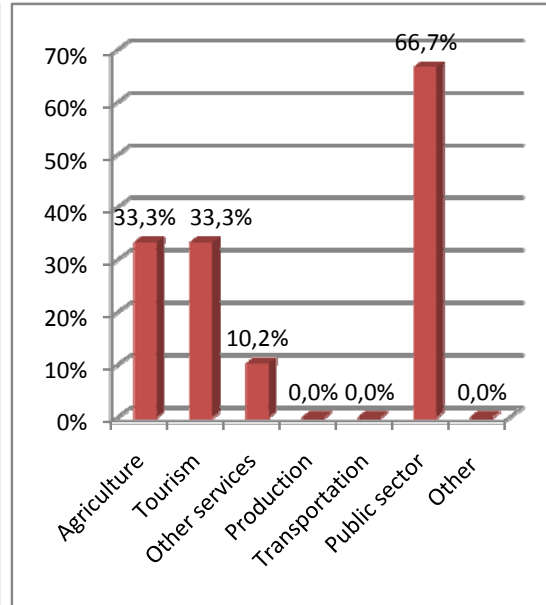


Figure 86: Sector, in which the respondents operate

In Switzerland 10 stakeholders participated in the online-survey.

Regarding the highest education 66,7% indicate to have vocational education and 33,3% have a higher education (see figure 85).

Most of respondents (66,7%) indicate to operate in the public sector. 33,3% operate respectively in agriculture or tourism and 10,2% indicated other services (see figure 86).

5.2. Personal experience

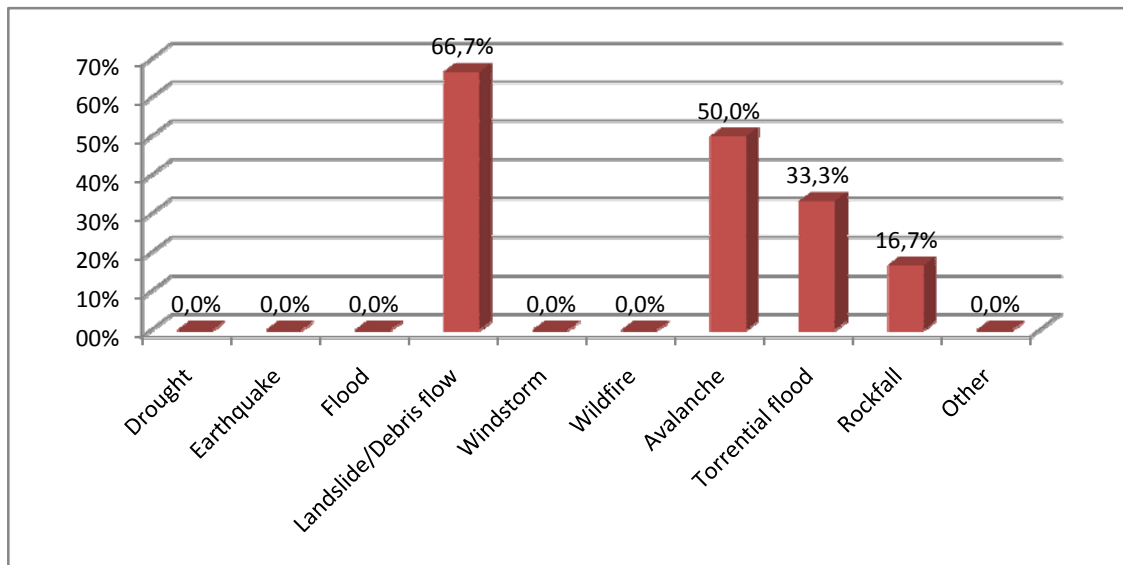


Figure 87: Type of natural hazards experienced (more answers possible)

80% of the respondents indicate that their institution or enterprise experienced a natural hazard in the past 5 years. In average they experienced 2,25 natural hazards over the indicated time.

Nearly 67% experienced landslides or debris flows. 50% indicate that they were affected by avalanches and 33,3% by torrential floods. 16,7% experienced rockfalls. The respondents have no experience with droughts, earthquakes, floods, windstorms and wildfire (see figure 87).

All the natural hazards over the last 5 years caused damages. 25% of the damages were primary or direct damages. 25% were secondary or indirect damages. 50% of the damages caused both primary and secondary damages (see figure 88).

In average these damages are estimated to a cost of Euro 500.000 per damage (minimum value: 0 €; maximum value: 2 Mio.).

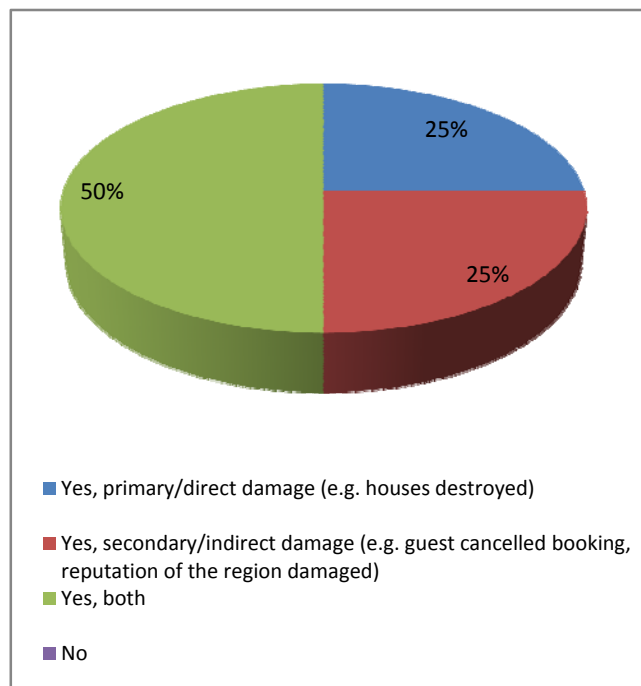


Figure 88: Damages caused by these natural hazards

5.3. Problem perspectives

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents are very concerned about avalanches (2), landslides and debris flows (2,33) and torrential floods (2,33). Also windstorms, wildfires and rockfalls (2,67) cause concern. The respondents are not concerned about drought (5) and earthquakes (4,67) (see figure 89).

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According the respondents landslides and debris flows (2,67), as well as avalanches (2) have a high degree of damage. A moderate degree of damage have torrential floods (3), wildfires (3), windstorms (3,33), rockfalls (3,33) and floods (3,33). A low degree of damages have earthquakes (4,67) and droughts (5) (see figure 90).

When confronting the results especially avalanches and landslides or debris flows seem to have a high impact on the location, because the rating is high in terms of concern and vulnerability.

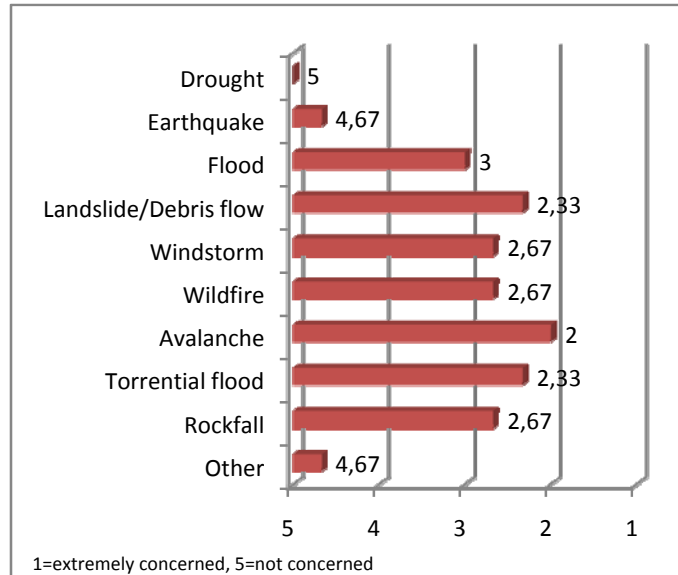


Figure 89: Degree of concern about natural hazards affecting the location

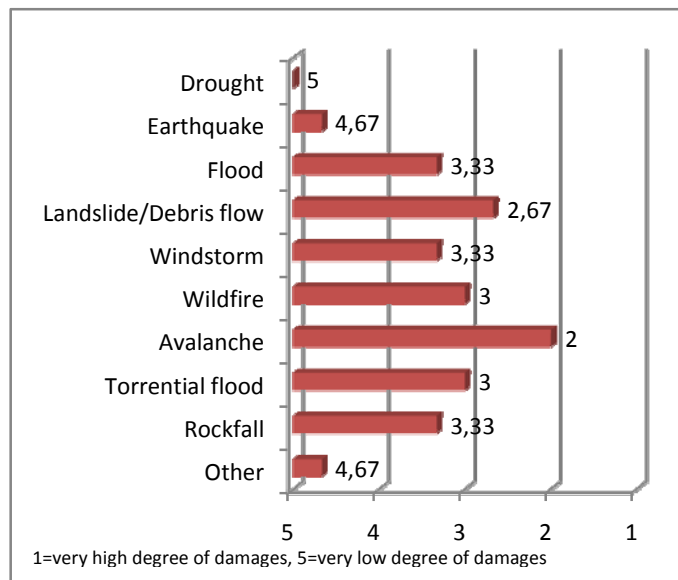


Figure 90: Degree of potential damages related to natural hazards

5.4. Perception of natural hazards

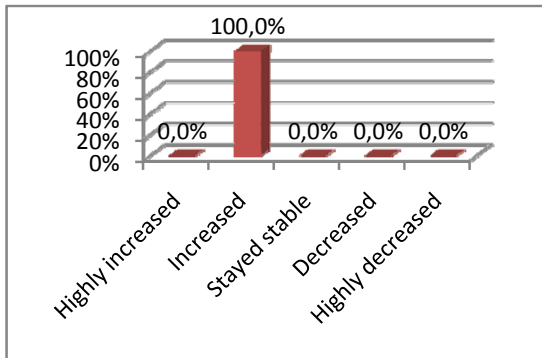


Figure 91: Development of awareness of natural hazards

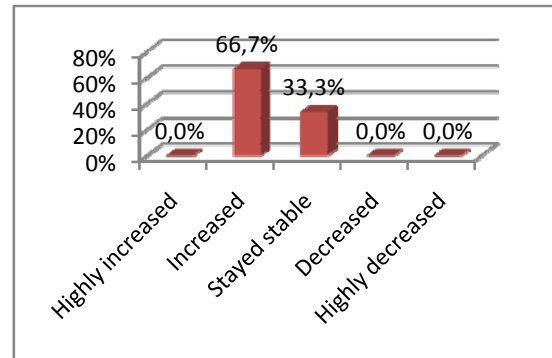


Figure 92: Development of natural risk

According to the respondents the natural risk increased over the last ten years (figure 92). Also the awareness of natural hazards increased over the same time period (figure 91).

According to the respondents the municipalities or local authorities (2,33), the population (2,33) and the managers of transport infrastructures (2,33) are very affected by natural hazards. Also water suppliers (3,33) and private businesses (3) are affected by natural hazards. The least affected are public institutions and energy providers (4) (see figure 93).

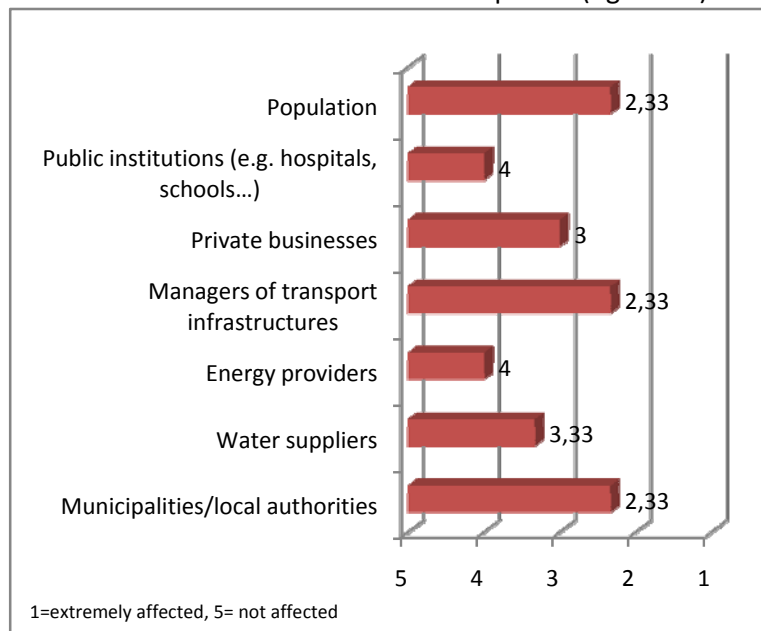


Figure 93: Groups affected by natural hazards

The respondents do agree with the statement 'Natural hazards are seen as a major problem in the location'. They are indifferent about the statements 'The potential of natural hazards is a disadvantage for the location' and 'Natural hazards impair the general attractiveness of the location' (see figure 94).

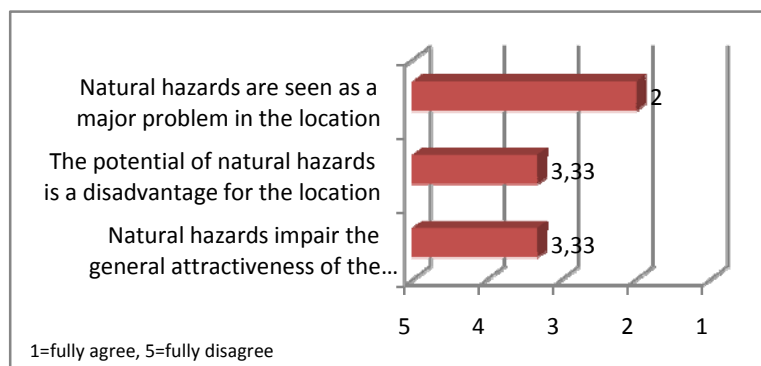


Figure 94: General perception of natural hazards

5.5. Impacts of natural hazards

To assess the impacts of natural hazards four different aspects were evaluated by the respondents: the impact on the regional economy, the impact on the quality of life of the local population, the ecological impact, as well as the impact on the decision behavior of the respondents. In all aspects the respondents were asked to rate the impact on a 5-point Likert scale from 1, meaning very strong impact to 5, meaning no impact.

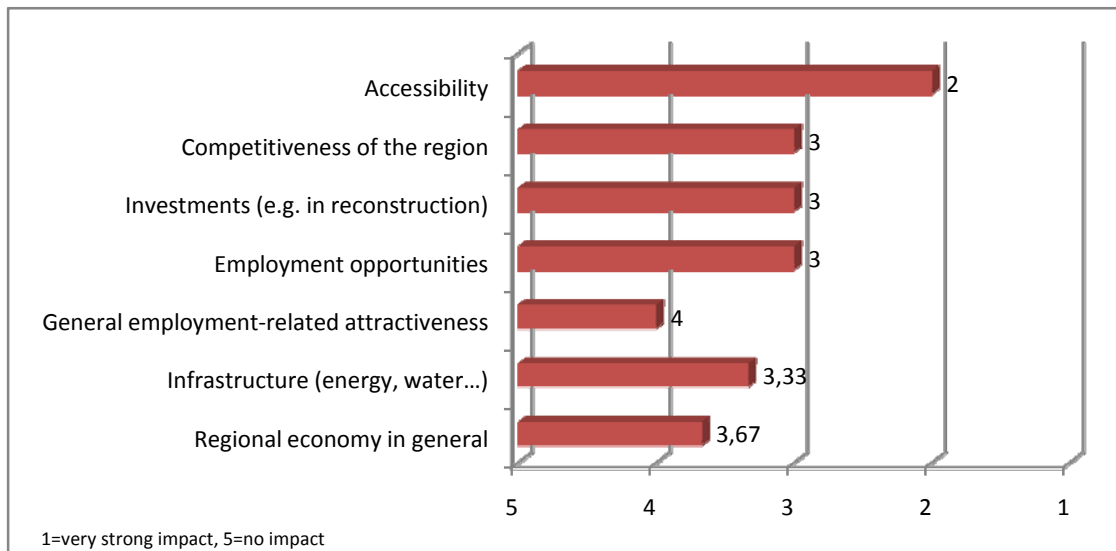


Figure 95: Impacts on the regional economy

In general the impact of natural hazards on the regional economy is rated as rather medium. The most important aspects affected by natural hazards is the accessibility of a region (2). A low impact for the economy is seen in general employment-related attractiveness (see figure 95).

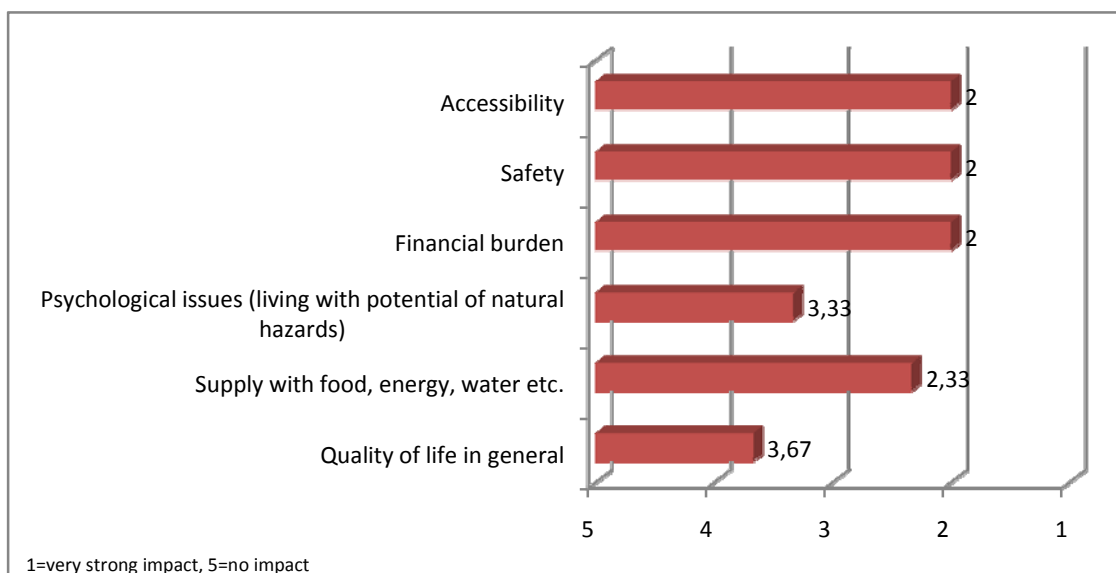


Figure 96: Impacts on the quality of life

Also the impact of natural hazards on the quality of life of the local population is rated moderately. According to the respondents natural hazards impact the safety (2), the accessibility (2) and the financial burden (2) (see figure 96).

The impact on the environment is rated as low. Impacts are seen on foresting (2,33) and landscape (2,33). Natural hazards do rather not affect the water cleanliness (see figure 97).

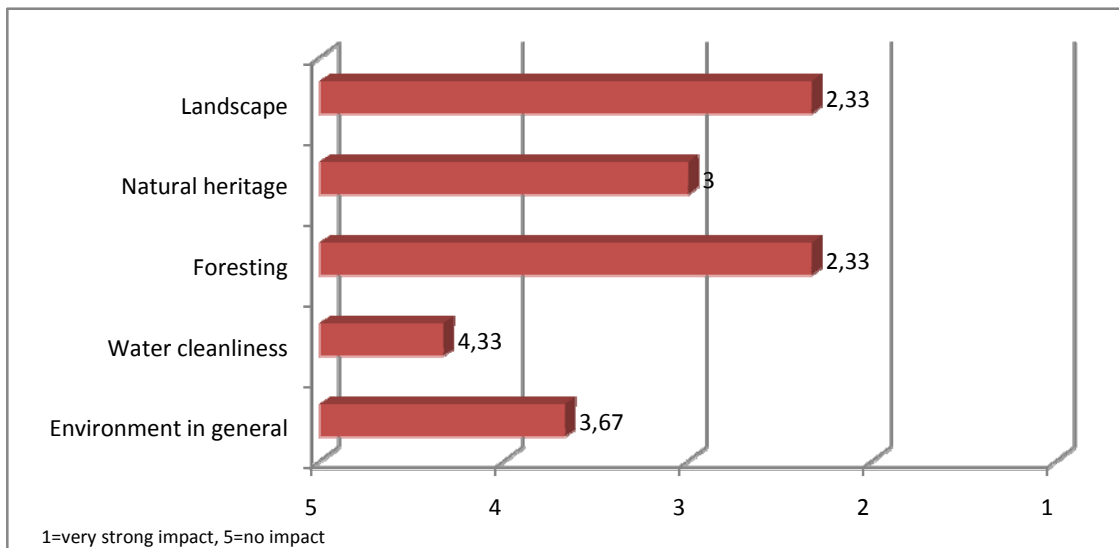


Figure 97: Ecological impacts

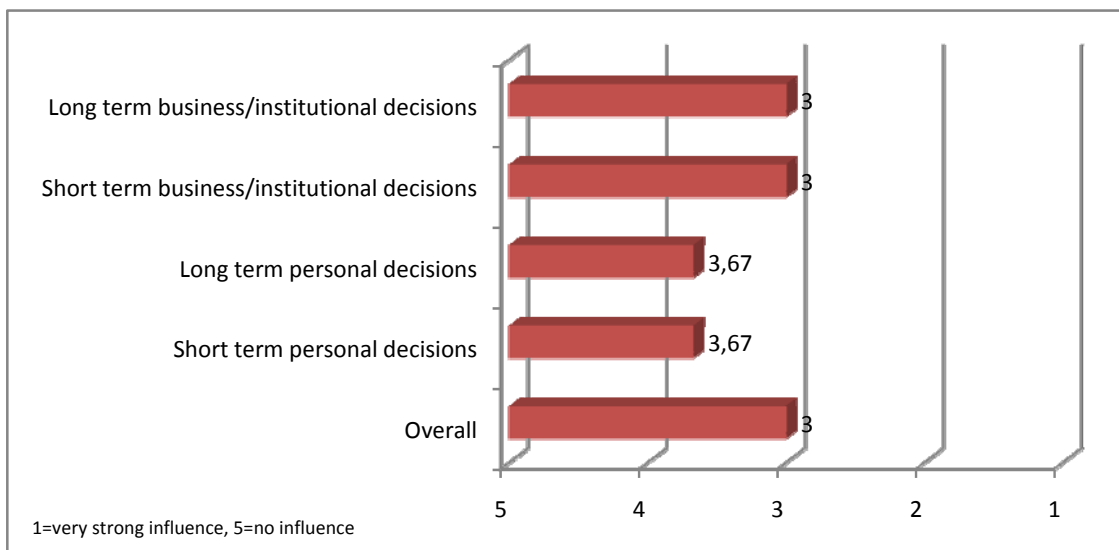


Figure 98: Impact of past experiences on the general decision behavior

Past experiences with natural hazards have impact on the general decision behavior of the respondents. The influence on business or institutional decision is higher than the influence on personal decisions, concerning both long term and short term decisions (see figure 98).

5.6. Information about natural hazards

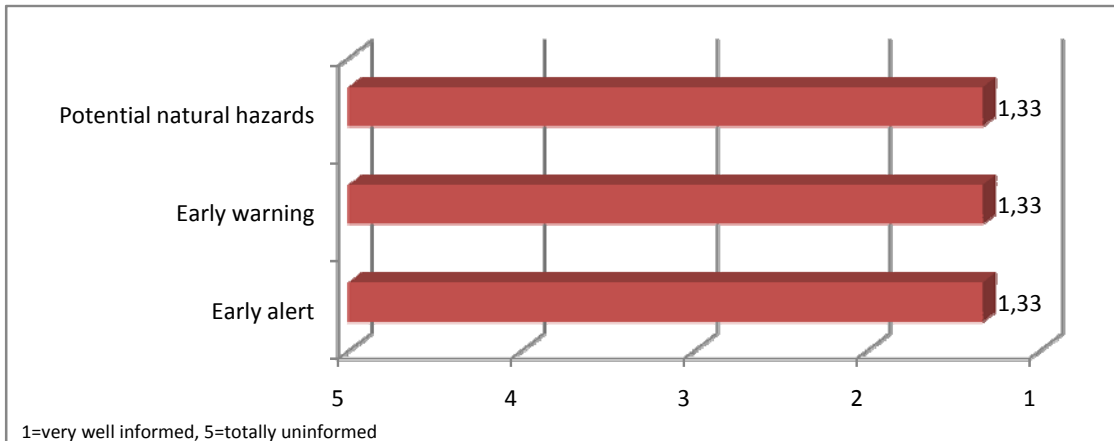


Figure 99: Information level of respondents regarding...

The respondents are well informed about potential natural hazards, early warning and early alert (see figure 99). The respondents indicated, that they do not need any further information from other institutions.

All of the respondents receive information on natural hazards. The most important information source is the national government (100%). Also important are the own institution or enterprise, local private institutions or enterprises and the regional government (66,7%). (see figure 100).

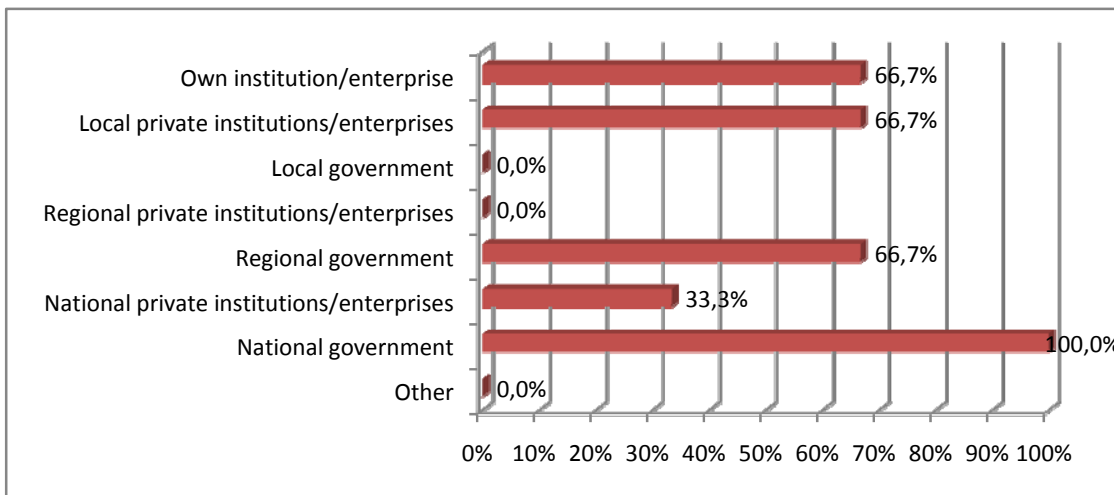


Figure 100: Information sources (more answers possible)

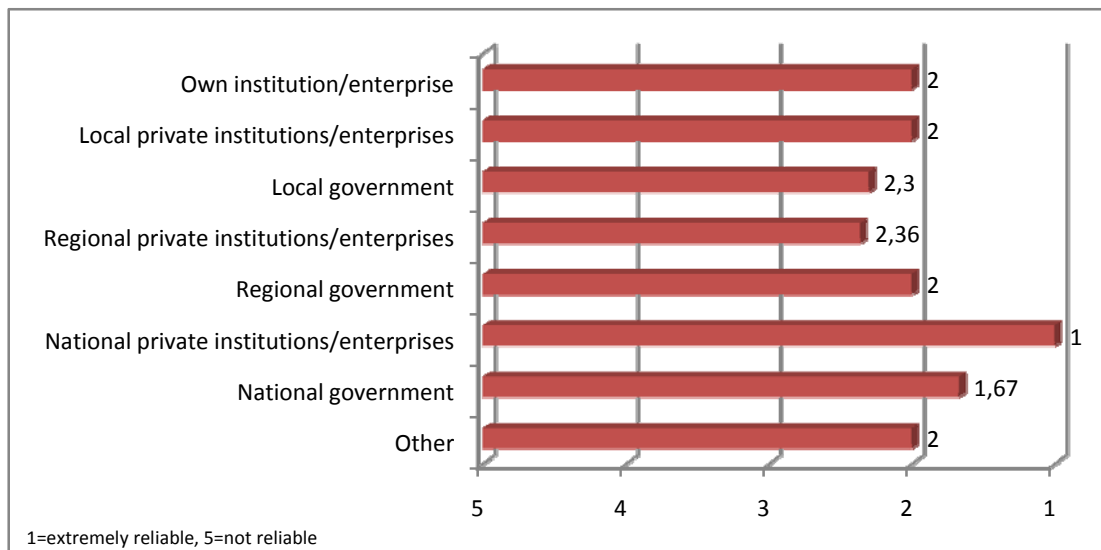


Figure 101: Reliability of information sources

The reliability of information sources in general is rated rather high. Information from national private institutions or enterprises (1) are rated as extremely reliable (see figure 101).

As indicated in figure 102 information uncertainty has influence on decisions. Therefore the reliability of information is of high importance.

More accurate warnings (1,33), better telecommunication (2), and greater availability of data (2) are seen as important factors to improve the warning services (see figure 103).

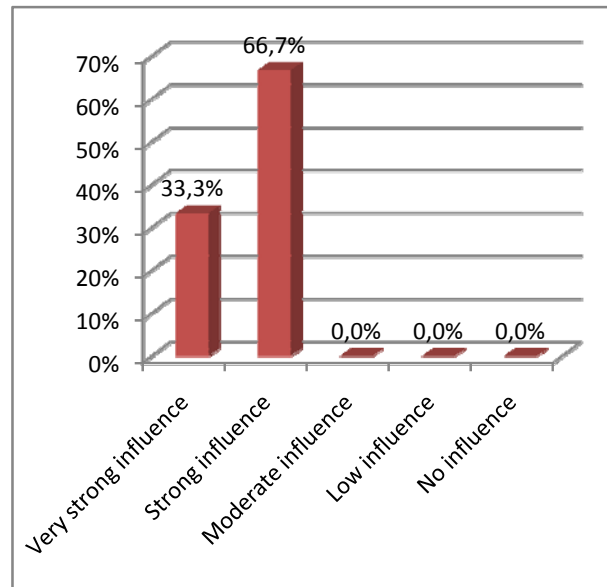


Figure 102: Influence of information uncertainty on decisions

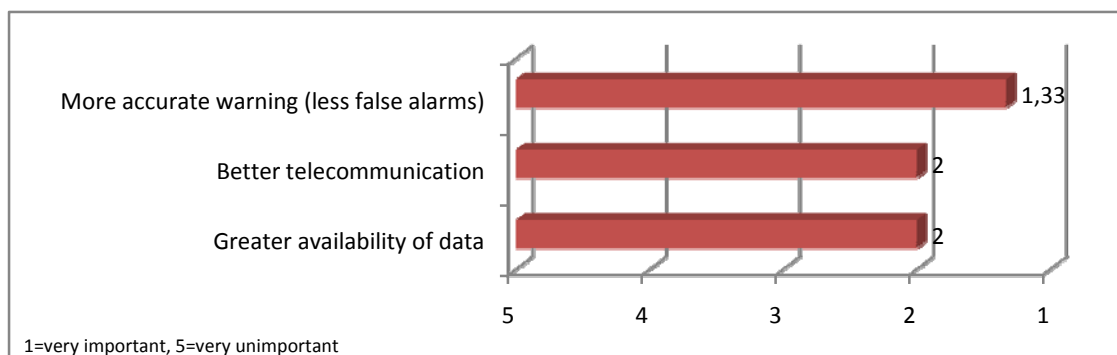


Figure 103: Factors to improve the warning system

5.7. Mitigation of natural hazards

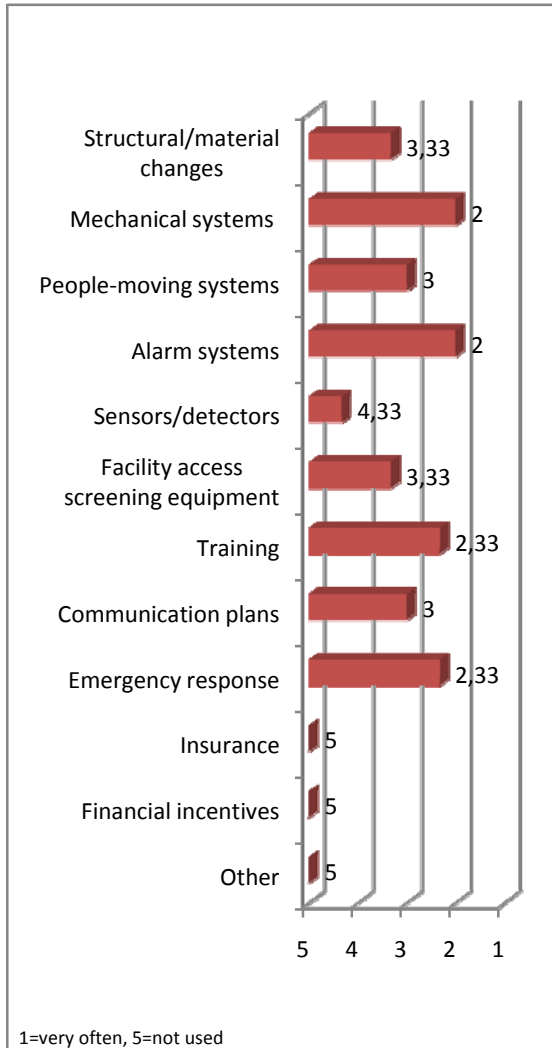


Figure 104: Usage of mitigation strategies

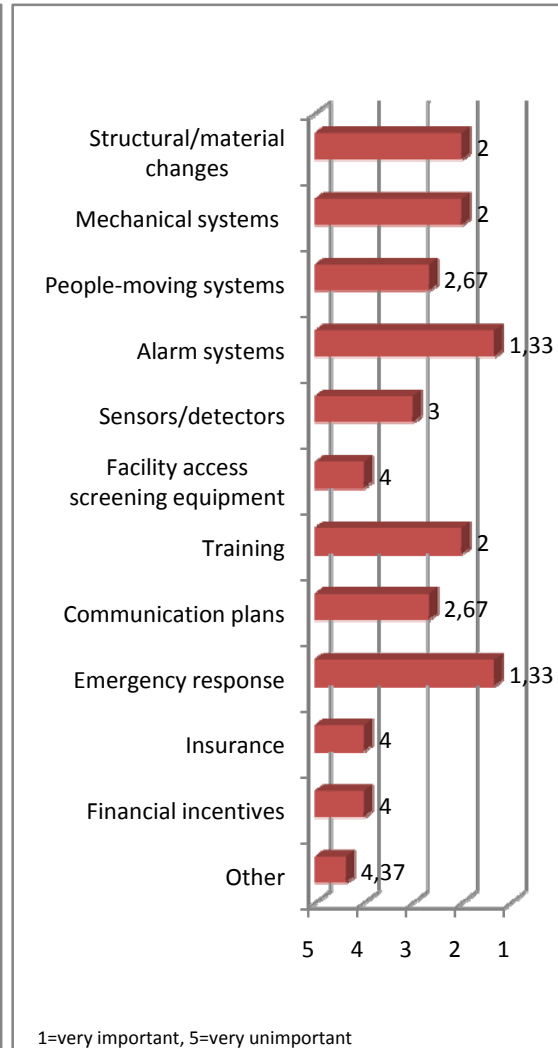


Figure 105: Importance of mitigation strategies

In general the respondents feel prepared to mitigate natural hazards. To assess the usage of certain mitigation strategies the respondents were asked to rate their usage on a scale from 1, meaning used very often to 5, meaning not used in the location.

In general it can be stated that the degree of usage of mitigation strategies is rather low. The respondents indicate that they primarily use mechanical systems (2), alarm systems (2), training (2,33) and emergency response (2,33). Not used are insurances (5), financial incentives (5) and sensors and detectors (4,33) (see figure 104).

Rating the mitigation strategies according to their importance for the respondents, alarm systems (1,33) and emergency response (1,33) are seen as very important. Rather unimportant are financial incentives, insurances and facility access screening equipment (see figure 105).

| | |
|----------------|-------------------------------------|
| Rank 1 | Insurance |
| | Financial incentives |
| | Structural/material changes |
| | Sensors/detectors |
| | Mechanical systems |
| | Other |
| | Facility access screening equipment |
| | Alarm systems |
| | People-moving systems |
| | Communication plans |
| | Emergency response |
| Rank 12 | Training |

The respondents were asked to rate the mitigation strategies according to their feasibility from 1, indicating the most feasible strategy to 5, indicating the least feasible strategy.

The most feasible mitigation strategies are insurance, financial incentives and sensors or detectors. Least feasible are training, emergency response and communication plans (see table 12).

Table 12: Feasibility of mitigation strategies

| | Own organization | Local level | Regional level |
|--------------------------------------|------------------|-------------|----------------|
| Hazard mapping tools | 100% | 0% | 0% |
| Early warning systems | 100% | 66,7% | 0% |
| Early alert systems | 33,3% | 66,7% | 0% |
| Decision support systems | 100% | 66,7% | 0% |
| Risk dialogue groups | 100% | 0% | 66,7% |
| Action plans | 100% | 0% | 0% |
| Training for hazard scenarios | 100% | 66,7% | 66,7% |

Table 13: Level at which risk management tools are used

Analyzing the usage of risk management tools at different levels it can be stated that in the own organization all respondents use hazard mapping tools, early warning systems, decisions support systems, risk dialogue groups, action plans and training for hazard scenarios. On the local level early warning systems, early alert systems, decisions support systems and training for hazard scenarios are used. On the regional level risk dialogue groups and training for hazard scenarios are in place (see table 13).

6. Comparison of results

The comparative analysis gives an overview of the results of the five test beds. The analysis comprises only those questions, which can be compared between countries. Questions on the impact of natural hazards, the reliability of information sources and mitigation strategies are not included because they are very site-specific.

6.1. General information

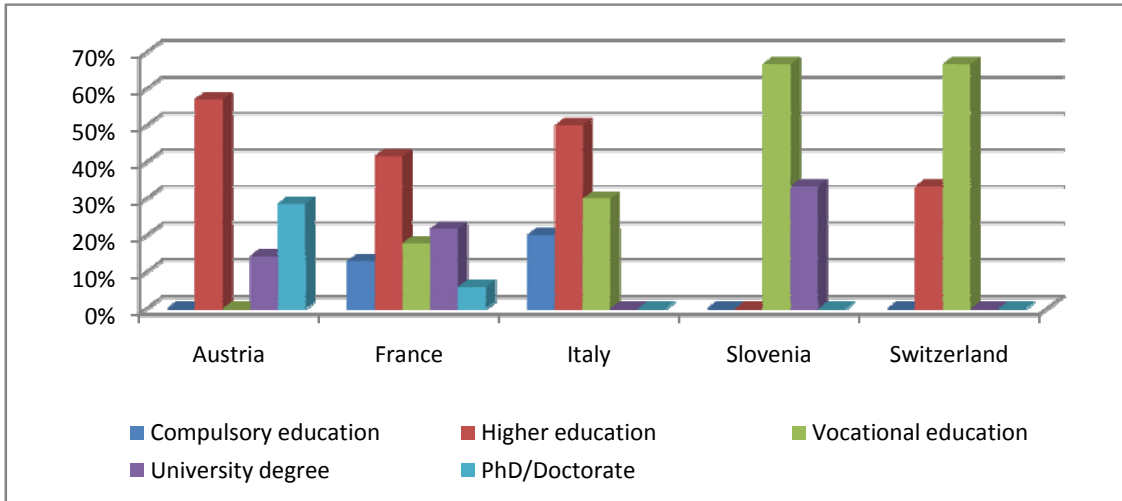


Figure 106: Highest education of the respondents

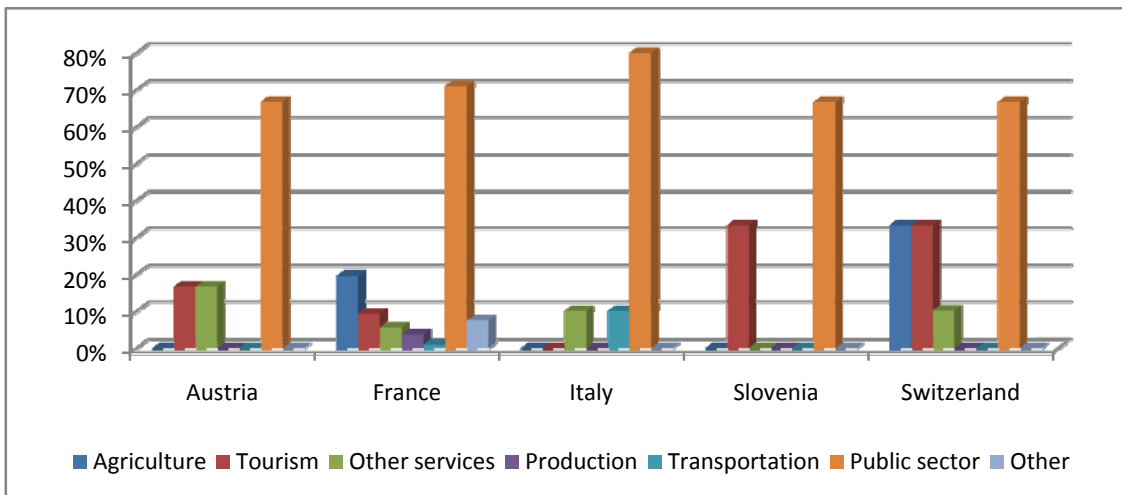


Figure 107: Sector, in which the respondents operate

The respondents in all test beds work mainly in the public sector. Some operate also in the tourism and agricultural sector (see figure 107). Most have higher education or vocational education. In Austria, France and Slovenia respondents indicate also to have a university degree (see figure 106).

6.2. Personal experience

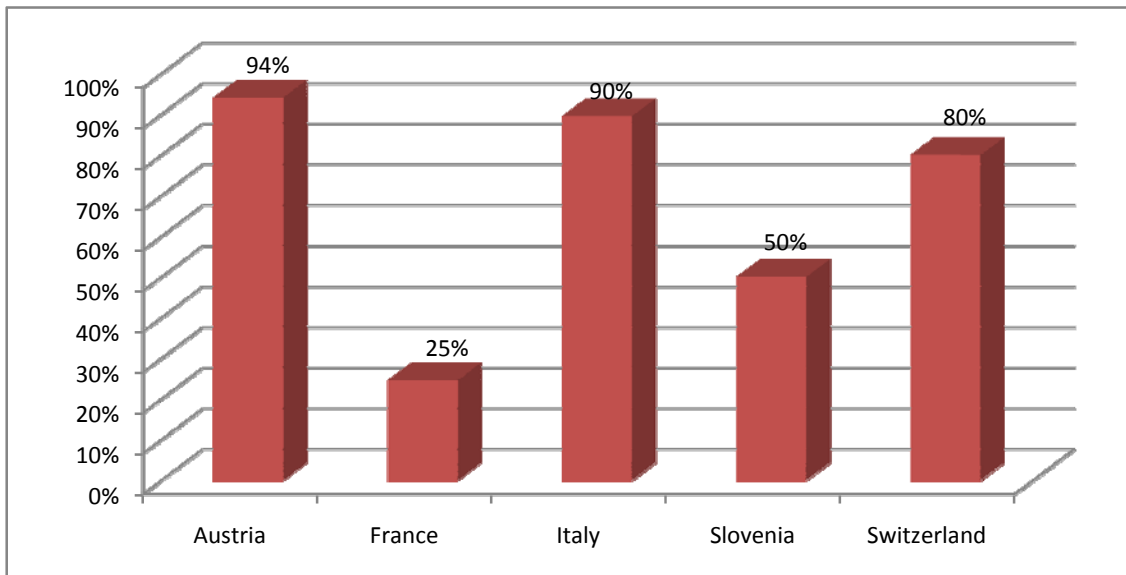


Figure 108: Experience with natural hazards in the past 5 years

Overall a high percentage of respondents indicated, to have experienced natural hazards in the past five years. In Italy 94,1% of respondents experienced natural hazards. In France the percentage is rather low (24,6%).

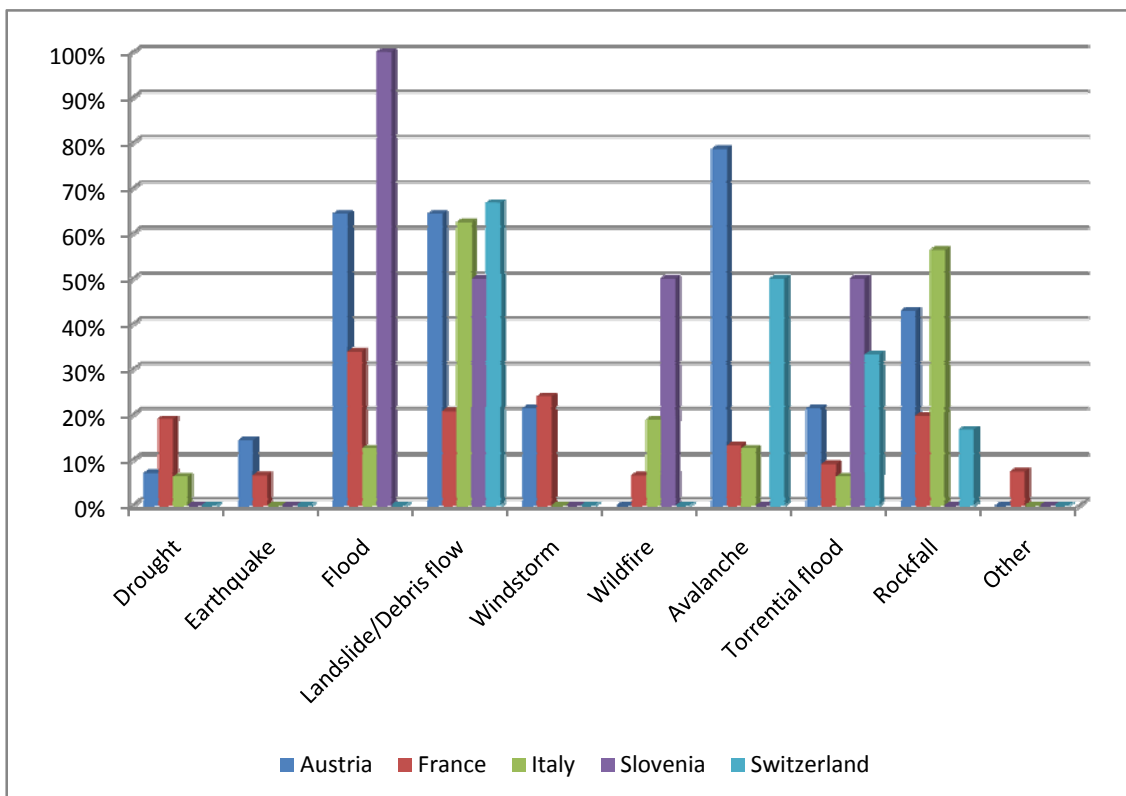


Figure 109: Type of natural hazards experienced (more answers possible)

The respondents of the several test beds made experience with different natural hazards (see figure 109). All countries are affected by landslides and debris flows. Austria is most affected by avalanches and floods. In contrast Italy is affected by rockfalls. For France and Slovenia floods are seen as a problem. Switzerland is affected mainly by avalanches and torrential floods.

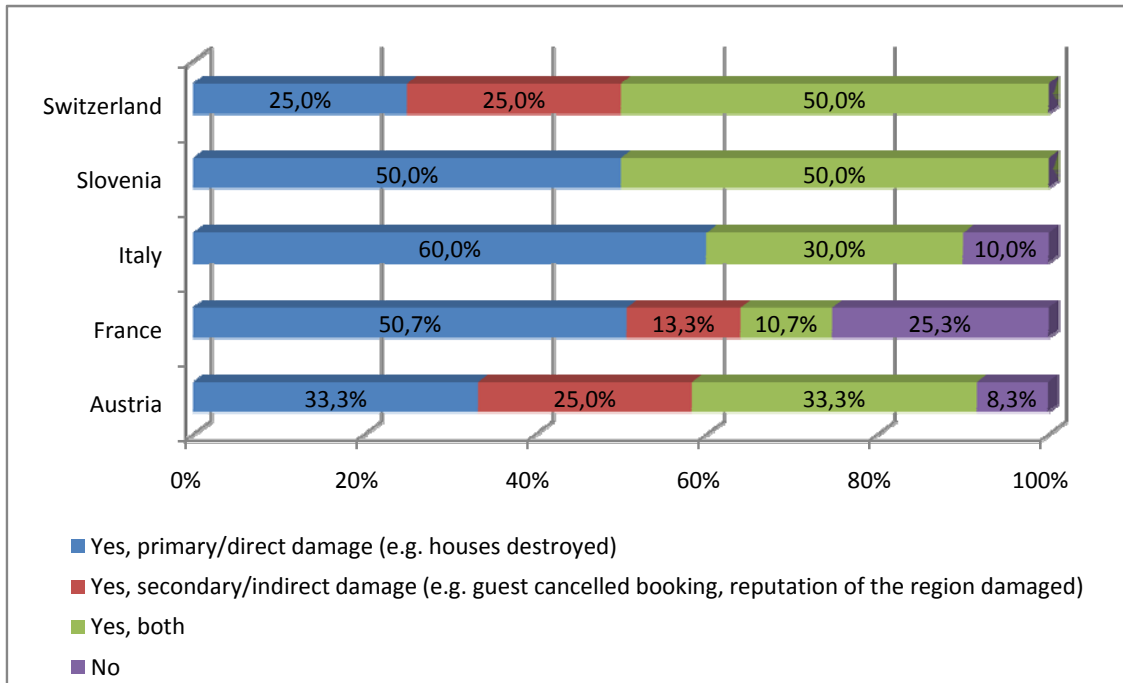


Figure 110: Damages caused by these natural hazards

Most natural hazards in all five test beds cause primary or direct damages, as well as secondary or indirect damages. The degree of primary damages in Italy is very high, whereas the degree in Switzerland and Austria is rather low.

Only few respondents in Italy, France and Austria indicate that natural hazards did not cause damages (see figure 110).

6.3. Problem perspectives

| | |
|--------------------|--|
| Austria | Avalanches (2,5) Landslides/Debris flows (2,9) Rockfalls (3,1) |
| Italy | Rockfalls (2,7) Landslides/Debris flows (2,8) Torrential floods (3,38) |
| France | Windstorms (3,46) Droughts (3,68) Floods (3,74) |
| Switzerland | Torrential floods (2,33) Landslides/Debris flows (2,33) Windstorms (2,67) Wildfire (2,67) |
| Slovenia | Floods (2,67) Earthquakes (3) Landslides/Debris flows (3) Torrential floods (3) |

Table 14: Degree of concern about natural hazards affecting the location (1=extremely concerned, 5=not concerned)

Rating the degree of concern on a 5-point Likert scale from 1, meaning extremely concerned to 5, meaning not concerned the respondents of the five test beds are differently concerned. Torrential floods and landslides or debris flows are perceived as important for all sites (see table 14).

| | |
|--------------------|--|
| Austria | Landslides/Debris flows (2,22) Floods (2,33) Torrential floods (2,88) |
| Italy | Floods (2,17) Landslides/Debris flows (2,2) Rockfalls (2,73) |
| France | Windstorms (3,07) Floods (3,42) Droughts (3,43) |
| Switzerland | Avalanches (2) Landslides/Debris flows (2,67) Wildfires (3) Torrential floods (3) |
| Slovenia | Torrential floods (1,5) Earthquakes (2) Floods (2) Landslides/Debris flows (2) |

Table 15: Degree of potential damages related to natural hazards (1=very high degree of damages, 5=very low degree of damages)

The respondents were also asked to rate the degree of damage on a 5-point Likert scale from 1, meaning very high degree of damages to 5, meaning very low degree of damages. According the respondents landslides and debris flows, as well as floods have a high degree of damage in all five testbeds. Other natural hazards like wildfire and earthquakes have a high degree of potential damage only in some locations (see table 15).

6.4. Perception of natural hazards

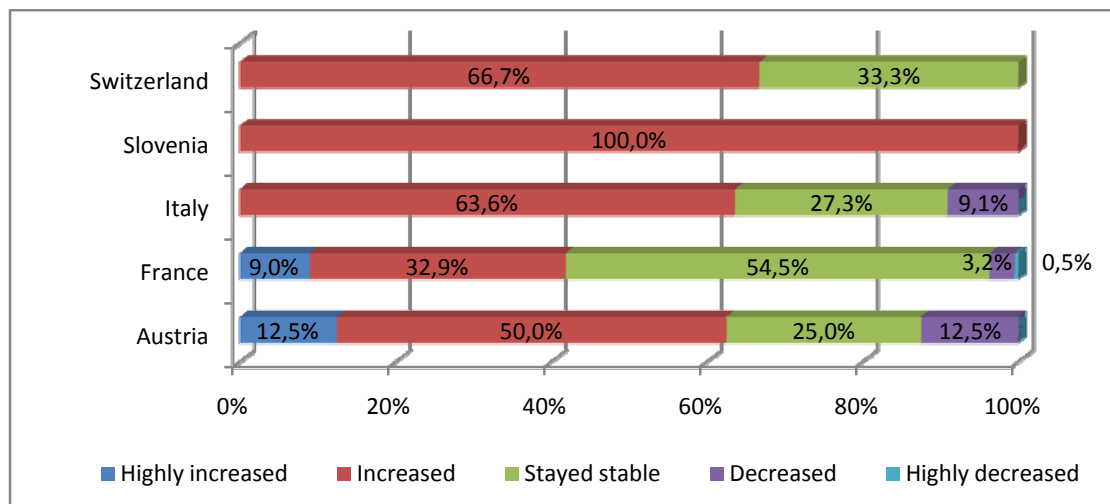


Figure 111: Development of natural risk

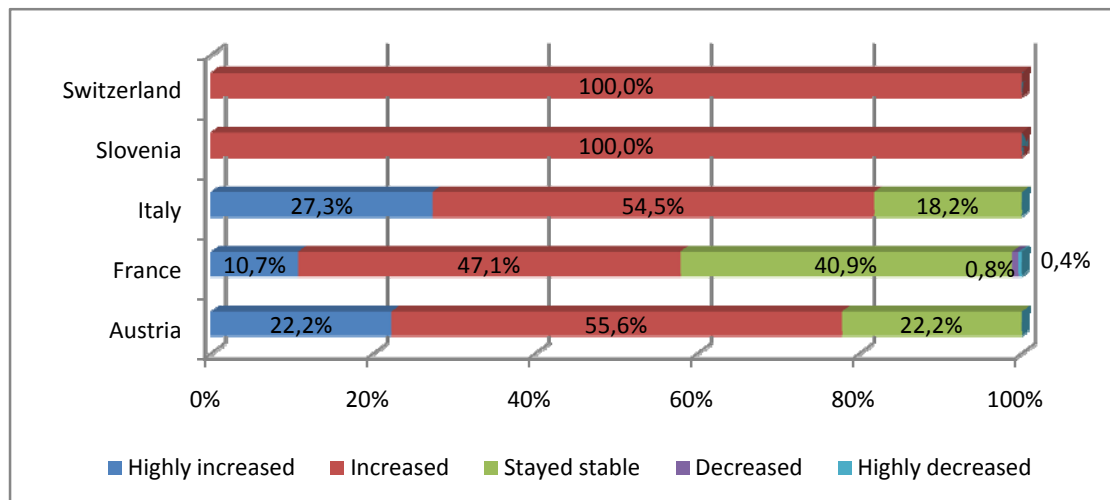


Figure 112: Development of awareness of natural hazards

According to the respondents the natural risk increased over the last ten years (figure 111). Only a small percentage of respondents state that the risk decreased over the time period. Also the awareness of natural hazards increased over the last ten years (figure 112).

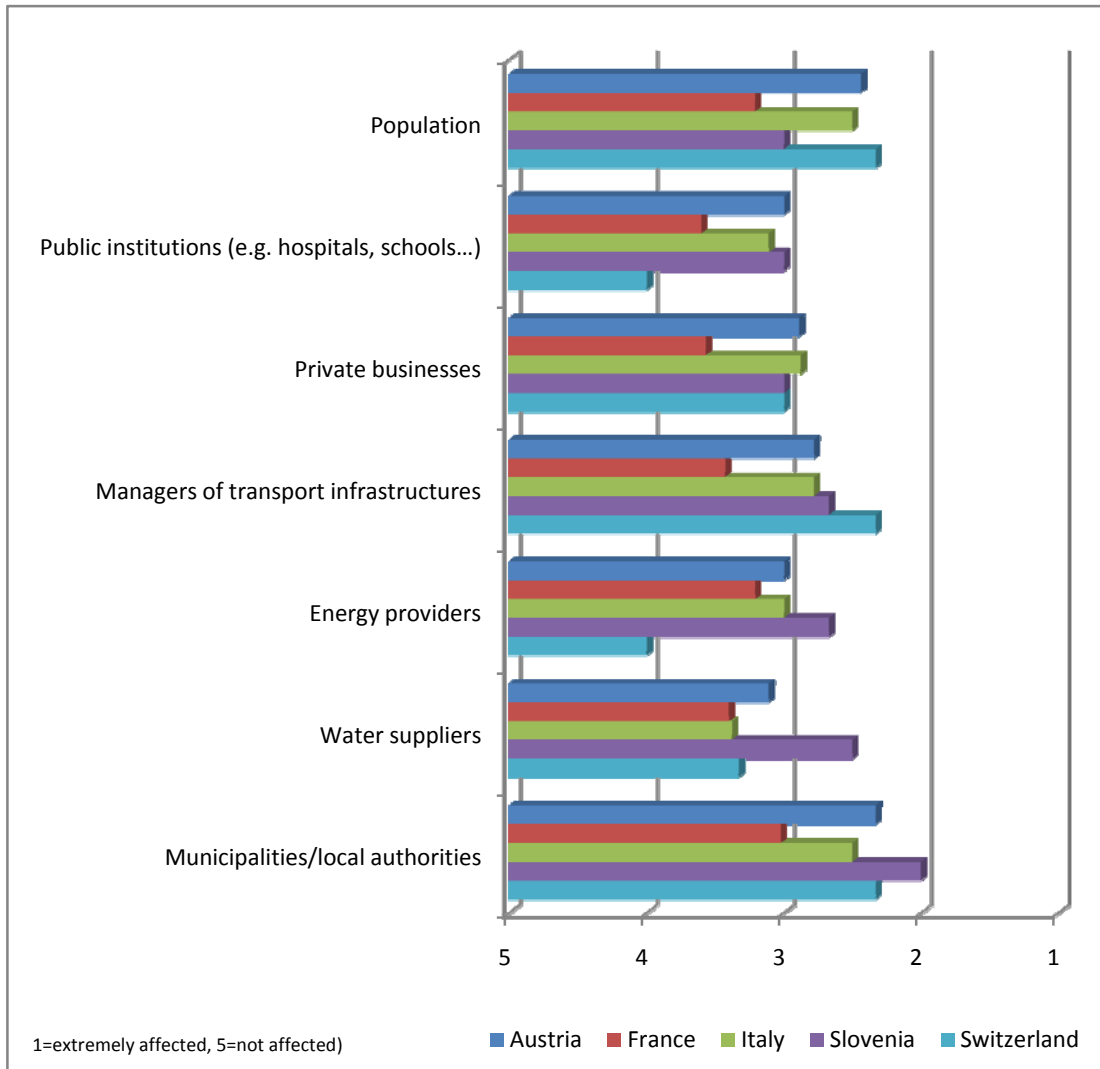


Figure 113: Groups affected by natural hazards (1=extremely affected, 5=not affected)

According to the respondents the municipalities or local authorities, the population and the managers of transport infrastructures are very affected by natural hazards in all five test beds (see figure 113).

6.5. Information about natural hazards

| | |
|--------------------|---|
| Austria | Local government (62,5%) Own institution/enterprise (50%) Regional government (50%) Local private institutions/enterprises (37,5%) Regional private institutions/enterprises (12,5%) National government (12,5%) |
| Italy | Own institution/enterprise (50%) Local government (40%) Regional government (30%) National government (42,3%) Local private institutions/enterprises (10%) |
| France | Local government (68,6%) National government (42,3%) Regional government (19,2%) Own institution/enterprise (14,7%) Local private institutions/enterprises (5,8%) National private institutions/enterprises (4,5%) Regional private institutions/enterprises (2,6%) |
| Switzerland | National government (100%) Regional government (66,7%) Own institution/enterprise (66,7%) Local private institutions/enterprises (66,7%) National private institutions/enterprises (33,3%) |
| Slovenia | Own institution/enterprise (66,7%) Local government (33,3%) Local private institutions/enterprises (33,3%) National government (33,3%) National private institutions/enterprises (33,3%) |

Table 16: Information sources (more answers possible)

The respondents are well informed about potential natural hazards, early warning and early alert.

All of the respondents receive information about natural hazards. The most important information sources vary between the test bed. The regional government and regional institutions are seen as important sources in all countries. Also the own institution or enterprise is an important information source (see table 16).

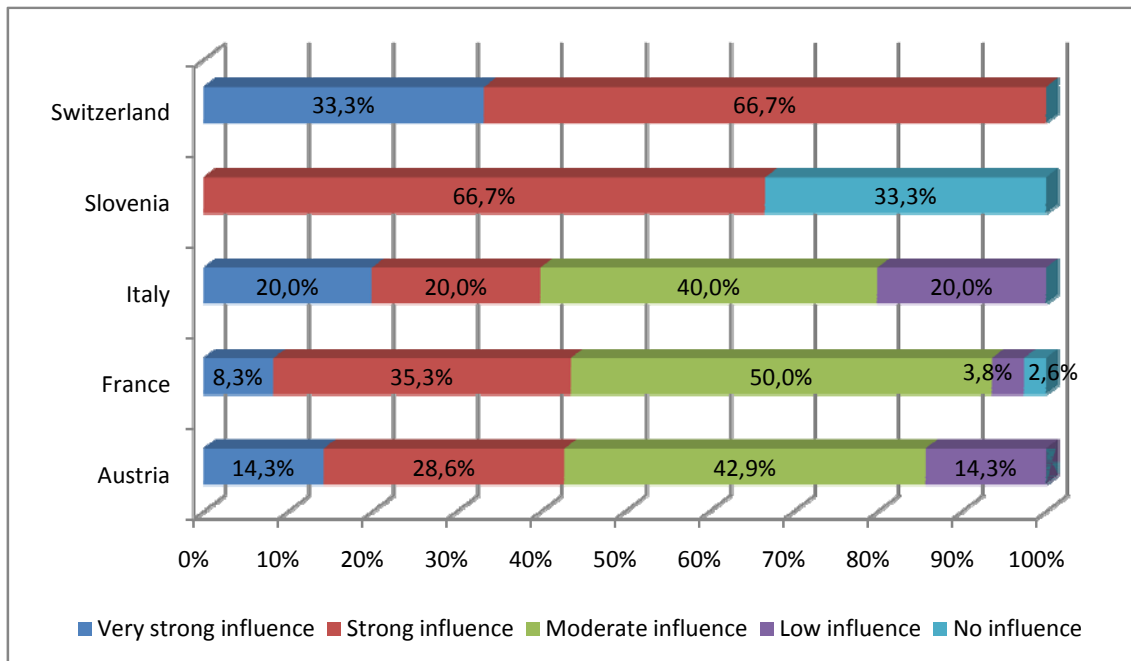


Figure 114: Influence of information uncertainty on decisions

As indicated in figure 114 information uncertainty has influence on decisions. Only in Slovenia (33,3%) and in France (2,6%) some respondents indicate that information uncertainty has no influence on decisions.

CHAPTER IV – RESULTS OF THE WORKSHOPS

1. Introduction

In order to discuss and evaluate the results of the qualitative and quantitative survey, four workshops in Italy (January, 13th), Austria (February, 26th), Slovenia (March, 2nd) and Switzerland (March, 3rd) have been realized in the beginning of 2011. The aim of the workshops was to bring together the local actors dealing with natural hazards and discuss further need for action. In this section the most important results of the discussion are displayed. For further information on the workshops see the minutes.

2. Indirect and direct vulnerability

Vulnerability is defined as the disposition of an object to undergo a certain degree of damage. In general a distinction between direct and indirect exposure can be made. Direct exposure is the economic and social degree of the instantaneous damages generated by the event itself, like, dead or wounded people, road barriers, damaged infrastructures or vehicles. Indirect exposure is the economic and social degree of the damage resulting from the interruption of the network, like influence on the economy, single businesses or sectors, f.ex. tourism.

The actors defined direct exposure as the effect on human life, recovery costs and recovery time as well as infrastructural damages. Indirect exposure is defined as effects on the accessibility and the possibility of alternative routes.

The indirect damage “closure of the infrastructure” depends much on the restauration time and on the question whether the traffic link is a “life-line” (strategic importance of the link). The importance and the type of the phenomenon impacts the structural damage on the artery, thus it is necessary to take this in consideration and to further consider any indirect consequences. Some groups highlight that the interruption of the infrastructure with its consequences is to be considered as a social and not as a private economic factor. In fact discontinuation of the line can cause inconvenience to the population and delayed emergency aid and can so produce indirect victims. In contrast, the indirect economic damage, considering the global market on a macro scale, does not exist because of the redistribution of income on the large scale. On this concept, the groups are divided.

Most groups consider that there must be given different emphasis to direct and indirect accessibility when talking about the management of public roads or about railways and highways where company policy is applied. Railways and highways must also consider possible indirect damages of the company, without giving them more emphasis than human life. Furthermore, considering railway the transfer of traffic on wheels or on another line can not be carried out immediately. However, the task of public managers is to preserve human life and the structural operation of the artery.

3. Climate change

Climate change is an important aspect in the discussion of natural hazards. The changes in the climate are notable and the awareness of the local stakeholders increased. Climate change is reflected in:

- Shift of rainfall, seasons and weather
- Increased rainfall in certain locations
- Sequences of extreme weather conditions (heats and colds)
- Higher frequency of torrential rainfalls
- Glacier retreat

For the local actors it is not always clear, what effects are caused by climate change. In general the personal awareness of climate change and their effect on natural hazards has increased. Due to climate change natural hazards will become more frequent and the maintenance and construction of barriers will become more expensive. The loss of biodiversity and the impacts on the forest are effects of climate change which are underestimated.

4. Natural hazards and their impact on transport and mobility

Natural hazards have a high impact on transport and mobility. In the mobility sector especially the commuters and tourists are affected by interruptions of transport routes. The evaluation of these effects is difficult, as it can not be measured only in monetary terms. The transport sector is affected by increasing costs and loss of time. Both factors can be expressed in monetary losses. For the participants it is very important that hazard mapping tools and actions plans are implemented also for transport routes.

The yearly costs for the construction and maintenance of barriers increased over the last years. This is due to the increased risk awareness, the need for preliminary studies and the higher frequency of natural hazards. Another problem regarding natural hazards and their impact on transport and mobility is the responsibility for the closure of transport routes. For the various routes the responsibility lies in the hands of different persons. The communication between these persons is therefore very important.

5. Cooperation in preventing natural hazards

The participants have defined three areas of action referring to the cooperation in preventing natural hazards. The first is the improvement of the cooperation between the local authorities and the managers of transport infrastructures. The second is the creation of common action plans and hazard mapping tools. Thirdly, a communication platform for the improvement of the coordination between the involved stakeholders should be established.

CHAPTER V – CONCLUSIONS FOR PARAMOUNT

1. Current risk perception

The risk resulting from natural hazards is high and the frequency and intensity of natural hazards has increased. Local authorities are aware of the risks resulting from natural hazards. They are collecting and analyzing information, running computation models and integrating their experience in action plans. Not only municipalities, but also the local population and economic sectors, especially tourism is affected by natural hazards. The degree up to which natural hazards cause economic losses in the tourism sector depends on the communication and management of hazard situation. In WP7 of the project decision support systems will be elaborated. It will provide a tool, which supports the relevant actors in their decision making process.

2. Problems and focus of future actions

2.1. Information about natural hazards

The information level of the local actors is high. According to the results, the availability of information in general and especially on local level should be improved. Therefore online services providing information of the local institutions should be installed. Furthermore information on the local level should be provided more frequently. In action 6.1 and 6.2 harmonised hazard forecast models will be adapted and an operative tool for the simulation of different hazard processes on the regional level will be developed.

In addition the quality and reliability of information must be secured. In order to take appropriate decisions, the responsible actors need support for interpreting the available information. Therefore the project partner in action 7.2 will adapt and develop a decision support system.

2.2. Risk management

According to the results concerning the risk management, more importance should be given to awareness raising activities, preventive actions, education, more accurate information system and the necessary equipment on site. In WP3 the project partner perform awareness raising activities, such as communication and dissemination activities. In WP 5 and WP6 the project provides for preventive actions, such as the development of hazard maps. These extended risk assessments will improve the knowledge about regional damage potentials. Furthermore early warning systems will be implemented in certain test beds. To improve the education, during action 8.5 of the project, specific post-graduate courses will be organized.

3. Need for actions on the regional level

In general a need for actions on the regional level could be identified. This is coherent with the focus of PARAMount. According to the results on the regional level there is a lack of decision support system, risk dialogue groups and action plans. In WP 7 the project partner will develop risk dialogue groups (action 7.1), decision support systems (action 7.2) and regional measure packages for risk reduction (action 7.4).

APPENDIX

Appendix 1: Interview guideline

Interviewpartner: _____

Institution: _____

Test bed: _____

Date: _____

| | |
|---------------|--|
| Part A | Personal experience with natural hazards |
| 1 | Which experiences do you have with natural hazards affecting transport infrastructures? <ul style="list-style-type: none"> – What type of natural hazard – How often – When – Where – Which damages – Degree of damage |
| 2 | How do you assess the risk of natural hazards? <ul style="list-style-type: none"> – Is it seen as a major problem? – Do you think that it is a disadvantage for your region/business or enterprise? – If yes, in which way? |
| 3 | Please rate the degree of risk/extent to which it is a problem on the following scale: Strong influence O O O O O No influence |
| 4 | Did the risk of natural hazards increase over the last years? |
| 5 | Did your awareness for natural hazards change over the last years? |
| 6 | Who is potentially affected by natural hazards? What are other stakeholders? |
| 7 | Does the awareness differ among the stakeholders? In which way? |
| 8 | What consequences do you draw from the risk? |
| Part B | Problem perspectives |
| 9 | What are location disadvantages stemming from natural risk in general? |

| | |
|---------------|---|
| 10 | Does it impair the general attractiveness of the location? In which way? |
| 11 | Does it have an impact on the regional economy? Which impacts does it have? How do you assess the impacts? (Traffic circulation, income, employment situation...) |
| 12 | <p>Please rate the impact on the regional economy on the following scale:</p> <p>Strong influence No influence</p> <p style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </p> |
| 13 | Does it have an impact on the quality of life of the local population? Which impacts does it have? How do you assess the impacts? |
| 14 | <p>Please rate the impact on the quality of life of the local population on the following scale:</p> <p>Strong influence No influence</p> <p style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </p> |
| 15 | Who is potentially affected by the damage? |
| 16 | What are the ecological impacts of natural hazards in the region? Which impacts does it have? How do you assess the impacts? |
| 17 | <p>Please rate the ecological impact on the following scale:</p> <p>Strong influence No influence</p> <p style="text-align: center;"> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> </p> |
| 18 | <p>What are the long-term consequences of these impacts for the region?</p> <ul style="list-style-type: none"> – Economic consequences – Social consequences – Ecological consequences |
| Part C | Effects of past experience on decision making |
| 19 | Did past experiences with natural hazards and/or the awareness of natural risk affect/change your decision behavior in general? (if not, go to question 24) |
| 20 | <p>How did it affect the decision making?</p> <ul style="list-style-type: none"> – Long term/Short term decisions – Personal decisions – Management decisions <p>(Focus on target group specific decisions)</p> |
| 21 | Could you please give an example |

| | |
|---------------|---|
| 22 | What did you learn from past experiences? |
| 23 | Did these experiences lead to changes? Which changes? <ul style="list-style-type: none"> – In the region – In your organization/enterprise – In other stakeholders |
| Part D | Information about natural hazards |
| 24 | Do you feel informed about natural hazards? <ul style="list-style-type: none"> – Potential natural hazards – Potential risk – Early warning – Early alert |
| 25 | Do you have information systems about natural hazards? Who manages these? What are these? (Describe the information systems) |
| 26 | Where do you take your information from? How do you assess these information in terms of quality? |
| 27 | How important are informal information? |
| 28 | How do you implement information about natural hazards in your action plans? |
| 29 | What should be improved? |
| 30 | What information would you still need in order to make more informed/better decisions? |
| Part E | Risk perception |
| 31 | How do you assess the probability of natural hazards? |
| 32 | Please rate the probability of natural hazards on the following scale: High probability Low probability <div style="display: flex; justify-content: space-between; width: 100%;"> O O O O O </div> |
| 33 | How do you assess the damage probability resulting from natural hazards? |
| 34 | Please rate the damage probability resulting from natural hazards on the following scale: High probability Low probability <div style="display: flex; justify-content: space-between; width: 100%;"> O O O O O </div> |
| 35 | What do you know about risk mitigation measures? |
| 36 | What do you think about the risk mitigation measures? |

| | | | | | |
|--|---|------------------------------|-----------------|--|---|
| 37 | Do you use certain risk management tools or a risk management system? (If not, go to question 39) | | | | |
| 38 | <table border="0"> <tr> <td>Which tools do you use? Why?</td> <td>At which level?</td> </tr> <tr> <td> <ul style="list-style-type: none"> – Hazard mapping tools – Early warning systems – Early alert systems – Decision support systems – Risk dialogue groups – Regional action plans – Training for hazard scenarios </td> <td> <ul style="list-style-type: none"> – Whole region – Specific sites concerned – Own organization/enterprise </td> </tr> </table> | Which tools do you use? Why? | At which level? | <ul style="list-style-type: none"> – Hazard mapping tools – Early warning systems – Early alert systems – Decision support systems – Risk dialogue groups – Regional action plans – Training for hazard scenarios | <ul style="list-style-type: none"> – Whole region – Specific sites concerned – Own organization/enterprise |
| Which tools do you use? Why? | At which level? | | | | |
| <ul style="list-style-type: none"> – Hazard mapping tools – Early warning systems – Early alert systems – Decision support systems – Risk dialogue groups – Regional action plans – Training for hazard scenarios | <ul style="list-style-type: none"> – Whole region – Specific sites concerned – Own organization/enterprise | | | | |
| Part F | Requirements and requests | | | | |
| 39 | Who is, in your opinion, responsible for the development of mitigation strategies? | | | | |
| 40 | What are, in your opinion, further requirements in risk management and risk prevention? | | | | |
| 41 | To whom are these requests addressed? | | | | |
| 42 | How do you voice your concerns/requests? | | | | |
| 43 | What has been achieved so far? | | | | |
| 44 | What still needs to be done? | | | | |

Personal data

Age:

Position in the institution:

Since when:

Responsibility with regard to natural hazards:

Appendix 2: Questionnaire

1. Did you or your institution / enterprise experience a natural hazard in the past 5 years?

- ☐ Yes ☐ No (continue with question 6)

2. How often did you experience a natural hazard? _____ times

3. Which of these hazards did you experience? (More answers possible)

- ☐ Drought ☐ Earthquake ☐ Flood ☐ Landslide/Debris flow
☐ Windstorm ☐ Wildfire ☐ Avalanche ☐ Torrential flood
☐ Rockfall ☐ Other _____

4. Did these natural hazards cause damage?

- ☐ No
☐ Yes, primary/direct damage (e.g. houses destroyed)
☐ Yes, secondary/indirect damage (e.g. guest cancelled booking, reputation of the region damaged)
☐ Yes, both

5. Could you please give a rough estimation of costs? _____ Euro

6. How concerned are you about the following natural hazards affecting your location?

| | Extremely concerned | Very concerned | Concerned | Somewhat concerned | Not concerned | No statement |
|-----------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Drought | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Earthquake | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Flood | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Landslide/Debris flow | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Windstorm | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Wildfire | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Avalanche | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Torrential flood | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Rockfall | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

7. How do you assess the degree of potential damages related to the following natural hazards in your region?

| | Very high degree of damages | High degree of damages | Moderate degree of damages | Low degree of damages | Very low degree of damages | No statement |
|-----------------------|-----------------------------|--------------------------|----------------------------|--------------------------|----------------------------|--------------------------|
| Drought | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Earthquake | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Flood | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Landslide/Debris flow | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Windstorm | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Wildfire | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Avalanche | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Torrential flood | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Rockfall | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

8. From your point of view, how did the natural risk develop over the last 10 years?

☐ Highly increased ☐ Increased ☐ Stayed stable ☐ Decreased ☐ Highly decreased

9. How did your awareness of natural hazards change over the last 10 years?

☐ Highly increased ☐ Increased ☐ Stayed stable ☐ Decreased ☐ Highly decreased

10. How strong do you think are the following groups affected by natural hazards?

| | Extremely affected | Very affected | Affected | Somewhat affected | Not affected | No statement |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Population | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Public institutions (e.g. Hospitals, schools...) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Private businesses | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Managers of transport infrastructures | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Energy providers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Water suppliers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Municipalities/local authorities | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

11. Please comment on the following statements:

| | Fully agree | Agree | Neutral | Disagree | Fully disagree | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Natural hazards are seen as a major problem in the location | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| The potential of natural hazards is a disadvantage for the location | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Natural hazards impair the general attractiveness of the location | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

12. Please rate the impact of natural hazards on the regional economy.

| | Very strong impact | Strong impact | Moderate impact | Low impact | No impact | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Accessibility | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Competitiveness of the region | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Investments (e.g. in reconstruction) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Employment opportunities | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| General employment-related attractiveness | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Infrastructure (energy, water...) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| The regional economy in general | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

13. Please rate the impact of natural hazards on the quality of life of the local population.

| | Very strong impact | Strong impact | Moderate impact | Low impact | No impact | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Accessibility | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Safety | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Financial burden | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Psychological issues (living with potential of natural hazards) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Supply with food, energy, water etc. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| The quality of life in general | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

14. Please rate the ecological impact of natural hazards on the following scale.

| | Very strong impact | Strong impact | Moderate impact | Low impact | No impact | No statement |
|----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Landscape | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Natural heritage | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Forestry | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Water cleanliness | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| The environment in general | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

15. How do past experiences with natural hazards influence your decision behavior?

| | Very strong influence | Strong influence | Moderate influence | Low influence | No influence | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Long term business/institutional decisions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Short term business/institutional decisions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Long term personal decisions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Short term personal decisions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Overall | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

16. How informed do you feel about:

| | Very well informed | Well informed | Moderate informed | Uninformed | Totally uninformed | No statement |
|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Potential natural hazards | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Early warning | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Early alert | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

17. From whom/which institution do you need more or better information? _____**18. Do you have information systems about natural hazards?**

☐ Yes ☐ No

19. Which of the following tools do you use in dealing with natural hazards?(More answers possible)

- ☐ Hazard mapping tools
 ☐ Early warning systems
 ☐ Early alert systems
☐ Decision support systems
 ☐ Risk dialogue groups
 ☐ Regional action plans
☐ Training for hazard scenarios
 ☐ Other _____

20. How important are informal information?

☐ Very important
 ☐ Important
 ☐ Neither / nor
 ☐ Unimportant
 ☐ Totally unimportant

21. Where do information come from?

- ☐ Own institution/enterprise
 ☐ Local private institutions/enterprises
☐ Local government
 ☐ Regional private institutions/enterprises
☐ Regional government
 ☐ National private institutions/enterprises
☐ National government
 ☐ Other _____

22. How do you consider the following information sources?

| | Extremely reliable | Very reliable | Reliable | Partially reliable | Not reliable | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Own institution/enterprise | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Local private institutions/enterprises | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Local government | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Regional private institutions/enterprises | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Regional government | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| National private institutions/enterprises | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| National government | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

23. How does information uncertainty influence your decisions?

☐ Very strong influence ☐ Strong influence ☐ Moderate influence ☐ Low influence ☐ No influence

24. What information would you still need in order to make better informed or better decisions? _____

25. Does your institution/enterprise provide warnings?

☐ Yes ☐ No (continue with question 29)

26. To whom is the warning provided? _____

27. Does your institution/enterprise cooperate with other national and/or international enterprises/organizations to provide warnings?

☐ Yes ☐ No (continue with question 29)

28. With whom do you cooperate? _____

29. In your opinion, how important are the following factors to improve the warning services?

| | Very important | Important | Neither/nor | Unimportant | Very unimportant | No statement |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| More accurate warnings (less false alarms) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Better telecommunication | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Greater availability of data | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

30. What is the level of preparedness of your institution/enterprise to mitigate natural disasters?

☐ Totally prepared ☐ Prepared ☐ Neither/nor ☐ Unprepared ☐ Totally unprepared

31. How often do you use the following mitigation strategies?

| | Very often | Often | Rarely | Very rarely | Not used | No statement |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Structural/material changes | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Mechanical systems (e.g. barriers etc.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| People-moving systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Alarm systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sensors/detectors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Facility access screening equipment | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Training | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Communication plans | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Emergency response | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Insurance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Financial incentives | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

32. How important are in your opinion the following mitigation strategies?**33. Please rank the following mitigation strategies according their feasibility (1=most feasible, 12= not feasible).**

| | Very important | Important | Neither/nor | Unimportant | Very unimportant | No statement | Ranking |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------|
| Structural/material changes | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Mechanical systems (e.g. barriers etc.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| People-moving systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Alarm systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Sensors/detectors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Facility access screening equipment | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Training | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Communication plans | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Emergency response | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Insurance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Financial incentives | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |

34. Who is, in your opinion, responsible for the development of mitigation strategies? _____

35. At which level are the following risk management tools used in your location? (more answers possible)

| | Own organization/ enterprise | Local level | Regional level | Not used | No statement |
|-------------------------------|------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Hazard mapping tools | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Early warning systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Early alert systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Decision support systems | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Risk dialogue groups | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Regional action plans | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Training for hazard scenarios | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

36. What are, in your opinion, further requirements in risk management and risk prevention? _____

37. Personal data:Age: _____ years

Highest education: ☐ Compulsory education ☐ Higher education ☐ Vocational education
☐ University degree ☐ PhD/Doctorate ☐ Other: _____

Municipality: _____

Sector: ☐ Agriculture ☐ Tourism ☐ Other services ☐ Production
☐ Transportation ☐ Public sector ☐ Other _____

Institution/enterprise: _____Position in the institution/enterprise: _____Since when? _____Responsibility with regard to natural hazards? _____Name: _____