SCIENCE PLAN 2030+

DISASTER RISK REDUCTION

DCNA Austria

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INHALTSVERZEICHNIS

FOREWORD

In a world marked by constant change and increasing challenges, we are more than ever compelled to develop proactive and innovative approaches to disaster risk management. Natural disasters, technological accidents, and the impacts of climate change present significant challenges to our society, necessitating a reevaluation of our strategies for disaster prevention and response. The Science Plan of the Disaster Competence Network Austria (DCNA) represents a crucial step in addressing these challenges and establishing a solid scientific framework for our future endeavors.

This Science Plan is founded on the belief that close collaboration among science, practice, and policy is essential for developing effective solutions. By integrating expertise from various disciplines and fostering dialogue between researchers, practitioners, policymakers, and civil society, we create a network that facilitates the exchange of knowledge and experiences. Our goal is to develop scientifically grounded approaches to risk reduction and to enhance resilience within our society.

A central aim of the DCNA is to continuously improve capacities and capabilities in disaster management and to ensure that research findings are effectively translated into practice. The Science Plan outlines clear strategies and actions that enable us to identify current challenges and develop innovative solutions. We place particular emphasis on promoting knowledge transfer and the exchange of best practices at both national and international levels.

The research questions articulated in the Science Plan are vital to ensuring the practical relevance of science and research. They serve as a guiding framework for generating insights that address both current and future challenges in disaster prevention and response. These questions are intended to form long-term and ongoing research lines, integrated into projects and strategies to foster innovative solutions. By continuously adapting to emerging developments, we can enhance the effectiveness of our scientific efforts and strengthen the resilience of our society. Thus, collaboration with diverse stakeholders is of paramount importance.

We invite all stakeholders to actively participate in implementing the measures outlined in the Science Plan. Through collective efforts, we can enhance the resilience of our communities and lay the foundation for a sustainable and secure future. Let us seize the opportunities that science offers to collaboratively tackle the challenges of today and tomorrow.

In this spirit, I would like to thank everyone who contributed to this outcome and look forward to working together to achieve our shared goals.

Christian Resch
DCNA Managing Director

1 INTRODUCTION

Disasters are an inevitable part of our world, caused by both natural events and human actions. Their impacts can be devastating, placing severe burdens on societies, economies, and ecosystems. Given the increasing frequency and complexity of disasters in the 21st century, a comprehensive scientific approach is essential to understand their causes, mitigate their effects, and enhance societal resilience.

The Science Plan of the Disaster Competence Network Austria represents a significant achievement to better understand disaster risk and develop effective risk reduction strategies. By fostering collaboration among various scientific disciplines and integrating social, technical, and ecological perspectives, we aim to achieve a comprehensive understanding of the complexity of disaster risks.

Our explicit goal is not only to respond to disasters but also to anticipate them whenever possible and mitigate their impacts. This requires not only deepening our scientific understanding but also ensuring that this knowledge is accessible to policymakers, practitioners, and the general public.

The Science Plan is the outcome of an extensive consultation process involving experts from diverse fields, as well as representatives from government, industry, and civil society. It encompasses a wide range of research questions and priorities that focus on social scientific analyses, technical innovations, ecological approaches, and policy frameworks.

1.1 OUR PERSPECTIVE ON THE DISASTER RISK MANAGEMENT LANDSCAPE

Through the interdisciplinary and transdisciplinary orientation of the Disaster Competence Network Austria, we are able to develop a comprehensive perspective on the disaster landscape.

In our research, we define "disaster" as a serious disruption to the functioning of a community or society at any level, caused by hazardous events that interact with conditions such as exposure, vulnerability, and coping capacity.

This definition encompasses economic, human, and environmental influences and may include death, injuries, illnesses, and other negative effects on the physical, mental, and social well-being of individuals. The impacts of a disaster event can be acute and locally confined, but they are often extensive and can persist over a long period. Additionally, these events can threaten or harm the lives or health of large numbers of people, the environment, or significant assets to an extraordinary degree. Responding to or managing the threat or damage requires a coordinated deployment of the necessary resources and capabilities.

The resources and capacities of a community or society available for disaster response may be excessively strained or overwhelmed. Assistance from external sources or neighboring jurisdictions, whether at the national or international level, may be necessary.

The term "emergency" is sometimes used synonymously with "disaster," particularly in the context of biological and technological hazards or health emergencies. However, it can also refer to hazardous events that do not lead to a serious disruption in the functioning of a community or society.

1.2 NEEDS AND OBJECTIVES

The increasing interconnectedness and complexity of our modern society and supply systems heightens interdependencies and, consequently, vulnerabilities to a wide range of hazards and threats. In addition to natural events, technological accidents, health emergencies, and security threats can also have far-reaching and long-lasting effects. In line with the Sendai Framework for Disaster Risk Reduction, we view the “DCNA Science Plan 2030+” as a guide for the future development of disaster research in Austria.

The DCNA Science Plan 2030+ aims to provide a detailed and comprehensive program for the Austrian research landscape, systematically addressing all aspects of civil and disaster protection research, from natural events to technological and health risks. Additionally, the interdependencies and interactions between different hazards are taken into account to cover as many dimensions of disaster events as possible.
Through committee work within the DCNA's working groups, the urgent need for a science plan in Austria's civil and disaster protection research was identified some time ago. This need can be attributed to several indicators:

1. **Growing and increasingly interconnected threats and risks faced by Austria.**
2. **The necessity of evaluating and steering the progress and effectiveness of research and related risk mitigation measures.**
3. **The need to promote coherent and effective collaboration between various research and practitioner communities.**
4. **The need for the long-term orientation and planning of research topics and funding mechanisms.**

These indicators highlight the important role that a well-structured science plan plays in promoting excellence and innovation in research.

The DCNA Science Plan 2030+ establishes the foundation for a long-term thematic perspective in civil and disaster protection research. This perspective enables researchers to look beyond the horizon of immediate demands and ask fundamental questions that have the potential to significantly change the understanding and management of disaster risks.

Current funding programs offer only limited opportunities for such long-term research perspectives. They often focus on short-term goals and respond to immediate needs rather than paving the way for future advancements. Therefore, there is a need to align these programs with the long-term research objectives and priorities of the DCNA Science Plan 2030+.

The formulation of overarching research goals is an essential step in establishing long-term research lines and priorities. It provides a guide for the development of research strategies and the identification of priorities, allowing resources to be effectively concentrated in areas with the greatest potential for significant advancements.

Moreover, incorporating well-defined, long-term research goals and priorities into the design of funding programs enables better alignment between research funding and research needs. This can help make the research environment more attractive and productive while ensuring that funding is used in the most effective and efficient way.

The formulation of specific research priorities forms a solid foundation for improved coordination between research institutions and stakeholders. It allows for the identification of synergies, fosters collaboration, and helps avoid duplication of efforts. This can not only improve the quality and scope of research outcomes but also contribute to building a stronger and more dynamic research community.

Over the next decade, the DCNA Science Plan 2030+ will serve as a guide and catalyst for Austrian civil protection and disaster research, aimed at enhancing both societal resilience and its ability to adapt and recover from disasters or large-scale societal threats. It is our shared goal that this plan will help raise risk awareness in Austria, promote innovative solutions, and better prepare society for challenges of the 21st century.

1.3 EVIDENCE4POLICY

The interaction between science, politics, and society is crucial for effective disaster prevention and management. Evidence-based policymaking utilizes scientific insights to make informed decisions and develop political measures grounded in solid data and analysis. The DCNA Science Plan 2030+ reflects the growing need for such a scientific foundation for political decision-making.

In line with the goals of the European Commission to promote a stronger evidence base for political decisions, the DCNA Science Plan 2030+ aims to create a solid and comprehensive knowledge base for disaster research in Austria. This plan proposes research objectives and focal areas that will contribute to providing the necessary scientific data, models, and analyses.

This evidence-based approach ensures that policymakers have access to reliable and up-to-date scientific insights to support the development, implementation, and evaluation of measures for disaster prevention and management. It will also help improve the transparency and accountability of political decision-making processes and strengthen public trust in these processes.

Creating a structured science plan allows for more effective use of resources available for disaster research. It will clearly define research priorities and funding allocations while maintaining flexibility to respond to new findings and developments.

Additionally, the plan will foster closer involvement of the research community in the political process by promoting communication and collaboration between researchers and policymakers. This will help develop a common language and understanding, facilitating the application of research findings in practice.

Overall, the DCNA Science Plan 2030+ represents a crucial step in linking science and politics in disaster research in Austria. It supports the European Commission's aim to build a better evidence base for policymaking and contributes to the development of a more resilient and safer society.

1.4 STRUCTURE, DEVELOPMENT, AND FORMATION OF THE SCIENCE PLAN 2030+

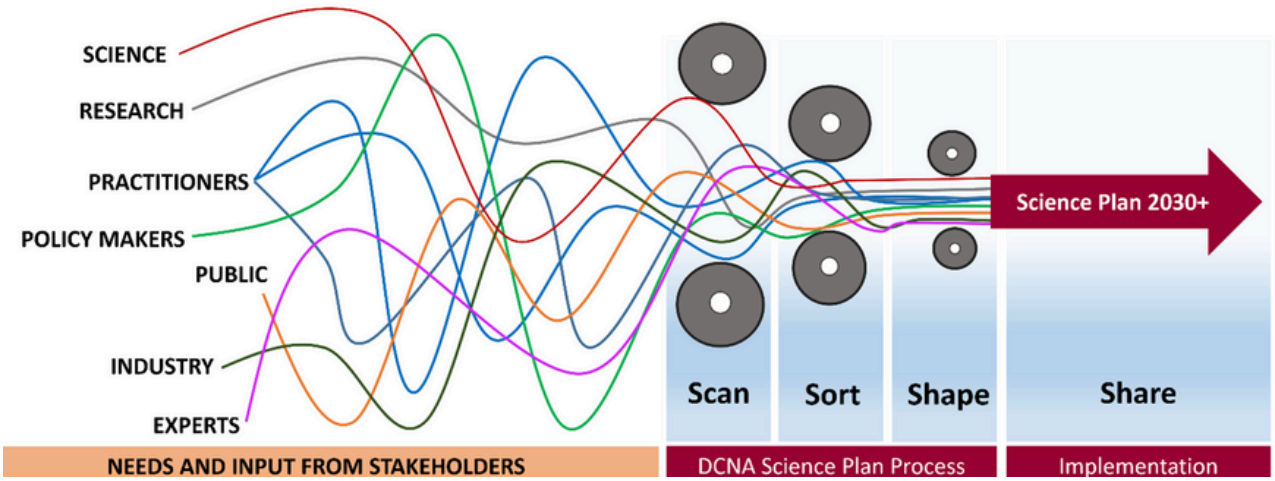
In light of the complex challenges in the field of security and disaster research, it is essential to establish an effective and coordinated research structure. To this end, six working groups were formed within the Disaster Competence Network Austria to enable continuous and long-term networking among experts and serve as a foundation for cooperation. These working groups facilitate access to expertise, models, tools, and research approaches and support the efficient coordination of excellent, contemporary, and internationally competitive activities in security and disaster research. Within the network, these expert groups form the backbone of research activities and cover the following topics:

- Mass movements, avalanches, and earthquakes
- Critical infrastructure and industrial hazards
- Floods
- Extreme weather events
- Disaster risk
- Public health

The DCNA Science Plan was developed through a participatory process that integrated the expertise and perspectives of these working groups. The structure of the document is designed to provide a comprehensive and accessible presentation of research goals, priorities, and methods. It is divided into various chapters, such as the examination of the Austrian civil protection and disaster research landscape, including the involved stakeholders and a SWOT analysis.

The specific research priorities are then examined in detail, followed by the framework conditions and a recommendation section for the implementation of the Science Plan.

Each chapter is focused on the integration of different scientific disciplines, cross-sectoral collaboration, and a practice-oriented approach. The document was developed with consideration of the long-term goals of the Disaster Competence Network Austria and in close collaboration with relevant stakeholders and interest groups to ensure that it addresses the current needs and challenges in civil protection and disaster research.



2 EUROPEAN SCIENCE-POLICY FRAMEWORK

The European research landscape in crisis and disaster management is characterized by cooperation, innovation, and a strong commitment to resilience. Institutions, networks, and frameworks are constantly evolving to address new challenges posed by climate change, technological advancements, and an increasingly interconnected world. Through initiatives such as Horizon Europe, the European Green Deal, and the EU Civil Protection Mechanism, Europe promotes an inclusive, data-driven approach to disaster preparedness that benefits not only the continent but also global efforts in disaster resilience.

Policies aimed at disaster risk reduction follow an integrated approach to managing both natural and man-made hazards, focusing on prevention, preparedness, and disaster response (including recovery and learning). This is reflected in many interconnected policy actions and legally binding frameworks that span various sectors and involve numerous EU directorates as well as intergovernmental agencies. These actors are involved in preparing and implementing various legal instruments, such as decisions, general frameworks, directives, communications, strategies, and plans.

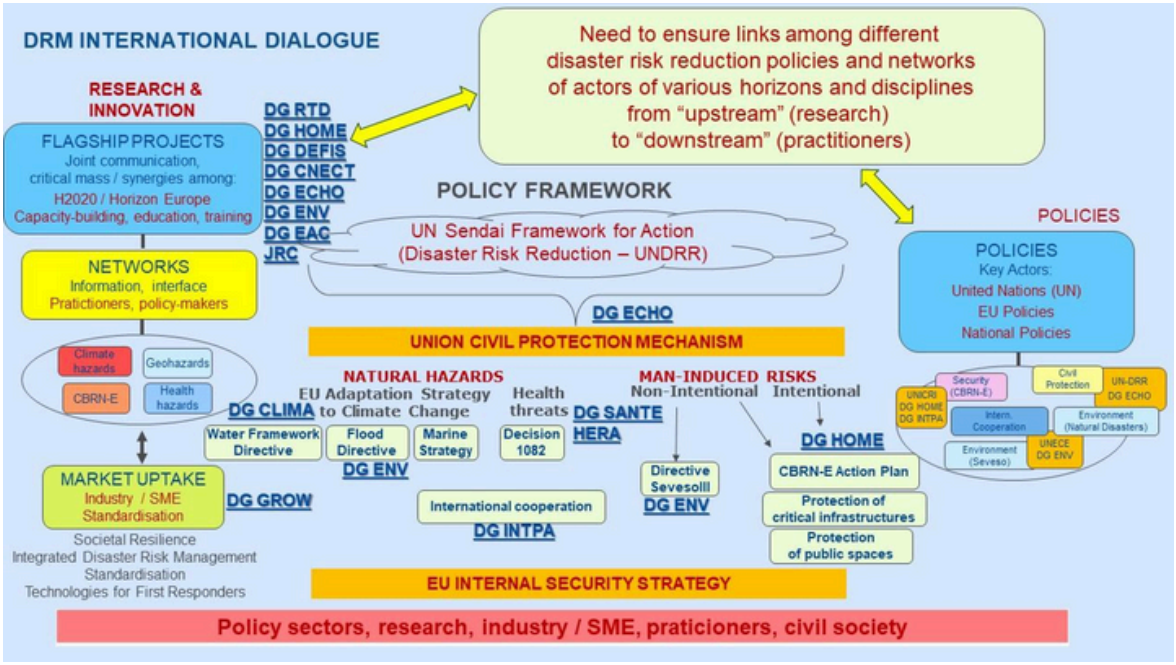
Within the EU, an international dialogue on disaster risk management takes place at both research and policy levels. Key institutional and sector-specific actors, as well as funding mechanisms, illustrate the complexity of this dialogue, which calls for improved coordination of existing and emerging initiatives.

Science and research to directly support the Sendai Framework are embedded in the Horizon Europe program – Cluster 3 (Civil Security for Society) under the destination “Disaster-Resilient Societies”. The aim is to achieve the following impact: “Losses from natural disasters, accidents, and man-made disasters are systematically reduced through improved disaster preparedness based on preventive measures, better societal preparedness and resilience, and improved disaster management”. In this context, the addressed topics and projects aim to achieve one or more of the following specific effects:

- Better utilization of the latest scientific findings (e.g., from research programs and institutions) and integrated technologies (e.g., Earth observation, in-situ data collection, advanced modeling, AI) for a better understanding of high-impact hazards and complex cascading events, as well as improved prevention, preparedness, response, and recovery tools.
- Increased understanding and improved knowledge and situational awareness of disaster-related risks by citizens, empowering them to act innovatively and thus strengthen the resilience of European society.
- More efficient cross-sectoral, cross-disciplinary, and cross-border coordination of the DRM cycle and governance (from scientific research to prevention, preparedness, mitigation, response, and recovery, including knowledge transfer and awareness of innovative solutions) at international to local levels.
- Improved collaboration, interactions, and cross-disciplinary dialogue, as well as networks between the scientific community, research institutions, and first and second responders through targeted networking and cooperation measures that promote faster transfer of scientific results into practice.
- Support for harmonized and/or standardized and interoperable guidelines, protocols, tools, and technologies in crisis management, natural disasters, and CBRN-E (chemical, biological, radiological, nuclear, and explosive risks).
- Strengthening the capacity of first responders in all phases of operations during any type of natural or man-made disaster, enabling them to better prepare for operations, access improved situational information, respond faster, more safely, and efficiently to incidents, and carry out victim identification, triage, and care more effectively.
- Improved capabilities for impact forecasting and scenario development to enhance stress testing of critical facilities and adapt protection and resilience measures.
- Enhanced abilities in rescue operations and the management of early emergency phases considering extreme climatic events and/or geological hazards that may threaten urban areas (e.g., wildfires, floods, earthquakes, tsunamis, volcanic eruptions, etc.).

2.1 SCIENTIFIC INTEGRATION INITIATIVES AND MODELS

Disaster risk reduction in Europe is strongly integrated into international and national policy frameworks that require close co-operation between science, policy and practice. In order to minimize the impact of natural and man-made disasters, scientific findings must be directly incorporated into political decision-making processes and practical implementation. This approach enables a comprehensive view of risks and their management.



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Below are the key political initiatives, frameworks, and networks that form the foundation for DRR (Disaster Risk Reduction) in Europe, illustrating the close integration of research, policy, and international cooperation.

- The **Sendai Framework for Disaster Risk Reduction** 2015-2030 ("Building the Resilience of Nations and Communities to Disasters"), closely followed by DG ECHO, is linked with the European Forum for Disaster Risk Reduction of the United Nations (UNDRR), which has established the **European Science and Technology Advisory Group** (E-STAG).
- The **European Union Civil Protection Mechanism** (UCPM), now supported by the **EU Knowledge Network for Civil Protection** (UCPKN).
- Disaster preparedness is also addressed by the **EU Internal Security Strategy** and the resulting European Security Agenda, adopted in April 2015 by the Directorate-General for Home Affairs (DG HOME). The aforementioned Horizon Europe program (Cluster 3: Civil Security for Society) is closely related to this agenda, as is the CERIS platform (**Community of European Research and Innovation for Security**).
- Consumer Health Protection (DG SANTE).
- EU Strategy on Adaptation to Climate Change (DG CLIMA).
- The Water Framework Directive and Floods Directive (DG ENV), supplemented by working groups operating under the Common Implementation Strategy.
- The CBRN Action Plan to enhance preparedness for chemical, biological, radiological, and nuclear security risks (DG HOME).
- Environmental and industrial risks, Seveso Directive (DG ENV).

The funding for research and capacity-building relevant to disaster risk reduction is orchestrated by various programs of the European Commission. The main programs include:

- Horizon Europe (2021–2027): The key European research funding program supports DRR-relevant projects in various areas. The most important clusters are:
  - Cluster 1: **Health** (Directorates-General: RTD, SANTE, CNECT & HERA): Research addressing health risks posed by disasters, such as pandemics or large-scale accidents.
  - Cluster 3: **Security** (Directorates-General: HOME, CNECT & RTD): Focus on protecting society from security threats, including preparedness and response to disasters.
  - Cluster 4: **Digital & Space** (Directorates-General: CNECT, DEFIS, GROW & RTD): Use of digital technologies and space solutions, e.g., for Earth observation, contributing to disaster preparedness and management.
  - Cluster 5: **Climate, Energy & Mobility** (Directorates-General: CLIMA, ENER, MOVE & RTD): Research on the impacts of climate change and strengthening resilience against climate-related disasters.
  - **Marie Skłodowska-Curie Fellowships**: This program supports researcher mobility and international knowledge exchange, essential for fostering innovative approaches in disaster risk reduction.
- In addition to research funding, capacity-building and training programs play a vital role in strengthening disaster preparedness. These programs aim to improve the skills and knowledge of disaster management professionals and promote cross-border collaboration. Relevant initiatives include:
  - Projects on prevention, preparedness, and response in disaster risk management (Knowledge Action for Prevention and Preparedness – Directorate-General ECHO): These projects aim to increase disaster resilience by prioritizing prevention and preparedness.
  - Internal Security Fund (Directorate-General HOME): This fund supports projects that contribute to ensuring internal security in the EU, including measures to improve crisis management.
  - European Regional Development Fund (ERDF): The ERDF helps regions strengthen their resilience to disasters and improve their disaster management capacity.

The planning of research programs lies with the respective Directorates-General of the European Commission. However, the management and implementation of projects are increasingly delegated to the Commission's executive agencies. The main actors include the Research Executive Agency (REA) and the Executive Agency for Small and Medium-sized Enterprises (EASME). The former is responsible for managing a large portion of Horizon Europe-funded research projects and supports the implementation of the EU research agenda. EASME promotes innovation and competitiveness in small and medium-sized enterprises, including projects that contribute to disaster risk reduction.

2.2 CHALLENGES AND CROSS-SECTORAL COOPERATION

One of the greatest challenges for science and research in disaster risk reduction lies in the fact that the various threats are spread across different disciplines and sectors. These range from natural hazards (extreme weather events, geological risks) to CBRN-E threats (chemical, biological, radiological, nuclear, and explosive hazards), which can occur either accidentally or intentionally, such as industrial accidents or terrorist attacks. The development and implementation of countermeasures is a complex and ambitious challenge, as it involves a wide variety of actors in the member states, each with specific national approaches to crisis management. The EU framework provides an opportunity to improve coordination and knowledge sharing between these various national approaches and to develop a common EU-wide vision with a shared strategy and its implementation.

Building communities and networks is crucial in this context to bring together key stakeholders from science, policy, industry (including SMEs and start-ups), operational organizations, civil society, and other interest groups. The key groups include:

- Political decision-makers and stakeholders at EU, national, and regional levels
- Scientists from various organizations and disciplines

- Various industries (including small and medium-sized enterprises)
- Operational units (e.g., emergency services, police, civil protection, military units, laboratories), training centers, command and control centers
- Crisis management decision-makers at all levels of administration (national, regional, and local)
- The general public, including civil society, NGOs, and educational institutions (e.g., schools)

While some of these actors already participate in international meetings, this is less the case for SMEs, regional/local crisis management actors, and the general public. New ways must be found to ensure that information can circulate freely both "horizontally" and "vertically," in order to enhance the outcomes of research and capacity-building projects. Knowledge transfer must be coordinated at various levels to address the following challenges:

2.2.1 HORIZONTAL INTERACTION

- **Policy to policy**: while International and EU policies are developed in close consultation among different sectors, in practice few interactions take place at the implementation level among sectors within the Member States. This is partly due to insufficient sharing of information and joint actions.
- **Science to science**: EU-funded projects respond to topics which are generally based on well-defined policy requirements. We might hence expect that (research and capacity-building) projects supporting common policy goals will establish synergies between themselves, but – owing to various considerations (IPR and classified information in particular) – this rarely happens without a push from the Commission. Here again, sharing information and developing interactions on a regular basis should become a practice that the Commission should ask to projects.
- **Policy to science**: an essential component of the policy to science interaction is the capacity for policy-makers to identify research needs on the short to long term and to communicate these needs in a timely way to the research community. In this way programming, research development and implementation can match the policy timeline (e.g. access to the scientific state-of-the-art, short-term research / capacity building, longer term research goals, pre- and co-normative research).
- **Science to policy**: this is obviously directly linked to the above, with the requirement for the scientific community to format/translate research information in a way which is tailor-made to policy applications, basically responding to well specified technical challenges. This is the subject of the mapping described in this document.

2.2.2 VERTICAL INTERACTION

- **International/EU to National**: at international/EU level, policies are elaborated by relevant organisations (e.g. UN for various conventions and European Commission for EU-DRR policies). The links to the National level take place through Committees (e.g. CBRN Advisory Group, Civil Protection Committee, H2020 Committees) in which Member States are represented.
- **National to Regional/Local**: once Member State's Committee representatives are duly informed, it is to be expected that appropriate relays with regional / local implementers will then take place under the MS responsibility. This also requires a level of coordination which depends upon the willingness and capacity of each Member State.

2.3 BRIDGING NEEDS

The needs to establish a science-policy interface enabling a dialogue among different actors (policy-makers, scientists covering various disciplines, operational policy implementers) have been discussed since more than 20 years, and initiatives became effective in some sectors, e.g. water policies, from mid-2000 onward.

In the 2010s, it became clear that research programming in support of policy implementation and development had to enlarge the dialogue not only to policy and scientific actors but also to a wider commu-

nity involving industry/SMEs, operational actors (first and second responders) and the civil society. This has been reflected in an enhanced involvement of industrial sectors, practitioners and civil society organisations in projects funded under the FP7 and H2020 programmes, as well as in community-building initiatives reinforcing the dialogue among different actors.

The 2020s decade is pursuing this trend with more structured and effective networking approaches with, however, a risk that the multiplication of initiatives leads to fragmentation. In this respect, bridging of various community-building initiatives is essential to streamline interactions that will ultimately lead to an enhanced take-up of research outputs and support to policy implementation and development. In the DRR sector, interactions are in place in the framework of different organisations / projects, and a bridging mechanism would be beneficial to all parties involved. Examples of running initiatives are listed below (the list is not exhaustive):

- Working Groups of the Water Framework Directive Common Implementation Strategy: Operational since 2001, these working groups have the mission to monitor the implementation of water policy implementation, including the Flood Directive. Links with research developments have been established in this framework since 2006.
- Community of Users: This initiative, started in early 2014 with a focus on disaster-resilient society's topics, has now turned into CERIS which is described in details in the Annex of this document.
- DRMKC: Launched by the Joint Research Centre in September 2015, the Disaster Risk Management Knowledge Centre is closely related to the Union Civil Protection Knowledge Network (UCPKN).
- IFAFRI: The International Forum to Advance First Responders Innovation is an initiative launched in 2015 by the US Department of Homeland Security which gathers a range of EU and non-EU countries (government representatives), as well as the Commission, to identify gaps, discuss research needs, and enhance / expand the development of affordable, innovative technology for first responders worldwide.
- E-STAG: The European Scientific and Technological Advisory Group (E-STAG) has been established in 2019 to support the implementation of the Sendai Framework on Disaster Risk Reduction in Europe.
- Networks of practitioners: Funded in H2020, several networks of practitioners play a clear role of interface among research, policies and operational units. Examples relevant to DRM are the FIRE-IN, NO-FEAR, DARENet, eNOTICE etc.
- National initiatives: Several national networking structures bring policy, scientific and practitioners altogether along similar principles as the ones pursued by CERIS. Besides DCNA, examples are the Spanish Community of Users, the ForAn network (Germany), the Association Française pour la Prévention des Catastrophes Naturelles (AFPCNT), etc.

In an ideal setting, a networking mechanism would establish "bridges" among these various initiatives, taking into account that most of them are directly or indirectly involved in CERIS events and discussions. In many instances, CERIS objectives (for what concerns the Horizon Europe Cluster 3 Disaster-Resilient Societies Destination) meet many of the goals of the above networks. Joining efforts to maximise synergies and effectiveness of these initiatives would benefit to stronger interactions among DRR actors in the light of the objectives below:

Enhance collaboration between scientists, practitioners, policy- and decision-makers
Most of the above networks are contributing to this objective through exchanges of knowledge among various DRR actors at different levels and across disciplines. Notwithstanding the fact that the focus may be addressed primarily on a policy-related primary audience (e.g. UCPM Member and Participant States, UN Regional platforms), the collaboration scope has been extended by networks such as CERIS and UCPKN among relevant authorities at different levels, first responders' organisations, universities, research and training centres, and civil society organisations in the research framework. Interactions with E-STAG would further strengthen this objective.

Efforts have been made to regularly survey EU-funded actions in the DRR sector and practical links are being developed among projects funded by different programmes mentioned in section 3. Common goals

also related to the willingness to provide access to tools, technologies, methodologies developed by research and capacity-building projects to the "end users", possibly linking them to training courses and capacity-building opportunities or networking events. The UCPKN online platform aiming to serve as the information and collaboration hub for the civil protection and disaster risk management community in Europe is going exactly in this direction.

Support knowledge sharing and learning to strengthen collective capacities
The H2020 / Horizon Europe combined with CERIS dialogues have enabled DRR actors to share their knowledge, lessons learnt, practices since the early stages of the Community of Users (CoU). Initiatives were developed to convey messages via national / regional platforms but, to date, this is not fully effective, and CERIS is acting more at European than at national/regional level. Links with the UCPKN and its "prime audience" (i.e. UCPM Member and Participating States) are of great value in conveying relevant research outputs and recommendations. Further coordinated interactions with UN-DRR via E-STAG would benefit this knowledge gathering at UN level.

Activities identified to implement this objective include workshops, seminars, training courses, exercises, exchanges of experts, projects, peer reviews and advisory missions, in a format that is aimed to be revisited by the Knowledge Network in order to boost uptake of research results. This is also one of the objectives of CERIS, hence actions might possibly be joint from 2024 onward.

Strengthening research uptake at all stages of disaster risk management (prevention, preparedness, response and recovery)
Links among DG ECHO and the scientific community and operational actors active in DRS projects have been considerably strengthened from 2014 onward, enabling an effective feedback from the policy side and feeding the scientific and research needs of the civil protection and disaster risk management community into Horizon Europe programming. The UCPKN plays an active role in pursuing these links that are already developed by the DRMKC. Dialogue opportunities will be pursued via joint events.

In addition, a closer partnership with relevant programmes which are funding Research and Innovation Actions, such as the Horizon's Cluster 3, Civil Security for Society will be even more beneficial with a regular engagement with the UCPM Member and Participating States, identifying and channeling their research needs to the EU level. Capacity-building funding opportunities for small-scale projects (funded by DG ECHO or HOME) and possible cooperation with relevant disaster risk management project consortia will be of great potential to strengthen joint initiatives with close links to CERIS, facilitating the transfer of research and innovation results.

On the longer-term, from 2024 onward, a joint planning of activities (workshops, side-events in international conferences, project-to-policy dialogues, gaps analyses, identification of research needs, research uptake actions etc.) might be established among UCPKN, CERIS and E-STAG, with possible links to national initiatives, forming the basis for an operational innovation hub in the DRR sector.

2.3.1 COMMUNITY OF EUROPEAN RESEARCH & INNOVATION FOR SECURITY

Since 2014, the former Community of Users (CoU), has brought together policy-makers, scientists, practitioners, industry/SMEs, and civil society organisations at international and regional level, creating dialogues around research in various thematic areas and building "bridges" among different sectors (areas, disciplines and actors). These dialogues and events had a clear effect on enhancing the participation of practitioners in the H2020 Security Research framework, in particular by promoting research results, including the identification and promotion of the most promising tools that might have the potential to be taken up by them. They also stimulated synergies among different thematic areas of security research and between research and capacity-building projects. With the larger scope of CERIS, a top-down direction is

initiated in terms of objectives to be met and issues to be addressed, directly supporting the implementation and developments of Cluster 3 Horizon Europe for the years 2023-2027. CERIS is embedded into an Action Plan to increase the impact and effectiveness of security R&I in the thematic areas addressed through research along the following objectives:

- Raising awareness on major updates in relevant policy sectors and on research and non-research initiatives, analyse impacts and provide policy recommendations.
- Analysing identified capability needs and gaps and prioritisation of related research orientations based, at least, on criticality and urgency, in order to produce recommendations for a civil security research agenda.
- Identifying solutions available to address the gaps, differentiating state-of-the-art technologies (off-the-shelf and Development & Integration products) and security research trends. It will also take into account other considerations, such as technological maturity, operational relevance, societal acceptance, cost-effectiveness, etc.
- Translating capability gaps and potential solutions into research needs (including scenarios linking research needs to capabilities and societal appropriation, Technology Readiness Levels, development roadmaps, research action types, perspectives of research uptake, etc.) and get feedback from practitioners about prioritisation of the needs, inputs to research programming and involvement in research activities.
- Identifying funding opportunities and synergies between different funding instruments, and propose measures to facilitate them.
- Identifying standardisation needs through existing networks/platforms and prioritise them in close consultations with policy-makers and practitioners.
- Integrating the views of citizens so as to promote responsible research and innovation which respects ethical considerations and civil liberties.

The CERIS framework is based along the following components:

- A permanent Expert Group (65 in total) covering the five thematic areas and providing directions for the future work as well as independent advice to the European Commission.
- Thematic Workshops gathering inputs from stakeholders/experts in the different fields and helping deepening the knowledge about relevant issues (organised by the Commission with secretarial support and contributions from projects). The Thematic Workshops aim to collect inputs from various sources, including from EU-funded projects (EU research as well as other programmes, e.g. capacity-building, training, education),
- Interaction with existing networks such as EU-funded Knowledge Networks or regional Communities of Users / Practitioners networks.
- Knowledge exchange and analytical tools, comprising an internet platform for dissemination of CERIS results (linked to the Explorer database of the JRC DRMKC and regular project/programme mapping), as well as the integration of work done by the future Knowledge Networks and relevant SSRI projects.
- From 2024 onward, CERIS State-of-the-art and Emerging Trends Reports (thereafter referred to as CERIS Reports) will be prepared by the Commission with the support of the CERIS Expert Group. These reports will be used as multi-purpose documents (summary of progress made and gaps identified, findings and recommendations for further work, dissemination of other key information, next steps etc.).

2.3.2 UNION CIVIL PROTECTION KNOWLEDGE NETWORK

The concept of the Union Civil Protection Knowledge Network (the “Knowledge Network”) was first introduced during the 2019 revision of the Union Civil Protection Mechanism (UCPM) legislation. It has been set up to strengthen the efficiency and effectiveness of civil protection training and exercises, to promote innovation and dialogue, and to enhance cooperation in prevention, preparedness and response between Member States’ national civil protection authorities and services. In many instances, the Knowledge Network is to work closely with the UCPM’s Emergency Response Coordination Centre (ERCC). The

Knowledge Network is meant to be a hub that connects first responders, disaster risk managers, scientists, and decision-makers and matches their needs for expertise and good practices with state-of-the-art methodologies, tools, solutions, and resources. It is conceived as an inclusive community whose members can learn from each other, share their knowledge, and work together. With such an ambitious agenda, the Union Civil Protection Knowledge Network has the potential to bring a significant contribution to the sector in the coming years, with a gradual expansion to reach maturity by 2026. Ultimately, it will be in a position to help reinforce cooperation and upgrade knowledge, expertise, and know-how at all levels and across communities, organisations, and countries to strengthen the EU's overall disaster risk assessment and management capacity and resilience. The Strategic Plan 2022-2026 outlines the position of the Knowledge Network within a broader civil protection and disaster risk management system and defines its vision, mission, and strategic goals to be pursued in the next five years, namely:

Goal 1: Enhance collaboration between scientists, practitioners, policy- and decision makers in civil protection and disaster risk management, facilitating communication and partnership building between civil protection and disaster risk management actors, at different levels and across disciplines:
At the initial stage, the Knowledge Network will focus on working closely with its primary audience, i.e. the civil protection and disaster risk management actors of the UCPM Member and Participating States: relevant authorities at different levels, first responders' organisations, universities, research and training centres, and civil society organisations. Along with its growing maturity, a gradual expansion in the scope of its engagement will follow, to include a broader set of stakeholders, e.g., from other sectors, relevant international organisations and actors from third countries. This goal is supported by funded projects such as the Knowledge Network Partnerships (first piloted in 2020) and UCPM Prevention and Preparedness Projects in Civil Protection. By giving access to a wide and comprehensive array of products, tools, methodologies, and services and providing training courses and capacity building opportunities or networking events, the community will offer an informal space for practitioners, policymakers, and researchers to connect, share and grow their knowledge, with the view of strengthening the UCPM at the grassroots level. To support its work with and for the community, the Knowledge Network is gradually developing a dedicated online platform, which will ultimately serve as the information and collaboration hub for the civil protection and disaster risk management community in Europe.

Goal 2: Support knowledge sharing and learning to strengthen the collective capacity to prevent, prepare for and respond effectively to emergencies, enabling civil protection and disaster risk management actors to develop and share their knowledge, expertise, lessons learnt and good practices in an effective and efficient way
This involves high-quality training, enhanced preparedness to multi-hazard, cross-sectoral and cross-border disaster scenarios, also in view of emerging and future risks, promotion of disaster risk management policies and practices at the European, regional, national and community level, and supporting higher visibility of and facilitating access to relevant activities and results of EU funded projects. The Union Civil Protection Knowledge Network will address the fundamental questions on how to better prevent, prepare for and respond to disasters by putting knowledge and knowledge-sharing at the forefront of disaster risk management, acting as a knowledge broker. This will include workshops, seminars, training courses, exercises, exchanges of experts, projects, peer reviews and advisory missions, in a format that will be revisited by the Knowledge Network. A dedicated working space and streamlined visibility of knowledge created through EU-funded projects will contribute to their sustainability, by supporting engagement and links with other stakeholders and uptake of research results. In close cooperation with international organisations, the Enlargement and the European Neighbourhood Policy countries, the Knowledge Network will ensure that the knowledge knows no borders and that it serves all people in need.

Goal 3: "Research that Matters" – Strengthen application of research in civil protection and disaster risk management planning and operations
Linking the scientific community with operational actors within the UCPM and enabling an effective feedback mechanism between them, identifying and feeding the scientific and research needs of the civil protection and disaster risk management community into national and international research agendas,

strengthening the development, sharing and use of scientific knowledge in all phases of disaster risk management, and making the scientific knowledge easily accessible and operational, so that it can respond to the needs of different actors.. Innovation cannot happen without exploring new ideas and technologies: scientific research plays a pivotal role in this process. It also has a strong role to play in the UCPM, as it provides evidence to support coherent planning and decision-making processes. The UCPKN will act as a collaborative and neutral space to connect the scientific community to the operational actors within the UCPM. At the initial stage, scientific activities already developed by the Commission's Disaster Risk Management Knowledge Centre (DRMKC) will be integrated through closer engagement of the UCPM Member and Participating States, including further development of a Risk Data Hub platform. Dialogue opportunities for the scientific community, practitioners, policy- and decision makers will be pursued through DRMKC Annual Seminar, workshops, seminars. Collaboration with and between existing scientific networks and communities in the UCPM Member and Participating States will be a key prerequisite for this process to succeed. To this end, the UCPKN will form a close partnership with relevant programmes that are funding Research and Innovation Actions, such as the Horizon's Cluster 3, Civil Security for Society. Through regular engagement with the UCPM Member and Participating States, it will also support identifying and channeling their research needs to the EU level. In addition, the Knowledge Network will provide its own funding opportunities for small-scale projects and cooperate with relevant disaster risk management project consortia, in particular those active in the Community for European Research and Innovation for Security (CERIS). These interactions will facilitate the transfer of research and innovation results and enable testing of new approaches, tools, and technologies, as well as raising awareness about and promoting tested solutions in the civil protection and disaster risk management planning and operations. Effectively, it will position the Knowledge Network as the innovation catalyst for the UCPM and its community. The UCPKN governance structure is composed of advisory bodies (Knowledge Network Board and Pillar's working groups) and a secretariat. The Knowledge Network Board (composed of a Commission representative and a representative from each Member State, with observers from UCPM Participating States) acts primarily as a strategic forum, advising the Commission on the strategic orientation of the Knowledge Network, monitoring activities and endorsing the annual report.

2.3.3 EUROPEAN SCIENCE AND TECHNOLOGY ADVISORY GROUP

The UNDRR European Scientific and Technical Advisory Group (E-STAG) is a group of experts nominated by Governments that provides scientific and technical support to UNDRR's implementation of the Sendai Framework for Disaster Risk Reduction in Europe and Central Asia. E-STAG's efforts are geared towards enhancing disaster risk reduction DRR policies and actions through the inclusion of expertise from the science and technology sphere. The group's activities include contributing to research-informed and evidence-based implementation of DRR strategies, assessing gaps and challenges, and formulating recommendations to support national and local authorities, policy and decision-makers, private investors, and other DRR stakeholders.

E-STAG's contributions cover a wide range of activities, from participating in the Midterm Review of the Sendai Framework for Disaster Risk Reduction 2015-2030 to authoring chapters and making scientific contributions to the UNDRR Regional Assessment Report on Disaster Risk Reduction 2023 for Europe and Central Asia. They also include enhancing the robustness of the Union Civil Protection Mechanism's Wildfire Peer Review Assessment Framework and participating in cross-continental collaboration with the UNDRR regional STAG for the Americas, among others.

The shared goal of CERIS and E-STAG is to enhance DRR efforts by facilitating the integration of scientific research and technological innovation into policy and practice, in line with the objectives of the Sendai Framework for Disaster Risk Reduction.

3 AUSTRIAN DISASTER RESEARCH LANDSCAPE

In a country characterized by a rich diversity of natural landscapes—from the Alps to river valleys—disaster research plays a critical role in public safety. Austria's disaster research landscape has traditionally focused heavily on the study, analysis, and management of natural hazards, spanning various disciplines from geology, hydrology, meteorology, and environmental sciences to sociology and technical sciences. Its strength lies in its highly developed infrastructure and technological capabilities, which enable precise predictions and analyses across many areas. This is supported by a strong tradition in geosciences and a high level of expertise in technological applications. There is also growing awareness and increased engagement by Austrian research institutions in the study of epidemics, pandemics, and long-term, large-scale infrastructure failures.

Austrian research institutions are often at the forefront of developing new methods for risk assessment and disaster management. Despite these strengths, disaster research in Austria faces challenges. Funding limitations and resource allocation restrict research in less prioritized areas. Furthermore, there is the challenge of keeping pace with the rapidly changing patterns of natural events and other threats influenced by climate change. The evolving nature of climate change and the increasing frequency and intensity of natural events, however, also present opportunities for research.

The effectiveness of disaster research depends not only on technical and scientific expertise but also on the ability to adapt to a rapidly changing environment and raise public awareness about the importance of disaster preparedness. Overall, Austria's disaster research landscape is a key factor in national security and the well-being of its citizens. It is not isolated but closely connected to global research communities and policies, enhancing its relevance and impact on the international level of disaster research and management.

3.1 RESEARCH FACILITIES, INSTITUTIONS AND NETWORK

Given the importance of scientific expertise, models, and innovations in crisis and disaster management, there are also significant efforts in Austria to advance crisis and disaster research. An empirically grounded overview of the current landscape of actors in this field is essential for accurately identifying challenges and areas requiring action, as well as for shaping relevant regional, academic, and funding policies. This forms the evidence base needed to provide forward-looking impulses for the further development of the field, successful integration of knowledge production and transfer, and strengthening the country’s position as a hub for science and innovation.

Although there are some efforts to systematize research areas, a comprehensive assessment is not yet available. Existing initiatives for systematization include:

- KIRAS Security Research Map
- Competence maps of networks such as Climate Change Center Austria (CCCA), the Austrian Biodiversity Network, and the Disaster Competence Network Austria (DCNA)

Special attention should be given to assessing the institutional framework and the situation of scientists in the field. Relevant aspects include:

- Degree of institutionalization (institutional integration in academic and non-academic research and teaching, e.g., research centers, academic chairs, regular study programs)
- Relevant national networks (DCNA, we4DRR, CCCA, Climate Change Adaptation Network)
- Events (Disaster Research Days, Natural Hazards Conference)
- Funding programs (KIRAS Security Research)
- Composition of scientific personnel
- Distribution of resources (funding sources such as core budgets versus contract-/grant-based research, access to (inter)national networks, autonomy in topic selection)
- Dissemination practices (knowledge transfer, implementation in teaching)
- Subjective and collective norms and values (research ethics, output evaluation)

These factors play a pivotal role in shaping the direction of crisis and disaster research in Austria and highlight the need for systematic evaluation and support mechanisms.

3.1 SWOT ANALYSIS

The SWOT analysis is an instrument for evaluating the strengths, weaknesses, opportunities and risks of organisations, systems or structures. As part of the preparation of the DCNA Science Plan 2030+ and in the course of the network and project work in the DCNA, there is always the opportunity to analyse strengths, weaknesses, but also potentials and challenges for disaster research quasi in situ.

The following brief analysis is intended to highlight the main capabilities and limitations in the field of disaster research in Austria, identify potential for technological and methodological innovations and evaluate risks that could influence research and development in this area.

3.2.1 WHAT ARE THE STRENGTHS OF AUSTRIAN DISASTER RESEARCH?

Disaster research in Austria is characterized by several strengths that position it as an important player internationally in this field. A detailed analysis reveals a multifaceted picture, showcasing various strengths of Austrian disaster research:

- **Excellent Research Institutions**: Austria is home to renowned universities and research institutes that have specialized for decades in environmental influences, geology, meteorology, and related fields. These institutions frequently collaborate internationally, significantly enhancing the quality and scope of their outputs in disaster research.
- **Geographical Diversity**: The varied landscape of Austria, including alpine regions, forests, and river systems, provides a rich field for investigating a wide range of natural events such as avalanches, floods, and landslides. This diversity enables comprehensive research on different types of disaster-triggering natural events.
- **Technological Infrastructure**: Austria's investments in technology, including advanced monitoring and data analysis tools, support detailed and accurate forecasting, analysis, and management of disaster events.
- **Strong Political and Administrative Support**: Austrian governments have placed great emphasis on disaster prevention and management for years, supporting research in this area. This support includes funding, policy-making, and the integration of research findings into practical applications.
- **Public Awareness and Education**: There is a high level of public awareness and education about disaster events in Austria. This is further supported by strong volunteer involvement in disaster protection efforts. This general attitude bolsters disaster research and the implementation of its findings.
- **Integrated Approach to Disaster Management**: Austria fundamentally pursues an integrated approach that combines research, policy, and practice. This holistic approach aids in developing effective disaster management strategies based on the latest research findings.
- **International Collaboration**: Austrian research institutions, companies, and authorities involved in safety-related tasks actively participate in international disaster research initiatives, thereby engaging in the global exchange of knowledge and experiences.

3.2.2 WHAT ARE THE WEAKNESSES IN THE RESEARCH LANDSCAPE?

Despite its many strengths, disaster research in Austria faces several challenges. Weaknesses in this area include limited funding, which can restrict the conduct of long-term studies or the development of innovative research methods, as well as disparities in resource allocation that may lead to knowledge gaps in certain aspects of disaster management.

Through the activities and collaborations of the Disaster Competence Network Austria, the following weaknesses in Austrian disaster research have been identified:

- **Fragmentation**: Disaster research in Austria is highly fragmented and lacks a unified strategy.
- **Funding:** Although the Austrian government supports disaster research, there are restrictions on funding for excellent and applied research, particularly for long-term studies or innovative but untested research methods. This can hinder the development of new technologies or approaches.
- **Governance, Coordination, and Resource Allocation**: Resources, personnel, and research infrastructure are not evenly distributed across all areas of disaster research. Consequently, some areas receive less attention, leading to knowledge gaps and inadequate preparedness for disaster events.
- **Data Integration**: While Austria and its research institutions possess advanced data collection technologies, integrating data from various sources (such as geological, meteorological, and socioeconomic data) into a coherent and actionable format poses a challenge. This limits the effectiveness of disaster forecasts and response strategies.
- **Adaptation to Climate Change**: The evolving nature of climate change may result in delays in adapting research methodologies and disaster response strategies to new types of risks or changing patterns of known hazards.
- **Civil Protection Research**: Despite increasing military and state-level threats, civil protection research is underrepresented and poorly developed within the Austrian research landscape. This represents a critical gap regarding comprehensive national defense.
- **Inter- and Transdisciplinary Collaboration**: Although there is extensive collaboration within the field of disaster research, there is room for improvement in inter- and transdisciplinary collaboration. Both forms of collaboration are crucial for holistic disaster management. Integrating humanities and social sciences, for example, can enhance understanding of societal responses to disasters.
- **Public Engagement and Communication**: Although there is a high level of public awareness, it is challenging to translate complex research findings into actionable recommendations for the general public. Effective communication strategies are essential for preparedness and risk reduction.
- **Reliance on Traditional Methods**: There is a tendency in Austria to rely on established research and disaster management methods, which may potentially slow the introduction of innovative approaches that could be more effective under changing environmental conditions. For example, the incorporation of disaster risk analyses into disaster prevention and preparedness is not uniformly implemented at all levels nationwide.

3.2.3 WHAT ARE OPPORTUNITIES AND POSSIBILITIES?

The strengths and weaknesses in the field of disaster research in Austria present numerous opportunities for further development. In particular, the development and application of new technologies such as artificial intelligence or the increasing importance of climate change research offer excellent opportunities to expand and deepen Austria's research capacities in this area.

- **Technological Advancement**: New technologies such as artificial intelligence, machine learning, citizen science, and the Internet of Things (IoT) provide significant opportunities to improve prediction, monitoring, and response to disasters. Austria can leverage these technologies to enable more accurate forecasts, real-time analyses, and efficient resource allocation during disasters.
- **Climate Change Research**: As climate change alters the frequency and intensity of natural events, Austria has the chance to further enhance its position as one of the leading countries in researching these changes. This includes understanding the impacts of climate change on local and regional weather patterns and developing specific adaptation strategies.
- **Civil Protection Research**: Strengthening civil protection research allows for the expansion of existing research areas and the exploration of new fields in this domain. This enables the development of targeted protection strategies for the civilian population and enhances national resilience and security.
- **International Collaboration**: Austria can expand its international collaborations, sharing knowledge and resources with global research communities. This can lead to a better understanding of cross-border disasters and the development of globally applicable disaster management strategies.

- **Interdisciplinary and Transdisciplinary Approaches**: By promoting interdisciplinary and transdisciplinary research that connects natural sciences with social sciences, economics, practitioners, or authorities and organizations with security responsibilities—such as the One Health approach in health—Austria can develop more holistic and effective solutions for disaster management.
- **Public-Private Partnerships**: Collaboration with private entities can provide access to additional resources, innovative technologies, and expertise. This can enhance research capacities and the implementation of disaster management solutions.
- **Educational Programs and Public Awareness**: Developing educational programs and awareness campaigns about disaster preparedness and mitigation can empower communities and lead to a more resilient society.
- **Policy Development and Implementation**: The findings from disaster research can inform policy development and lead to more effective strategies for disaster preparedness and response at both national and local levels.
- **Sustainable Development and Spatial Planning**: Research can support sustainable development and spatial planning, ensuring that new infrastructures are resilient to potential disasters.
- **Disaster Recovery and Resilience Building**: A comprehensive examination and analysis of past disasters can provide insights into effective recovery strategies and targeted resilience building, which is crucial for long-term social and economic stability.

3.2.4 ARE THERE ANY THREATS TO THE SUCCESS OF DISASTER RESEARCH?

Disaster research in Austria faces various challenges that could jeopardize its progress and effectiveness. Particularly, the unpredictability of climate change and fluctuations in funding represent significant risks. The following threats can be identified:

- **Uncertainty of Climate Change**: The unpredictable and evolving nature of climate change poses a significant challenge to the research landscape. New extreme weather patterns and unforeseen types of natural events may call existing research paradigms and preparedness strategies into question, requiring adjustments.
- **Societal Overconfidence**: Despite a high awareness of disaster risks, there is a risk of societal over-confidence, especially during periods without significant events. This can lead to a lack of support for ongoing research and preparedness efforts. Particularly for unpredictable yet potentially devastating events, this can result in inadequate preparation.
- **Civil Protection**: Insufficient consideration of civil protection, particularly in the context of military threats, could impair the effectiveness of national security strategies. Therefore, it is crucial to intensify research and preparedness in this area to strengthen the resilience of the civilian population.
- **Funding**: Dependency on governmental or external funding is risky, especially during economic uncertainties or when political priorities shift. Reduced investment in disaster research and infrastructure could significantly hinder progress in this field.
- **Technological Development**: Rapid technological changes can render existing tools and methodologies obsolete, requiring continuous adjustments and investments in research. This may lead to technological lag if research cannot keep pace.
- **Data Security and Privacy Concerns**: The increasing use of technology and data collection raises concerns about data security and privacy. The ethical and secure handling of sensitive data is essential but requires strict policies and procedures.
- **Brain Drain**: The potential loss of experts to other countries or industries can weaken Austria's disaster research capacities. This is particularly problematic in highly specialized fields such as universities or research institutions, where available expertise is limited.
- **International Conflicts and Economic Strain**: Global political and economic instability can affect international collaboration and funding, which are essential for comprehensive disaster research and management.

- **Integration of Research into Practice**: A gap between research findings and their practical application in disaster preparedness and response can pose a potential threat. The effective translation of research into actionable strategies is crucial to ensure the effectiveness of disaster research.

4 RESEARCH FOCUS AREA

The following chapter presents a balanced agenda closely aligned with the Sendai Framework for Disaster Risk Reduction and encompasses various areas of security and disaster research. A central focus is on better understanding disaster risks and systemic vulnerabilities to enable preventive measures and strengthen community resilience. Moreover, the Science Plan emphasizes the importance of a robust evidence base for decision-making in disaster management. Another key goal is the development of foundational approaches and strategies to improve disaster prevention, representing a direct implementation of the Sendai principles. Additionally, it addresses support for disaster preparedness, the strengthening of disaster response, and the efficient recovery after disasters.

4.1 UNDERSTANDING RISKS BETTER

Disasters, whether caused by natural events or triggered by human actions, often leave devastating impacts on societies, economies, and ecosystems. The 21st century has already witnessed a number of unexpected and complex disasters, highlighting the importance of comprehensive research in this field. Within the context of the DCNA Science Plan 2030+ for disaster research, it is essential not only to gain a deep understanding of disaster risk but also to make this knowledge accessible to policymakers, practitioners, and the general public. This chapter focuses on research questions from various scientific disciplines, aiming to shed light on the complexity of disaster risk and develop effective methods for communicating these risks. From social science approaches to technical analyses, the goal is to gain a holistic perspective on the topic, not only to respond to disasters but to anticipate them in advance and mitigate their impacts.

4.1.1 UNDERSTANDING RISK CULTURE(S) AND RISK CONCEPTS

Different Risk Concepts
(1) How do classical risk definitions differ from new risk concepts in disaster risk analysis? What role do cultural, social, and technological factors play in this context?
(2) To what extent can new risk concepts complement or improve existing models in risk analysis? What specific challenges and opportunities do these new approaches offer?
(3) How can interdisciplinarity in risk concepts be improved to achieve a more holistic understanding of disaster risks?

Risk Culture at Different Levels
(1) How does individual risk and safety awareness influence risk culture on the organizational and societal level?
(2) To what extent do subjective risk perceptions and the optimism paradox have an impact?
(3) What role does trust in institutions (e.g., science, authorities) play in shaping risk culture and risk perception at different levels?
(4) How do personal experiences with risks and dangers affect subjective risk perception?
(5) To what extent do local and regional political structures contribute to shaping risk culture?
(6) What interdisciplinary approaches are necessary to improve the perception and management of climate change-related risks in companies?

Cross-Cultural Differences in Risk Perception
(1) How do risk perception and management differ in various cultural contexts?
(2) What role do traditions, belief systems, and social norms play in shaping risk cultures?

Ethical Aspects in Risk Management
(1) What ethical questions arise in the context of risk management, particularly in decisions that affect the well-being of many people?

Risk Perception and System Knowledge
(1) How can insights into risk perception be used to understand and minimize distortions and biases in the perception of risks?
(2) To what extent do perceptual biases and human error affect risk perception in various contexts (e.g., natural disasters, technological risks)?
(3) What methods can be developed to obtain comprehensive system knowledge, and how can this knowledge be integrated into risk analysis and management?

(4) How can social differences and factors such as gender, age, sexual orientation, ethnicity, and culture be considered in risk analysis?
(5) To what extent do self-definitions of vulnerability differ from objective vulnerability assessments, and how can this be addressed in risk communication?
(6) To what extent do factors such as sense of coherence or emotional stability influence subjective risk awareness?

Influence of Digitalization on Risk Perception
(1) How does increasing digitalization and availability of information change risk perception and risk culture in different societies?

Risk Communication on Social Media
(1) What role does social media play in shaping risk culture, especially among younger generations, and how can this be used for more effective risk communication?

4.1.2 UNDERSTANDING AND MODELING HAZARDS AND RISK FACTORS

A Holistic Approach to Knowledge Transfer in Risk Management
(1) How can an integrated, holistic approach to disaster and risk management be developed that encompasses various disciplines and sectors?
(2) How can processes of knowledge generation, acquisition, management, and transfer be optimized and integrated in risk management?
(3) What role does robust data sets and risk information play in the context of holistic knowledge transfer?

The Role of Uncertainty in Risk Management
(1) How can awareness of uncertainties in risk management be strengthened and the handling of uncertainty improved, particularly for High Impact Low Probability (HILP) events?
(2) How can "positive" aspects of risks be identified and integrated into risk assessment?

Reflective Risks from Technological Innovations
(1) How can uncertainty effects arising from technological innovations in risk and disaster management be systematically addressed in risk analysis? What insights from innovation research and technology assessment can support this?
(2) To what extent do new technologies affect traditional risk concepts, and what reflexive risks emerge as a result?
(3) What societal and technical assessment mechanisms are necessary to fully understand the risks and opportunities of decarbonization?

Multi-Hazard Themes in Austria
(1) What multi-hazard issues exist in Austria, and how can they be effectively captured, described, and integrated into disaster preparedness?
(2) How can historical data and experiences be used to inform and improve future risk assessments?

Linking Risk Research with Resilience and Vulnerability
(1) How can risk research, resilience, and vulnerability be considered together and objectively to develop comprehensive risk management strategies?
(2) What methods can be applied to better understand and assess the interactions between these aspects?

Risks from the Interdependence of Critical Systems
(1) What specific risk arises from the failure of certain critical infrastructures?
(2) How can the risks arising from the interdependencies of critical systems and new technological developments be assessed and kept up to date?
(3) What methods can be developed to better describe and understand the impacts of High Impact Low Probability (HILP) events and systemic risks?

Risks from the Failure of Critical Infrastructures
(1) What specific risk arises from the failure of certain critical infrastructures and how can this risk be quantified?
(2) What preventive measures and emergency plans are necessary to minimize the impacts of such failures?

Analysis of Societal Resilience to Disinformation Campaigns
(1) How can the resilience of society against attempts to exacerbate socio-cultural divisions and generate fear among the population be analyzed and strengthened?
(2) What methods and technologies are effective in strengthening trust in governments and institutions and countering the influence of disinformation?

Societal Processes and Critical Infrastructure
(1) Which societal processes, such as digitization and climate change, can destabilize or stabilize critical infrastructures?
(2) What limitations exist with available resources that could endanger critical infrastructures in the context of societal changes?

Quantitative Assessment and Securing of Risks
(1) How can risks, particularly in the area of cybersecurity, be better quantified to facilitate their protection?
(2) What roles do innovative technologies and methods, such as hazard visualization and data analysis, play in this process?

Influencing Factors on Mass Movements
(1) How do geogenic, meteorological, biological, and anthropogenic factors interact in mass movements, and what specific impacts do they have?
(2) What methods can be developed to better understand these interactions and integrate them into risk management strategies?

Characterization of Avalanche Hazard Potentials
(1) How can the hazard potentials of powder and flow avalanches be precisely characterized? Is flow regime-dependent monitoring, warning, alerting, or modeling of flow types effective?
(2) To what extent is monitoring for detecting flow regimes or modeling flow types of avalanches effective for hazard prevention?
(3) What measurement methods or innovative extensions of existing modeling tools can be developed to improve the process understanding of wet snow avalanches and the transition from powder to flow avalanches?
(4) How do factors such as snow temperature and "rain-on-snow" conditions influence the runout behavior of glide avalanches?

Reevaluation of Historical Earthquakes
(1) To what extent can the analysis of macroseismic and intensity data points contribute to the reevaluation of historical earthquakes?
(2) How can such analyses be used to homogenize and expand the earthquake catalog?

Development of Accurate Localization Methods in Seismology
(1) How can accurate localization methods be realized for the development and characterization of geological subsurface models and fault zones?
(2) Can new methods be developed for more precise determination of the earthquake source mechanism, including in-situ stresses and stress drop due to the earthquake?

Real-Time Analysis of Earthquake Data
(1) What technologies could be developed to enable real-time analysis of ShakeMaps for emergency situations?
(2) How could such technologies, in combination with historical and paleoseismological data, contribute to improved risk assessment?

Artificial Intelligence in Seismology
(1) What new methods in artificial intelligence can be developed to improve Ground Motion Prediction Equations and Ground Motion Intensity Prediction Equations?
(2) Can AI be utilized to develop automatic methods for seismic phase determination and earthquake localization (seismic or induced)?
(3) What advances could be achieved in early warning and risk assessment through these methods?

Induced Earthquakes
(1) What proportion of earthquake activity is attributable to human activities such as reservoir filling, deep drilling, or wastewater injection? How can these be predicted?
(2) How can predictability and understanding of the interplay of geogenic, meteorological, biological, and anthropogenic factors in induced earthquakes be improved?
(3) How can such induced earthquakes be effectively predicted and incorporated into risk management strategies?

Flood Modeling and Climate Change
(1) How can future developments and interactions of pluvial and fluvial floods be estimated considering climatic and seasonal changes?
(2) What parameters can be used to adapt existing flood models?

Changes in Health Risks Due to Global Developments
(1) How are health risks changing on a global and regional level due to current global developments?
(2) What roles do economic, ecological, and social factors play in these changes?

Epidemiological Risks
(1) Which pathogens currently pose a risk for new

pandemics and what measures can be taken to minimize this risk?
(2) How can new insights from microbiology and epidemiology contribute to improving the understanding and prevention of pandemic risks?
(3) How could new findings from veterinary medicine and human medicine be better integrated?

Pathogen Networks and Their Mapping
(1) How can pathogen networks between different systems be effectively mapped and analyzed?
(2) What roles do interdisciplinary approaches such as One Health, which includes biological, environmental, and sociological factors, play in this?

Transdisciplinary Risk Models
(1) How can transdisciplinary models be developed that integrate ecological, technical, social, and economic aspects to enable more comprehensive risk assessments?

Prediction and Modeling of Black Swans
(1) How can prediction models for unexpected or unpredicted extreme events ("Black Swans"), whose probability and impact are difficult to quantify, be improved?
(2) What roles do innovative statistical methods and the inclusion of expert knowledge play in this?

Long-Term Socioeconomic Impacts of Risks
(1) How can the long-term socioeconomic impacts of risks, such as natural disasters or technological accidents, be better understood and mitigated?
(2) What roles do insurance and financial risk mitigation strategies play in risk prevention and reduction?

The Role of Human Factors in Industrial Accidents
(1) To what extent do human factors influence the frequency and severity of industrial accidents?

4.1.3 RISK ANALYSIS

Consideration of Emerging Risks
(1) How can new developments or phenomena considered emerging risks be systematically observed, documented, and assessed? What specific due diligence is required in this regard?
(2) How can emerging risks be integrated into existing risk management systems and effectively managed?
(3) How can new technological developments for decarbonization in various industries be assessed with consideration of emerging risks?
(4) What specific risks arise from the use of new materials such as Direct Reduced Iron (DRI), batteries, CO2-, and H2- pipelines in the energy transition?

Statistical Challenges in Risk Analysis
(1) Given that statistical analyses are mainly based on historical data, how can future risks and uncertainties be more effectively integrated into risk analyses?
(2) What methods or models can be developed to draw conclusions from historical data for future risk scenarios?

Dynamic Risk Analyses
(1) What methods and tools are suitable for mapping and assessing dynamically changing and systemic risks?
(2) How can dynamic processes and "moving targets" be effectively captured and continuously updated in risk analysis?

Methods for Capturing Risk Complexity
(1) What new approaches and methods are needed to collect and calculate the necessary data for assessing complex risk situations?
(2) How can various complementary methods be used to better capture and understand the complexity of risks?

Definition of Thresholds for Monitoring Systems
(1) How can thresholds for various monitoring systems (e.g., precipitation, deformation, groundwater, water levels, pathogen/vector circulation, and habitat changes) be determined and defined?
(2) How can sufficient intervention time be integrated into these thresholds to enable effective measures?

Knowledge Exchange and Interdisciplinary Approaches
(1) How can knowledge exchange between different disciplines be improved to develop innovative joint methods of research, communication, and action?
(2) What methods from other fields can be adapted to enable a more comprehensive approach in risk management?

Social Risk Reception and Crisis Response Modeling
(1) How can social risk reception be investigated and processed, especially concerning the use of social media data?
(2) How can population behavior in crises and the spread of information, particularly fake news, on social media be modeled and simulated?
(3) How can individual reactions to crisis situations be modeled and anticipated, considering demographic, social, and other factors?

Economic Calculation of Risks
(1) Can risk be economically calculated, especially with regard to the impacts of high-impact low-probability events on various economic sectors?

Risk Analysis Considering Cybersecurity
(1) To what extent must cybersecurity risks be integrated into general risk analysis, especially given the increasing interconnection and digitization of critical infrastructures?

The Role of Digital Technologies and Data Science in Risk Analysis
(1) How can big data and machine learning be used to improve risk models and make predictions about risks?
(2) What ethical and data protection challenges arise from using digital data in risk research?

4.1.4 RISK ASSESSMENT

Incorporation of Neglected Assets and Objectives in Risk Assessments
(1) How can intangible assets such as cultural heritage, environment, and biodiversity be more effectively included in risk assessments at various levels (individual, organizational, societal, state), alongside tangible damages?
(2) What methods and approaches can be developed to integrate the assessment and protection of these often-neglected assets into risk management?

Participatory Methods in Risk Assessment and Management
(1) How can participatory methods be effectively integrated into risk assessment and management, especially when setting protection goals?
(2) What roles do stakeholders and the general public play in developing and implementing protection goals?

Effective Risk Assessment for Natural Hazard Processes
(1) How can effective risk assessment be conducted at the national level for various natural hazard processes such as mass movements, earthquakes, and avalanches, to enable evidence-based decisions in disaster protection?
(2) What methods are needed to comprehensively assess the different aspects of these natural hazard processes, including primary and secondary effects?

Long-Term Risk Assessment and Management
(1) How can long-term risk assessments, considering climate change and other long-term changes, be integrated into disaster preparedness?
(2) What models and methods are particularly suited for predicting and assessing risks over extended time periods?

Quantitative Determination of Residual Avalanche Hazard
(1) What methods can help quantitatively and reliably determine the residual hazard areas of avalanches?
(2) How can information about residual hazards be effectively communicated to the general public, especially in the context of protective structures?

A Holistic Approach to Vulnerability and Resilience
(1) How can a holistic approach to assessing vulnerability and resilience be developed that includes various disciplines and sectors, to optimize multidisciplinary and cross-sectoral strategies for managing vulnerability?
(2) How can such integrated approaches contribute to optimizing recovery after disasters through various aspects?

Improvement in Avalanche Hazard Assessment
(1) How can methods for assessing avalanche hazard and its extent be improved, particularly concerning small avalanches in high-altitude regions?
(2) Can the development of a standardized guideline contribute to improved hazard assessment?

Innovative Approaches for Temporally and Spatially Variable Hazard Assessments
(1) Are there innovative approaches for temporally variable and spatially specific hazard assessments

and risk evaluations for critical infrastructures, considering the underlying ground?
(2) How can such approaches be integrated into 4D spatial planning to enable effective risk assessment and management?

Risk Assessment in Dynamic Urban Spaces
(1) How can risk assessment be improved in rapidly growing and changing urban areas, especially in developing and emerging countries?

Integration of psychosocial aspects into risk assessment
(1) To what extent do psychosocial factors, such as stress responses and psychological burdens, need to be more strongly considered in risk assessments and management strategies?

Impact of Global and Local Political Dynamics on Risk Management
(1) How do political decisions and international relations influence the development and implementation of risk management strategies?

4.1.5 RECOMMENDATIONS AND KEY TAKEAWAYS

Classical risk definitions differ from new risk concepts in disaster risk analysis. To deepen this understanding, comparative studies should be conducted to highlight the differences between these approaches and identify their specific challenges. Interdisciplinarity plays a central role in achieving a more comprehensive understanding of disaster risks. Therefore, programs and initiatives should be developed to promote collaboration among different disciplines.

Individual risk and safety awareness significantly influence risk culture at organizational and societal levels. To enhance risk awareness, the implementation of awareness and training programs should be promoted. Subjective risk perceptions and the optimism paradox can distort risk perception. Therefore, it is important to develop measures to account for and minimize these effects. Trust in institutions such as science and authorities plays a crucial role in risk culture and perception. Transparent communication and the provision of credible information are essential to strengthen public trust. Personal experiences with risks and dangers also affect subjective risk perception and should be considered in risk communication strategies. Additionally, local and regional political structures should be better integrated into risk management processes to shape risk culture.

Comparative studies allow for a better understanding of differences in risk perception and risk management across various cultural contexts. Based on this understanding, tailored risk management strategies can be developed. It is important to analyze the role of traditions, belief systems, and social norms in shaping risk cultures and to develop awareness programs that consider these aspects. Identifying and discussing ethical issues in the context of risk management is crucial for developing ethically sound decision-making processes. Special attention should be given to decisions that affect the well-being of many people. Establishing ethical guidelines and integrating ethical reflections into the risk management process is essential.

A holistic approach to knowledge transfer in risk management that encompasses various disciplines and sectors should be developed. This includes creating interdisciplinary research teams and fostering platforms for knowledge exchange. Processes of knowledge generation, acquisition, management, and transfer in risk management should be optimized and integrated. This can be achieved by establishing standardized protocols and utilizing digital platforms. Solid data and risk information play a crucial role and should be ensured through the creation of databases and the continuous updating of risk data.

The role of uncertainty in risk management should be strengthened by conducting training and awareness campaigns for risk managers and decision-makers. Additionally, it is important to identify "positive" aspects of risks and integrate them into risk assessment to leverage opportunities. It is crucial to systematically address reflexive risks arising from technical innovations. This can be done through technology assessments and the involvement of experts from various fields. Continuous examination of new technologies in terms of their impact on traditional risk concepts and the emergence of reflexive risks must be prioritized.

Multi-hazard topics should be effectively assessed, described, and integrated into disaster preparedness. Comprehensive risk analyses and collaboration between authorities, research institutions, and communities are required. Additionally, the use of historical data and experiences is essential to improve future risk assessments.

4.2 EVIDENCE BASE AS FOUNDATION FOR DECISION-MAKING

In this chapter of the DCNA Science Plan, we focus on expanding the evidence base as a crucial foundation for decision-making in disaster management. Given the increasing complexity and frequency of disasters worldwide, it is essential to establish a robust and diverse evidence base that enables decision-makers to implement effective and sustainable measures. The Sendai Framework emphasizes the importance of science and research as the foundation for risk reduction. Our goal is to create an evidence-based foundation through interdisciplinary approaches and collaboration between scientists, policymakers, and practitioners. This will allow for the development and implementation of efficient and tailored strategies for dealing with natural disasters. The aim is not only to reduce the risk of disasters but also to enhance society's ability to respond to and recover from them effectively.

4.2.1 DEALING WITH EVIDENCE, DATA AND UNCERTAINTY

Limits of Knowledge
(1) How can scientific methods be used to make the limits of knowledge in risk and crisis communication transparent?
(2) What strategies are necessary to differentiate between established and uncertain knowledge, and how can the handling of ignorance and unknown factors in science, risk, and crisis communication be improved?
(3) How can the process of knowledge validation be made transparent and comprehensible to ground action guidelines based on the current state of knowledge?

Analysis and Strengthening of Error Culture
(1) How do different error cultures (intra- and inter-organizational, interstate) influence crisis management?
(2) How can comparative analyses of error cultures contribute to developing effective strategies for error prevention and acceptance?
(3) What conditions are necessary to strengthen a constructive error culture, and what role do organizational and cultural factors play in this?

Evidence-Based Decision-Making
(1) What impact do error avoidance and denial have on the evidence-based nature of decisions?
(2) How can insights from analyses of errors, failures, and setbacks be used to strengthen evidence-based decision-making processes in organizations and politics?
(3) To what extent can comparative studies of error cultures help minimize biases in decision-making processes?

AI in Risk Assessment of Mass Movements
(1) What potential do AI-supported technologies offer for the hazard and risk assessment of gravitational mass movements?
(2) How can such technologies be employed for precise analysis and prediction of mass movements, and what challenges are associated with this?

Cascade and Feedback Processes in Mass Movements
(1) What potential cascade and feedback processes exist in gravitational mass movements?
(2) How can these processes be identified and integrated into risk assessment models to enable more accurate predictions and effective protective measures?

Characterization of Active Faults
(1) How can national baseline data for characterizing active faults in Austria be improved with paleo-seismological methods, particularly regarding the magnitude and frequency of prehistoric earthquakes?
(2) What methods can be applied to characterize the kinematics of active faults concerning their geometry and movement speed, and how can this contribute to earthquake hazard analysis?

Event Catalogs and Process Documentation
(1) How can event catalogs and derived process documentation from historical, archaeological, and paleo-seismological data enhance understanding of possible earthquake-scenarios, as well as secondary cascade effects and damage scenarios?

(1) How can these data be utilized effectively across different time scales (centennial, millennial, and beyond)?

Acceptance and Use of Central Databases
(1) What strategies can be developed to promote the acceptance and use of central databases?
(2) What factors influence the acceptance of such databases, and how can these be overcome?

Handling Uncertainties and Surprises
(1) How can organizations and decision-makers better handle uncertainties and unexpected events?
(2) What methods and strategies can be developed to strengthen resilience to uncertainties and enable effective responses to unforeseen crises?

Cultural and Social Factors in Data Use
(1) How do cultural and social factors influence the collection, interpretation, and use of data in disaster management?
(2) How can these factors be considered to improve the effectiveness of decisions and increase public acceptance of measures?

4.2.2 DATA STRUCTURES AND NOMENCLATURE

Interoperability and Standardization
(1) How can data standards and interoperability protocols be developed and implemented to promote the exchange and integration of data between different organizations, systems, and countries?
(2) What roles do international collaborations and standardization bodies play in this process?

Development of a Harmonized Classification System for Mass Movement Processes and Avalanches
(1) How can a harmonized national classification system for gravitational mass movement processes and avalanches be developed, which is also compatible with international systems?
(2) What steps are necessary to implement this system in both the public and private sectors, and what challenges might arise?

Harmonization of Event Documentation for Natural Hazard Processes in Austria
(1) How can harmonization of event documentation based on a standardized classification system be achieved in Austria?
(2) What strategies are required to standardize and unify databases, including process legends, related to natural hazard processes?

Standardization of Event Reporting and Documentation
(1) What methods and processes can be developed to achieve standardization of event reporting and documentation?
2) How can it be ensured that this standardization is implemented effectively and consistently across different areas and regions?

Standardization and Harmonization of Data Across Disciplines
(1) How can data be appropriately standardized and harmonized across various disciplines?
(2) What specific challenges arise in standardizing data across disciplinary boundaries, and how can these challenges be overcome?

Universal Data Standards for Further Processing
(1) What universal data standards are necessary to make data suitable for automated processing ("robot-ready")?
(2) How can universal data types, data structures, and protocols be developed to enable efficient and interoperable data processing across different systems and applications?

Standardization of Data Exchange Formats
(1) What standardization measures are necessary to achieve compatibility between different data formats and platforms?
(2) How can existing systems (e.g., command and control systems, and management information systems) be adapted to support uniform data exchange standards?

Development of Interoperable Data Platforms
(1) How can effective data spaces be developed that allow interoperable use of critical data between various authorities and organizations with security responsibilities (BOS)?
(2) What technical and organizational challenges need to be overcome to ensure seamless data integration and communication?

4.2.3 DATA AVAILABILITY AND DATA MANAGEMENT

Cloud Data Collection via Smartphone App
(1) Can low-threshold cloud data collection using a smartphone app effectively contribute to detecting hazard and risk zones as well as identifying scenario clusters?
(2) What technical and data protection challenges need to be considered?

Harmonization of Existing Databases for Gravitational Mass Movements
(1) How can existing databases for gravitational mass movements (e.g., GEORIOS, WLK, ÖBB, ASFINAG) be efficiently merged and harmonized?
(2) What technical and organizational challenges need to be addressed?

Development of a Unified and Anonymous Database
(1) How could a freely accessible, unified, and anonymous server-based database with geophysical, geotechnical, and other relevant parameters of solid and loose rocks be created?
(2) What contributions can universities, resource companies, and the construction industry make?

National Database for Scientific Purposes
(1) How can a national database for scientific purposes be created from the interfaces of existing databases, serving the harmonization and inventorying of avalanche events?
(2) What role does existing data infrastructures play in this process?

Bundling and Exchange of International Expertise
(1) How can effective bundling and exchange of international expertise, for example through platforms like AvaFrame, be achieved?
(2) What conditions are necessary for successful knowledge transfer?

Linking Remote Sensing and Monitoring Data
(1) How can remote sensing and monitoring data be effectively linked to obtain comprehensive information about the snow cover?
(2) What technological and methodological approaches are required for this?

Identification of Data Gaps in Disaster Situations
(1) Where are the data gaps that need to be filled for decisions in disaster situations?
(2) What data are critical and how can they be efficiently collected?

Data Exchange Beyond Subject-Specific Boundaries
(1) How can data exchange be promoted as a basis for decisions beyond specific subject and interest areas?
(2) What strategies and technologies can support this?

Development of a Data Platform for Managing Measurement Data
(1) How can the development of a data platform for managing and visualizing measurement data, including user management and alert options, be achieved?
(2) What requirements exist for the preparation, harmonization, and analysis of sensor data formats and metadata?

Material and Immaterial Cultural Goods
(1) How can valuable material and immaterial cultural goods be better captured systematically?

Climate Change and Flooding
(1) Based on what parameters can various future scenarios be calculated?
(2) How can data from different sources (urban and rural areas) be standardized to be incorporated into models?

Data Standards for Flood Data
(1) What data standards are necessary for flood data, and how can they be developed and implemented?

Collection and Management of Nationwide Flood Data
(1) Where can nationwide flood data be collected and managed?
(2) Who is responsible for maintenance, security, and access?
(3) How can the provision of metadata be organized and how can data clutter be avoided?

Cost Management for Storage, Processing, and Transmission
(1) How can costs for the storage, processing, and transmission of data be minimized, especially in a system oriented towards crisis management?
(2) What approaches can be implemented to avoid redundant data storage and unnecessary data transmission?

Application of Decentralized Data Architectures
(1) How can modern decentralized data architectures be utilized to enable efficient and secure use of data across organizational boundaries?
(2) What specific benefits do such architectures offer for crisis management and the coordination of critical resource supply?

Transparent and Traceable Data Retrieval in Crisis Situations
(1) How can a system be developed that transparently and traceably retrieves and efficiently processes relevant data when needed?
(2) What mechanisms are necessary to ensure the acceptance and cooperation of the affected organizations?

Legal Framework for Data Exchange
(1) What legal conditions need to be defined and implemented for the exchange of sensitive and private data between emergency services?
(2) How can data protection and security be ensured without compromising the efficiency of data exchange?

Implementation of Data Spaces for Crisis Management
(1) How can the implementation of Data Spaces contribute to improving the responsiveness and effectiveness of emergency services in crisis and disaster situations?
(2) What specific technological components and agreements are required to create a secure and efficient data space?

4.2.4 DATA PREPARATION AND DATA QUALITY

Improvement of the National Seismic Hazard Map
(1) How can a comprehensive improvement of the national seismic hazard map be made, including the identification of seismogenic sources, estimation of earthquake rates and magnitude frequency distributions, description of the propagation behavior of ground movements, site amplification models and determination of hazard curves?
(2) How can new accurate localization methods contribute to the characterization of relevant fracture zones and be integrated into the seismic hazard map?

Analysis Methods in the Event of a Crisis
(1) Which analysis methods can be developed to map the dynamic situation in the event of a crisis and to support decisions based on the growing database?
(2) How can these methods be flexibly adapted to different crisis situations?

Merging and Processing of Different Data Sources
(1) How can data from different sources be merged and processed securely and efficiently?
(2) What technical and organizational challenges must be taken into account when merging and processing data?

Availability of Data under Data Protection Requirements
(1) How can data, especially those collected with public funds, be made available for further processing steps or research projects taking into account data protection requirements?

Criteria Catalogs and Instructions for Generating Training Data
(1) What criteria and guidelines should be set for the generation of training data for AI-based detection tools?
(2) How can quality characteristics for the use of AI tools in different applications in civil protection and disaster control be defined and standardized?

Differentiation between Real and Machine-Generated Information
(1) How can "real" information be distinguished from machine-generated information, especially in re-lation to automated systems such as "ChatGPT"? What methods and technologies can help authenticate information?
(2) How can an effective public-private analysis and evaluation process be developed for the early detec-tion and strengthening of state resilience?
(3) How can existing whole-of-government approaches to combating disinformation be integrated and improved?

Connection of Statistical and Anecdotal Evidence
(1) How can statistical evidence be combined with anecdotal evidence to facilitate communication with the public and generate understandable information from data?

Improvement of Data Quality
(1) How can the quality of collected data be considered and improved?
(2) What methods and standards can be developed to ensure data integrity?

Standardization of Flood Data Quality
(1) How can the quality of flood data be standardized?
(2) What standards are necessary, and how can they be implemented to ensure consistent and reliable flood data?

Integration of Big Data and Machine Learning in Risk Analysis
(1) To what extent can Big Data and machine learning contribute to the identification and analysis of hidden patterns in risk data?

Role of Citizen Science in Data Collection and Risk Analysis
(1) What contribution can citizen science make to data collection and risk analysis, especially in hard-to-reach or poorly monitored regions?
(2) How can the quality and reliability of data collected through citizen science be ensured?
(3) What methods are necessary to effectively and validly integrate these forms of knowledge into decision-making processes?

4.2.5 APPLICATION OF MODELS

The Use of Numerical Models for Hazard Assessment
(1) How are numerical models used for hazard assessment of various scenarios and for representing the risk of natural hazards?
(2) How can statistical uncertainties and numerical inaccuracies in existing and newly developed risk representation forms, such as traffic light systems and zones, be identified and communicated?

The Use of AI in Process and Data Analysis
(1) How can artificial intelligence (AI) be used to improve the understanding of processes related to mass movements, earthquakes, and avalanches, particularly through AI-supported numerical modeling, and for analyzing large datasets with high variability and uncertainties?

Characterization of Gravitational Mass Movements
(1) How can gravitational mass movements be characterized from a rock mechanics perspective?
(2) What innovative approaches and models exist to better understand and predict progressive failure processes?

Open-Source Development Tools for Mass Movement Assessment
(1) What open-source development tools are available for the assessment of mass movements?
(2) What potential do open-source software packages have compared to proprietary software?

Process Inventory as a Benchmark for Model Validation
(1) How can a process inventory of various mass movements, including real case examples, serve as a benchmark for the validation of numerical models?

Improvement of Numerical Modeling Approaches
(1) How can numerical modeling approaches be improved, expanded, and combined to represent various gravitational mass movement processes?
(2) How can boundary conditions and (in-situ) model parameters be realistically captured?

Development of a National Tectonic/Geological Subsurface Model
(1) How can the development of a national, comprehensive tectonic/geological subsurface model be implemented as a basis for assessing earthquake hazard/risk in Austria?

Collection and Calculation of Exposure and Vulnerability Data
(1) How can a comprehensive, homogeneous collection and calculation of exposure and vulnerability data be carried out to form the basis for seismic risk assessment at the national level?

Development of Open-Source Tools for Avalanche Simulation
(1) How can open-source tools for avalanche simulation be further developed for various scales to serve as a "digital toolkit" for users in both the public and private sectors?

Lifespan and Life-Cycle of Critical Infrastructure (KRITIS)
(1) What is the lifespan of critical infrastructure (KRITIS), and what life-cycle considerations (monitoring, aging, etc.) are relevant?

Long-Term Data for Flood Models
(1) What long-term data are necessary for various flood models, and how can these be effectively collected and utilized?

Development and Application of Predictive Analytics in Risk Management
(1) How can predictive analytics methods be used to identify potential risks and hazards early?
(2) What challenges exist in interpreting and implementing predictions into concrete preventive measures?

4.2.6 DATA COLLECTION AND MONITORING AND EXPANSION OF EXISTING DATA POOLS

Improvement of the Fundamental Data Base for Natural Hazards
(1) How can the fundamental data base for gravitational mass movements, earthquakes, and avalanches in Austria be significantly improved?
(2) What new data sources and methods can contribute to this improvement?

Uniform Collection of Exposure and Vulnerability Data
(1) How can exposure and vulnerability data be collected uniformly across Austria for the mentioned natural hazard processes?
(2) What standards and methods are required for this?

Impact of Climate Change on Natural Hazard Processes
(1) What impact does climate change have on natural hazard processes such as gravitational mass movements and avalanches in Austria, and what mid-term adaptation strategies are necessary at the national level?

Exploration Methods for Gravitational Mass Movements
(1) What exploration methods and innovative approaches are available to improve the characterization of gravitational mass movements?

Development of a Monitoring System for Mass Movements
(1) How can a long-term, continuous, multimodal monitoring system for mass movements be established in both alpine and non-alpine regions of Austria?

Identification and Long-Term Observation of Critical Mass Movements
(1) How can critical gravitational mass movements be identified and monitored over extended periods?

Development of Robust, Cost-Effective Monitoring Systems
(1) How can robust, cost-effective, and autonomous monitoring systems be developed?
(1) How can the advancement of Low-Range (LoRa) radio frequency sensor technology be utilized for rapid and cost-effective instrumentation of slope instabilities?

National Survey and Representation of Monitoring Sites
(1) How can a national survey and map-based representation of monitoring sites for mass movements in Austria be conducted?

Long-Term Monitoring Test Sites and Process Understanding
(1) How does the establishment of long-term monitoring test sites contribute to the improvement of process understanding?

Statistics and AI Based on "Small Data"
(1) How can statistics and AI be effectively utilized based on "small data"?

Targeted Collection of Sensitive Data in Critical Infrastructure
(1) How can sensitive data in the field of critical infrastructure be specifically collected?

Assessment of Climate Change Impacts in the Industrial Sector
(1) In which industries and locations can concrete, measurable changes due to climate change be observed?

GIS-Based Analyses for Gravitational Mass Movements
(1) To what extent can statistical and GIS-based analyses, considering geology, hydrology, exposure, etc., be advanced for assessing gravitational mass movements?

Probabilities of Mass Movements
(1) How can potential triggering and initiating factors be better captured?
(2) How can new methods define and better capture the probabilities of gravitational mass movements?

Innovative Measurement Techniques for Seismic Waves
(1) What novel measurement techniques, such as distributed acoustic sensing, can be developed for capturing seismic waves?

Expansion of the National Seismic Monitoring Network
(1) How can the national fundamental data, particularly the national seismic monitoring network, be expanded or improved comprehensively?

Creation of an Avalanche Hazard Map
(1) How can an avalanche hazard map for the alpine region in Austria be created?

Infrastructure Substance Survey and Digital Documentation
(1) How can the survey of infrastructure substance and digital documentation of existing infrastructures be efficiently conducted?
(2) How can valuable tangible and intangible cultural assets be systematically recorded?

Closing Data Gaps in Soil Loss Due to Flooding
(1) How can data gaps in assessing soil loss due to pluvial flooding be sustainably addressed?

Collection of Data from Farmers on Soil Loss
(1) How can data from farmers experiencing problems due to soil loss be effectively collected?

Updating Crop Rotation for Predictions
(1) How can crop rotation be updated annually to keep maps current and make predictions?

Improving Collection, Standardization, and Availability of Flood Data
(1) How can the collection, standardization, and availability of flood data be improved?

Evaluation Methods for Remote Sensing Data
(1) What (automated) evaluation methods for remote sensing data can be developed or improved for detecting, characterizing, and monitoring mass movements?

Collection and Use of Building Properties Data
(1) How can data on building properties be systematically collected and analyzed to better determine the vulnerability of buildings to various natural hazards?
(2) Which specific properties and data points are particularly indicative?

Development of an Integrative Building Database
(1) What data is necessary, and what sources are available to create a comprehensive building database that considers all natural hazards?
(2) How can such a database be structured to facilitate efficient classification and assignment of vulnerability categories?

Handling Knowledge About Old and New Buildings
(1) How can existing knowledge about old buildings, which may not be as well documented in current databases as new buildings, be managed to adequately assess their vulnerability?
(2) What specific challenges arise in this context and how can they be overcome?

Development of a Cross-Border Model
(1) How can a cross-border model for the assessment and evaluation of building vulnerability to natural hazards be developed?
(2) What mechanisms are necessary for monitoring the condition of the included buildings, and who will bear the costs for implementation and maintenance?

Assessment of Protective Structures
(1) What future strategies and technologies can be applied to assess the condition of existing protective structures to reliably evaluate their functionality?
(2) How can missing data on protective structures be systematically collected and integrated into GIS maps?

Impacts of Climate Change on Water Balance
(1) How does climate change affect the landscape water balance, particularly groundwater levels and the interaction between surface waters and groundwater?
(2) What strategies can be developed to mitigate the risk of pollutant entry into groundwater due to changed hydrological conditions?
(3) How does climate change influence hydrological cycles, especially groundwater recharge and runoff conditions in surface waters in Austria?
(4) Which specific regions are most affected by changes in groundwater recharge?

Long-Term Monitoring and Management
(1) What monitoring systems are needed to capture long-term trends in groundwater balance and to take proactive measures based on this data?

(2) How can collaboration between various stakeholders such as water suppliers, regional authorities, and the scientific community be improved to ensure efficient data and information analysis?

Development of Regional Ground Water Models
(1) How can regional transient groundwater models be developed to simulate the spatial impacts of climatic changes on water supply systems?
(2) What scenario calculations are necessary to forecast potential changes in groundwater levels?

Development of Adaptation Strategies
(1) What adaptation strategies can be developed to enhance the resilience of water supply systems against climate-related changes?
(2) How can these strategies be integrated into existing water supply plans to ensure sustainable supply security?

Collection and Management of Economic Data
(1) What specific economic data are necessary to detect shortages early, and how should this data be characterized in terms of quality, timeliness, and consistency?
(2) How can an open data pool be designed to provide relevant data to ministries, regions, and municipalities during crisis situations?

4.2.7 DATA PROTECTION AND DATA SECURITY

Balancing Data Use and Privacy in Disaster Management
(1) How can a balance be achieved between effective data use in disaster protection and management and maintaining data privacy and security?
(2) What strategies and technologies can be used to comply with privacy regulations while ensuring that necessary data for disaster protection remains accessible?
(3) How can public interest in data be aligned with the privacy and confidentiality requirements of critical infrastructure operators (KRITIS)?
(4) What solutions exist to make internal information available for risk assessment without compromising security and confidentiality requirements?

Ethical Guidelines and Technical Developments
(1) What ethical guidelines are necessary in light of new technological developments in the field of disaster protection and risk management?
(2) How can adherence to these ethical guidelines be ensured, especially concerning the use of artificial intelligence and other advanced technologies?
(3) How can ethical and privacy concerns regarding the use of "Big Data" in risk assessment be addressed?

Data Protection and Anonymization
(1) How can data, particularly personal and sensitive information, be effectively protected and anonymized in the context of disaster management without compromising its usefulness for analysis and decision-making?
(2) What techniques and technologies can be applied to ensure balanced data protection?

4.2.8 RECOMMENDATIONS AND KEY TAKEAWAYS

Expanding the evidence base in disaster management requires a range of interrelated recommendations to create a comprehensive and effective framework. Firstly, it is crucial to handle evidence, data, and uncertainty transparently. This means clearly communicating the limits of knowledge and distinguishing between confirmed and unconfirmed knowledge. This includes strategies to improve knowledge validation and appropriately address gaps in knowledge.

Another important step is to analyze and strengthen the error culture. Different error cultures must be examined to develop effective strategies for error prevention and acceptance. A constructive error culture can enhance the evidence-based nature of decisions and improve learning capacity in disaster management. Additionally, the integration of Artificial Intelligence (AI) in risk assessment is of significant importance. AI-powered technologies offer potential for precise analysis and prediction of mass movements and other disasters. It is crucial to utilize these technologies effectively and address challenges related to handling large data volumes and interpreting AI results.

Standardization of data and nomenclature is another key step. This involves the development and

implementation of data standards and interoperability protocols to facilitate data exchange and integration. International collaborations and standardization bodies are essential in this regard.

Furthermore, data collection and monitoring need to be improved. This includes the collection and management of data, such as cloud data collection through smartphone apps, and the harmonization of existing databases. Developing a unified database for scientific purposes is central to this effort.

Special attention should also be given to data protection and security. It is necessary to find a balance between data use and privacy in disaster protection. Strategies and technologies are required to comply with data protection regulations while making necessary data accessible for disaster management.

Finally, the application of models is a critical aspect. The use of numerical models and AI in hazard assessment, as well as the improvement of modeling approaches, is essential. A cross-border model for capturing and assessing building vulnerability would be an example of a highly beneficial initiative in this area.

4.3 IMPROVING THE FOUNDATIONS AND STRATEGIES FOR PREVENTION

Based on the priorities of the Sendai Framework for Disaster Risk Reduction, this section focuses on the key question: What research priorities need to be established to improve the foundations and strategies in the area of disaster prevention? The questions formulated in this section are intended to serve as a guide for future scientific investigations in the field of disaster prevention. The topics presented in this chapter serve as a starting point for scientists to develop innovative approaches aimed at expanding knowledge of prevention strategies and strengthening the resilience of societies against disasters.

4.3.1 EXPANDING THE FOUNDATIONS OF PREVENTION

Gender Vulnerability Gaps/Intersectionality
(1) How can gender- and diversity-specific differences in vulnerability to disasters be quantified and analyzed?
(2) What specific data and methods are required to develop a comprehensive understanding of gender- and diversity-based inequalities related to natural disasters?
(3) How can these insights be integrated into disaster prevention strategies to ensure more equitable and inclusive preparedness and response?

State-of-the-Art-Studies on Risk Reduction
(1) What studies can be conducted to identify the most effective measures for reducing seismic risk and the vulnerability of critical building types and infrastructures?
(2) What criteria and benchmarks should be used to evaluate the effectiveness of these measures, such as retrofitting?

Future Scenarios and Climate Change
(1) What future scenarios regarding climate change, population dynamics, mobility, and land use are to be expected?
(2) How can these scenarios be modeled and utilized for planning and preparing for future challenges?

Real-time Integration of Earthquake Alerts
(1) How can the development of models that integrate real-time earthquake alerts with GM(I)PE, historical seismology, archaeoseismology, and paleo-seismology contribute to improved disaster preparedness?
(2) What technological and methodological advances are necessary for this?

Identification of Vulnerable Individuals
(1) How can individuals in vulnerable situations be effectively identified?
(2) What criteria and data sources are needed for this?

Identification and Protection of Vulnerable Groups against Disinformation
(1) How can vulnerable groups and individuals, particularly susceptible to disinformation campaigns, be identified?
(2) What targeted protective measures can be developed to effectively shield these groups?

Reaching Diverse Populations
(1) How can different population groups be involved in and reached by disaster protection measures?
(2) What communication and outreach strategies are most effective for this?
(3) How can individuals with diverse linguistic backgrounds be reached better?

Strengthening the Participation of Different Groups
(1) How can the participation and inclusion of various population groups in disaster protection measures be strengthened?
(2) What approaches and methods are particularly promising in achieving this?

Consideration of the Prevention Paradox
(1) How can the prevention paradox and the "full-coverage mentality" be considered and addressed in prevention strategies?
(2) What psychological and social factors play a role in this context?

Incentives for Risk-Adjusted Behavior
(1) What framework conditions must be created to provide incentives for risk-adjusted behavior?
(2) How can these incentives be designed to achieve broad acceptance and implementation among the population?

Assessment of Population Vulnerability
(1) How can the vulnerability of various population groups to disruptions in food supply be quantified and assessed?
(2) What socio-economic and geographical factors contribute to vulnerability, and how can these be integrated into risk analysis?

Systemic Risk Analysis of Food Supply
(1) How can a systemic risk analysis of Austria's food supply, including inputs, be developed and implemented?
(2) What methods and tools are most effective in analyzing and strengthening the resilience of the food supply chain?
(3) How can food supply flows within Austria and transnationally be captured and analyzed?
(4) What vulnerable nodes exist in the national and transnational supply system, and how can they be effectively monitored?

Critical Production Goods
(1) What production goods are essential for maintaining production in Austrian companies?
(2) How can these companies be supported to increase their resilience to crisis-induced fluctuations?
(3) What measures can be taken to monitor the overall risk situation and proactively respond to changes in procurement markets?

Resilience of Companies
(1) What criteria and guidelines can be developed for a self-assessment to determine system relevance and implemented resilience measures in companies?
(2) How can the scalability of these criteria be ensured to allow broad application?

Identification of Critical Goods for Crisis Management
(1) What goods are essential for managing crisis scenarios, and what role do they play in maintaining critical infrastructure?
(2) How can these goods be systematically identified and categorized based on criteria such as criticality, vulnerability, and feasibility?

Identification of Critical Supply Goods for the Population
(1) Which products and services are critical for the basic supply of the population and supply-relevant companies during crises?
(2) How can the health and nutritional needs of specific population groups be incorporated into the cataloging of these goods?

Food Security and Supply
(1) How can Austria's food security and supply be ensured in light of current challenges such as farm closures, extreme weather events, and the biodiversity crisis?
(2) What strategies and measures are necessary to address these challenges?

Consideration of Unintended Side Effects of Prevention Strategies
(1) How can unintended side effects of prevention strategies and resilience-building measures be taken into account?
(2) What methods are suitable for identifying effects such as the "Cobra Effect" and integrating them into planning?

4.3.2 HOLISTIC PREVENTION CONCEPTS FOR DIFFERENT HAZARDS AND STAKEHOLDERS

International and Interdisciplinary Cooperation in Disaster Prevention
(1) How can international and interdisciplinary cooperation in disaster prevention be effectively promoted?
(2) What specific mechanisms and platforms are needed to facilitate and strengthen the exchange of knowledge and resources between different countries and disciplines?

Biodiversity, Climate Change, and Land Use
(1) How do changes in biodiversity, human-induced climate change, and land use or spatial planning policies affect the frequency and intensity of natural disasters?
(2) What "Nature-Based Solutions" can be developed to address these challenges?

Climate Protection and Climate Change Adaptation
(1) How can climate protection measures and adaptation strategies to climate change be optimally combined to effectively address both the causes and impacts of climate change?
(2) What roles do local and global strategies play in this process?

Protection and Use of the Information Space for Counter-Narratives
(1) How can the information space be effectively protected to minimize disinformation and hostile influences?
(2) What strategies and tools are necessary to actively use the information space for the dissemination of counter-narratives?

Designing an Analysis and Evaluation Process
(1) How can an effective public-private analysis and evaluation process be developed for early detection and strengthening state resilience against disinformation?
(2) How can existing whole-of-government approaches to combat disinformation be integrated and improved?

Protection of Cultural Institutions
(1) How can measures be developed and implemented to protect cultural institutions, collections, and historically, religiously, or culturally significant sites from the impacts of natural disasters?
(2) What specific challenges and solutions exist in this area?

Motivating Property Owners to Ensure Earthquake Safety
(1) How can the state motivate property owners to improve the earthquake safety of their buildings, particularly for the most vulnerable building types?
(2) What role can combined measures, such as linking earthquake safety with energy-efficient renovation measures, play?

Resilience of Health Systems
(1) How can the resilience of national health systems to disasters be improved?
(2) What measures are necessary to integrate disaster risk management into healthcare, enhance training capacities in disaster medicine, and educate healthcare professionals in disaster preparedness concepts?

Sustainable Sediment Management
(1) What methods can be developed to achieve more sustainable sediment management in catchment areas and water bodies?
(2) How can these methods contribute to reducing environmental impacts?

Continuity of Sediments in Flowing Waters
(1) How can sediment continuity in anthropogenically affected flowing waters, especially concerning cross-structures and hydropower plants, be restored?
(2) What technical and ecological challenges need to be addressed?

Impact of Sediments on Flood Safety
(1) To what extent do sediment deposits and movements affect flood safety?
(2) What strategies can be developed to reduce the risk of flooding through effective sediment management?

Protection from Extreme Flood Events (HQ300)
(1) What preventive measures and models are necessary to prepare buildings and infrastructure for extreme flood events (HQ300)?
(2) How can the safety of structures deemed secure be ensured in such extreme cases?
(3) What is Austria's current situation regarding overload scenarios?
(4) Does it make sense to increase the level of protection, and what scientific basis supports this?

Strategies for Stockpiling and Ressource Management
(1) What goods are critical for the daily supply of the population, and how can their continuous availability be ensured?
(2) What goods should be stockpiled to enable a quick response to crises?
(3) What goods could be produced within Austria during crises to reduce dependency on international supply chains?
(4) How can the distribution of these goods in times of crisis be managed efficiently and fairly?

4.3.3 RISK COMMUNICATION AND AWARENESS BUILDING

Recipients of Risk Communication
(1) How can the goals of risk communication be analyzed and optimized?
(2) What role does awareness building in education and citizen education play in this process?

Scientific Nomenclature and Classification in Communication
(1) How can scientific nomenclature (e.g., hazard vs. risk, spatial planning) and classification (climate change, mass movements) be communicated to the general population, including deaf individuals and people with migration backgrounds, in an understandable way?
(2) What role does the use of plain language play in this?

Risk and Education
(1) How can education be utilized to increase awareness and understanding of risks?
(2) What roles do schools and universities play in imparting risk competence?

Awareness of Natural Hazards
(1) What must be conveyed to the general population about various processes of natural hazards to create a basic understanding of, for example, climate, weather, tectonics, zoonoses, and epidemics/pandemics?
(2) How can this serve as a basis for effective and clear risk communication?

Awareness of Earthquake Risk in Austria
(1) How can awareness of earthquake risk and potential, especially with its low probability but high impact, be strengthened in Austria?

Communication of CBRN Hazards
(1) How can effective communication strategies be developed to educate the public about CBRN threats and protective measures?

Process Representation and Risk Communication for Gravitational Mass Movements
(1) How can effective and clear process representation, hazard assessment, and risk communication/visualization for gravitational mass movements, earthquakes, and avalanches in Austria be achieved?

Involvement of Various Actors in Risk Communication
(1) How can digital media, non-profit organizations, public authorities, educational institutions, associations, and tourism organizations be involved in risk communication?

Avalanche Hazard Warning Map for the Alpine Region
(1) How can the creation of an avalanche hazard warning map for the alpine region in Austria be carried out to effectively reach target groups such as ski tourers and hunters?

Communication of Residual Avalanche Hazards
(1) How can residual avalanche hazard areas or residual risk in the context of protective structures be effectively defined and communicated to the general population?

Shared Communication Culture in Interdisciplinary Research
(1) How can a shared communication culture in interdisciplinary research and collaboration with decision-makers be established, considering both internal and external communication (including multilingualism and cultural conventions)?

Strengthening Health Literacy and Risk Awareness
(1) How can health literacy, risk awareness, tolerance for uncertainty, and willingness to change be strengthened in the population?

Development of Communication Tools
(1) What communication tools can be developed to address uncertainties and effectively translate scientific findings into political decisions?

Adapted Communication in Increasing Crises
(1) How can communication be adapted to the

challenge of increasing crises to focus on health awareness rather than just risks, while not underestimating public interest?

Reaching Skeptics and the Uncertain
(1) How can skeptics and the uncertain members of society be reached, especially in light of increasing populism? Who can deliver the message to ensure it is received?

Increasing Risk Competence and Self-Efficacy
(1) How can the risk competence and self-efficacy of the population be increased?

Targeted Presentation of Risks in Critical Infrastructures
(1) How can risks related to critical infrastructures be presented and communicated in a way that is appropriate for different target groups?

Educational Measures for Systemic Risks
(1) What educational measures are needed to better anticipate the risks associated with increasing interconnectedness and complexity (systemic risks)?

Improving Self-Preparedness for Floods
(1) How can self-preparedness be improved? In which areas is there a need to better support citizens with information before and during a flood event, and which existing communication measures can be built upon?

Use of Technologies to Enhance Risk Perception and Communication
(1) To what extent can new technologies such as Augmented Reality (AR) and Virtual Reality (VR) be used to enhance risk perception and communication?
(2) How can these technologies help make complex risk information more understandable and promote awareness and preparation for disasters?
(3) What technologies are currently in use to improve risk communication and disaster response in the area of flooding, and which technologies could potentially be implemented in the future at local and national levels?

4.3.4 TECHNOLOGY FOR PREVENTION

Advancing the Effectiveness of Protective Structures for Gravitational Mass Movements
(1) How can the effectiveness of protective structures and measures for gravitational mass movements be improved through (i) new in-situ tests and scaling approaches from model experiments to real-world cases, (ii) the use of innovative sensors and drones, (iii) functional assessment of existing structures and damage documentation, and
(iv) innovative foundation concepts?

Protection of Cultural Heritage
(1) How can measures to protect movable and immovable cultural assets in crisis situations be improved?
(2) How can technologies for digital archiving be advanced to enhance the protection of societally relevant cultural assets?

CBRN Protection in Building Technology
(1) What materials and construction techniques offer the best protection for buildings against CBRN threats?
(2) How can shelters be designed to provide effective protection against all forms of CBRN threats?

Physical Protection of Buildings
(1) What structural measures can make buildings more resilient to the impacts of physical effects (e.g., fires and explosions)?

Monitoring and Early Warning Systems for Supply Shortages
(1) How can the monitoring of critical commodity supply in companies be improved to detect shortages early?
(2) What roles do data analysis and artificial intelligence play in developing early warning systems for supply security?

Improving Avalanche Protection Structures through Technology
(1) What new or existing technologies can be developed and implemented to improve avalanche protection structures?

Earthquake Prevention through Earthquake Engineering
(1) What preventive approaches and technologies can be developed in the field of earthquake engineering to minimize the risk and impact of earthquakes?

Condition Assessment of Protective Structures
(1) What (automated) methods can be developed to

improve the condition assessment of existing protective structures?
(2) How can active and passive protective structures be continuously updated and improved?
(3) Where is protective forest located in Austria, and what is its condition?
(4) How can a protective forest inventory be used to prioritize areas and derive forestry recommendations?

Preservation and Diversity of Protective Forests
(1) How can threats and disturbances to protective forests be counteracted?
(2) How can the lifespan of a protective forest be extended and a shift from monocultures to diverse protective forests be promoted?

Use of Artificial Avalanche Triggering Systems
(1) Can artificial avalanche triggering systems also be used to protect infrastructure and transportation routes?
(2) What potentials and challenges are associated with these systems?

AI-Assisted Seismic Detection of Mass Movements
(1) What (AI-assisted) methods can be developed or improved to enable timely seismic detection of gravitational mass movement events?

Urban Planning and Climate Change Resilience
(1) What urban planning measures and designs contribute to increasing resilience against the impacts of climate change?
(2) To what extent can the implementation of green infrastructure, such as city parks and green roofs, help mitigate flood and heatwave risks?

Use of Robotic Systems in Prevention
(1) How can robotic systems, such as those for infrastructure inspection, be more extensively utilized in prevention?

Handling Failures in Critical Infrastructure
(1) How can the ability to handle failures in critical infrastructure be improved?

Value of Other Technologies for Organizational Tasks
(1) What added value do other technologies offer for organizational tasks and individuals?

Preventing Security Incidents in Networked Systems
(1) How can security incidents in networked, complex, and highly distributed systems be reliably prevented or reduced, particularly in the context of the NIS Directive?

4.3.5 SOCIOLOGICAL, SOCIETAL, AND POLITICAL FRAMEWORK CONDITIONS

Adapting Spatial Planning Structures to Current Challenges
(1) How can the adaptation of spatial planning structures to current challenges such as climate change, population dynamics, land use, and infrastructure development in Austria be achieved?
(2) What specific adaptation strategies are necessary to ensure sustainable and resilient spatial development?

Impact of the Austrian Administrative Structure on Disaster Prevention
(1) How does the Austrian administrative structure and its responsibilities affect disaster prevention?
(2) What improvements can be made to achieve more effective prevention and crisis management?

Effects of Administrative Structure on Prevention Strategies
(1) What influence does the Austrian administrative structure have on the development of tailored strategies for preventive measures at the national level?
(2) How can these strategies be optimized?

Adapting Administration to Increasing Complexity in Society
(1) What adjustments are needed in the Austrian administration to keep pace with the increasing complexity in society and crisis management?
(2) How can the challenges of responsibility diffusion and silo thinking be addressed to promote integrated thinking and action?

Analysis of the Effectiveness and Legitimacy of Prevention Instruments
(1) How can the effectiveness and legitimacy of instruments for promoting prevention and governance concepts in Austria be analyzed more precisely in an international comparison?
(2) What measures, from incentives and nudging to coercive power, are effective in influencing individual contributions?

Reducing International Dependence in Healthcare Supply
(1) How can Austria's international dependence on health-related materials be reduced? What strategies and measures are necessary for this?

Minimizing Risks from Highly Optimized Supply Chains
(1) How can the risks resulting from highly optimized supply chains be minimized? What diversifications and fallback levels can be established to reduce the impact of disruptions in these chains?
(2) How can supply chains and production processes for these critical products be made more resilient to external shocks?
(3) Which system-critical products are particularly vulnerable in the context of global crises such as pandemics?

Impact of Laws on Settlement Development in Flood-Prone Areas
(1) How do laws, regulations, and guidelines affect settlement development in flood-prone areas in Austria?

Effects of the Absence of Permit Requirements in HQ100 Areas
(1) What are the impacts of the absence of permit requirements for buildings in HQ100 areas on risk management?
(2) What are the implications for the fundamental discussion of Austrian Water Law?

Involving Youth in Disaster Preparedness
(1) How can young people be effectively involved in disaster preparedness and recovery to train the next generation of resilience leaders?

4.3.6 ECONOMY

Economic Evaluation of Preventive Measures
(1) How can the costs and benefits of preventive measures be economically evaluated to ensure efficient allocation of resources?
(2) What roles do insurance and risk transfer mechanisms play in disaster preparedness, and how can they be designed more effectively?

Disaster Risk Transfer and Insurance
(1) How can mechanisms for disaster risk transfer and insurance be developed and implemented to reduce the financial impacts of disasters on governments and societies, both in urban and rural areas?
(2) What models of risk-sharing and self-participation can support financial security for public and private investments?

Resilience of Workplaces to Disaster Risks
(1) How can workplace resilience to disaster risks be enhanced through structural and non-structural measures?
(2) What specific strategies and technologies can be employed to protect work environments across various industries?

Sustainable Use and Management of Ecosystems
(1) How can the sustainable use and management of ecosystems be strengthened and integrated approaches to environmental management and natural resource management be implemented, incorporating disaster preparedness?
(2) What methods and techniques can be employed to make ecosystems more resilient to natural disasters?

Identification and Assessment of Crisis-Prone Supply and Sales Markets
(1) Which supply and sales markets are particularly relevant and vulnerable to crises for the Austrian economy?
(2) How do global changes such as digitalization and climate change impact these markets?

Analysis of Transport Routes and Supply Chains
(1) How are transport routes and supply chains for key import and export goods structured?
(2) What weaknesses exist in these chains, and how could they be affected in various crisis scenarios?

Evaluation of Alternative Supply Markets
(1) What alternative supply markets could be considered for Austrian products and services?
(2) What socio-political and economic conditions prevail in these alternative markets?

Analysis of Sales Markets
(1) How might the identified supply and sales markets develop under various medium- to long-term scenarios?
(2) What specific risks and opportunities exist for the sales markets of Austrian products?
(3) How could changes in global market conditions impact the export of Austrian goods?

Identification of Macroeconomic Mechanisms and Their Relevance for Security
(1) Which macroeconomic mechanisms are particularly relevant for the Austrian economy and could have significant impacts if disrupted?
(2) Which economic mechanisms are especially vulnerable to influences, whether from geopolitical, economic, or technological factors?
(3) How can the resilience of these mechanisms to external disturbances be improved?

Development of Strategic Options to Strengthen Economic Resilience
(1) What strategic options can be developed to strengthen the resilience of the Austrian economy?
(2) How can these strategies be integrated into existing economic policies and operationalized?

Identification of Critical Risk Factors in Supply Chains
(1) How can critical risk factors and vulnerable nodes in the supply chains of Fast Moving Consumer Goods (FMCG) be effectively identified?
(2) What methods and technologies are best suited to analyze and understand the complexity and interconnectivity of supply chains?

Disaster Risk Management in Agriculture and Food Production
(1) How can the protection of livelihoods and production assets, including livestock, working animals, tools, seeds, and agricultural land, be improved?
(2) What innovative approaches and technologies can be used to protect these resources from disaster risks?
(3) How can the population be protected from hazards arising from animal husbandry and agriculture?
(4) How can livestock herds be protected from pathogens introduced by humans into the livestock population?

Disaster Risk Management in the Tourism Sector
(1) How can disaster risk management concepts be effectively integrated into the tourism sector to enhance its resilience, particularly in regions heavily dependent on tourism as a major economic driver?

4.3.7 RECOMMENDATIONS AND KEY TAKEAWAYS

The effective prevention of disasters requires a variety of action-oriented recommendations that focus on different aspects. These include expanding the foundations of prevention by quantifying gender- and diversity-specific differences in vulnerability, as well as conducting studies to identify effective risk mitigation measures. Additionally, the development of future scenarios related to climate change and population dynamics is of great importance. The integration of real-time earthquake reports into prevention strategies and the effective identification of vulnerable individuals are also crucial.

Comprehensive prevention concepts require promoting international and interdisciplinary cooperation, as well as developing "nature-based solutions" to address biodiversity changes and climate change. Enhancing the resilience of health systems and utilizing technologies to improve protective structures also play an important role.

In terms of risk communication and awareness-raising, analyzing and optimizing the goals of risk communication are key. Furthermore, it is essential to make scientific terms and classifications understandable to the general public and to integrate risk awareness into educational programs.

Technology plays a critical role in disaster prevention. The further development of protective structures through innovative sensors and drones, as well as the use of AI-supported methods for seismic detection of mass movements, are important steps in this direction.

Socio-organizational, societal, and political frameworks must also be considered. This includes adapting administrative structures to current challenges and involving young people in disaster preparedness and reconstruction efforts.

Economic aspects are equally important, such as the economic evaluation of preventive measures for efficient resource allocation and the development of mechanisms for disaster risk transfer and insurance

4.4 SUPPORTING DISASTER PREPAREDNESS

The following chapter centers around the central question: What research priorities are being set to support disaster preparedness and disaster protection planning? This chapter outlines a framework that demonstrates how research and development in various fields can contribute to enhancing the effectiveness and efficiency of disaster preparedness and planning. It identifies research areas specifically aimed at improving disaster preparedness and strengthening the resilience of communities against future disasters. The insights gained from addressing these topics are intended to be directly applied in the development of disaster protection plans and strategies.

4.4.1 DISASTER RESPONSE PLANNING

Consideration of Gravitational Mass Movements, Avalanches, and Earthquakes in Disaster Protection Plans
(1) To what extent are gravitational mass movements, avalanches, and earthquakes included in Austria's national, regional, and local (municipal level) disaster protection plans?
(2) What strategies can be developed to achieve greater standardization and integration of these risks in disaster protection plans?

Harmonization of Disaster Preparedness
(1) How can synergies and redundancies in disaster preparedness, particularly in areas such as planning, infrastructure, and communication, be better harmonized?

Building and Maintaining Redundancies in Supply Infrastructures
(1) What strategies can be developed to build and cost-effectively maintain redundancies in supply infrastructures, such as in cases of medication shortages?

Measuring Central Aspects of Disaster Protection
(1) How can central aspects of disaster protection be made measurable to assess and optimize the effectiveness of measures?

Improving Disaster Protection through Artificial Intelligence
(1) In what ways can artificial intelligence contribute to improving disaster protection, and which specific applications are promising?

Contribution of Science to Administrative Decisions
(1) How can science effectively contribute to improved decision-making at the administrative level in the field of disaster protection?

Promoting International and Interdisciplinary Cooperation in Disaster Preparation
(1) What approaches and strategies can be developed to promote international and interdisciplinary collaboration in disaster preparedness?

Evaluation Criteria for Effectiveness and Efficiency of Disaster Protection Measures
(1) What criteria and standards can be established to evaluate the effectiveness and efficiency of disaster protection measures?

Integration of Multi-Hazard Issues in Disaster Preparedness and Response
(1) How can the interaction of different natural hazards be better integrated into national and local disaster preparedness and response in Austria?

Management and Analysis of Cascading Effects in Flood Events
(1) Can events such as floods trigger cascading effects, and how does the warning chain function in this case?
(2) Are the necessary disaster protection plans available and accessible to all relevant stakeholders, and how is the distribution of information organized?

Emergency Plans for Waste Management
(1) How can effective emergency plans for managing disaster waste be developed and integrated into general disaster management plans?

Inclusive Disaster Preparedness
(1) How can disaster preparedness be made more inclusive to ensure that the needs of all population groups, including people with disabilities, older adults, and other vulnerable groups, are considered?
(2) What specific measures and programs are necessary to ensure accessibility and participation for all groups?

4.4.2 WARNING AND ALERTING THE POPULATION

Development of an Effective Early Warning System in Austria
(1) How can an effective, comprehensive early warning system be developed and implemented in Austria that utilizes modern communication tools such as social media and cell broadcasting/SMS-CB?
(2) What key factors are crucial for the successful establishment of this system?

Development of a Methodological Framework for Information Space Assessment
(1) How can a methodological framework be developed that allows the analysis of activities and strategic intentions of actors in the information space?
(2) What specific indicators and metrics are necessary to effectively capture and evaluate activities in the information space?

Warning Systems for CBRN Hazards
(1) How can innovative warning systems be developed that are specifically designed for the early detection and warning of Chemical, Biological, Radiological, and Nuclear (CBRN) hazards?
(2) How can monitoring systems be improved to detect chemical agents early and on a large scale?
(3) How can mobile and stationary detection systems for the early detection of radioactive radiation be improved?

Evaluation and Adjustment of Analysis Methods for Wastewater Monitoring
(1) How can existing analysis methods for detecting pathogens in wastewater be evaluated and optimized?
(2) What methods and techniques are required to expand wastewater monitoring to additional pathogenic agents?

Development of Early Detection Strategies for Health Risks
(1) How can existing wastewater monitoring systems be adjusted to detect other pathogenic microorganisms or biological hazards early?
(2) What new analytical approaches are needed for broader application in early detection?

Integration and Networking of Monitoring Programs
(1) How can wastewater monitoring programs be effectively integrated with existing sentinel systems?
(2) What concepts are necessary to develop and implement joint data platforms?

Integration of Water Quality Data into Digital Systems
(1) How can water quality data, including testing data, be effectively integrated into digital systems to ensure stable information exchange between water suppliers and analysis agencies?
(2) What digital platforms and interfaces are necessary to enable real-time data analysis and responses to water quality issues?

National Observation of New Drinking Water Hazards
(1) What new hazards to drinking water caused by climate change, such as microcystins in water animals, need to be particularly monitored?
(2) How can a national monitoring system be designed that takes climatic changes into account and responds early to new hazards?
(3) How can information on water quality and health risks be effectively communicated to the public to promote awareness and protective measures?

Warning Systems for Gravitational Mass Movements
(1) Can warning systems or concepts specifically for gravitational mass movements, similar to avalanche warning systems, be developed and implemented?
(2) What technological and methodological approaches are particularly promising for this purpose?

Novel Measurement Methods for Avalanche Warnings
(1) What innovative measurement methods can be used for monitoring and early warning of avalanches?
(2) Are there new approaches with the potential to enhance the effectiveness of avalanche warning systems?

Designing Accepted Early Warning Systems
(1) How can early warning systems be designed to increase acceptance and use by civil society and emergency organizations?
(2) What factors influence the effectiveness of communicating early warning information?

Development of Human-Centered Early Warning Systems
(1) How can human-centered and cross-hazard early

warning systems be developed and tailored to meet the needs of users, including gender-specific requirements?
(2) How can the use of simple and cost-effective technologies for early warning be promoted?

Strengthening the Evacuation Capacities of Local Authorities
(1) What methods can be developed to strengthen the evacuation capacities of local authorities for evacuating people in disaster-prone areas?

Innovative Approaches for Communication Channels and Advisory Services
(1) What new, innovative approaches can improve the expansion of communication channels and impact-oriented advisory services for authorities and the private sector in routine and emergency situations?

Real-Time Hazard Assessment for Natural Hazards
(1) What methods can be developed for real-time hazard assessment and threshold evaluation for gravitational mass movements, avalanches, and earthquakes?

Use of Building Information Models in Disaster Preparedness
(1) How can Building Information Models be used more effectively in disaster preparedness and planning, for example, in modeling evacuation scenarios?

Information on Hazard Status in Flooding
(1) How can individuals be effectively informed about their hazard status in the case of pluvial/fluvial floods?
(2) What measures can individuals take if needed, and how can self-responsibility be effectively communicated and improved?

Strengths and Weaknesses of Digitalization in Flood Warnings
(1) What strengths and weaknesses does digitalization bring to the field of flood warnings?
(2) How robust are digital warning systems in the event of a disaster, and what analog backup systems are necessary?

Integration of Big Data and AI into Early Warning Systems
(1) How can Big Data and Artificial Intelligence (AI) be used to make early warning systems more precise and effective?
(2) What ethical and data protection challenges arise from using these technologies, and how can they be addressed?

4.4.3 EDUCATION, TRAINING, EXERCISE AND EXERCISE EVALUATION

Development of Educational Strategies
(1) What educational strategies could be developed to improve awareness and understanding of crisis management and civil defense topics?
(2) How can schools and educators be better supported to effectively teach these topics?

Cooperation and Educational Approaches
(1) What opportunities exist for cooperation between schools, military commands, and other relevant organizations to embed civil defense in the educational system?
(2) How can interactive and student-centered teaching methods help to enhance student engagement and understanding of security policy education?

Training and Education
(1) How can training and education for emergency personnel and the general public be improved to increase awareness and responsiveness to CBRN (Chemical, Biological, Radiological, and Nuclear) threats?

Critical Accompaniment Research for Disaster Response Exercises
(1) How can scientific accompaniment research critically analyze disaster response exercises to achieve maximum learning effects and progress in dealing with risks and manifest disasters?
(2) What approaches are necessary to enable systematic evaluation of exercises, including the analysis of participant performance and infrastructure?
(3) How can the communication of exercise results be optimized and a culture of constructive handling of errors be promoted?

Utilizing Technological Developments in Exercises and Simulations
(1) How can current technological developments be used to make disaster response exercises and simulations more efficient and effective?

Evaluation of Exercises and Simulations
(1) What methods can be developed to comprehensively evaluate exercises and simulations in disaster response?

Use of Artificial Intelligence in Disaster Response Exercises
(1) What potential does the use of artificial intelligence have in the context of disaster response exercises and preparedness, and what specific applications are available?

Development of New Training and Exercise Concepts
(1) How can new training and exercise concepts be developed to allow for greater public involvement, similar to Japan's Life Safety Learning Centers?
(2) How can training and educational programs in the industrial sector be better adapted to the specific human factors that lead to accidents?

Regular Exercises for Disaster Preparedness
(1) How can regular exercises for disaster preparedness be promoted to ensure a swift and effective response to disasters and evacuations?

Establishment of Routine Earthquake Disaster Response Exercises
(1) How can routine earthquake disaster response exercises be established and conducted at the national level to train and sensitize both emergency personnel and the general population?
(2) What existing emergency plans and administrative procedures are in place, and what do the feasibility studies look like?

Disaster Response Exercises for Specific Scenarios
(1) How can disaster response exercises for specific scenarios be established and conducted to increase awareness among the population and the organizations involved in the disaster(s)?

4.4.4 PERSONNEL AND RECRUITMENT

Promotion of Voluntary Engagement in Disaster Response
(1) How can existing imbalances in volunteer sector participation, such as the underrepresentation of women, people with migration backgrounds, and individuals with disabilities, be identified and addressed?
(2) What strategies can be developed to encourage broader public participation in voluntary disaster response efforts?

Structural Changes in Volunteering
(1) What changes are observable in the structural transformation of volunteering, and how can these changes be positively utilized to enhance the effectiveness of volunteer engagement in disaster response?

Ensuring Adequate Personnel in Emergencies
(1) How can it be ensured that sufficient personnel, particularly for (medical) care, is available and ready for deployment in the event of a disaster?
(2) What measures and systems can be implemented to improve the availability and mobility of volunteers?

Training Health, Care, and Rescue Personnel
(1) How can health, care, and rescue personnel be effectively trained for crisis and disaster situations?
(2) What specific training and continuing education programs can be developed to enhance the skills of these professional groups in emergency situations?

Strengthening Technical and Logistical Capacities for Disaster Relief
(1) How can existing workforce and volunteers in disaster relief be trained to ensure a more effective response in emergencies?
(2) What technical and logistical capacities are required, and how can these be strengthened and expanded?

Identification of Stress Factors and Resilience Mechanisms
(1) What specific psychosocial stress factors affect employees in critical infrastructures during and after crises?
(2) How do these stress factors manifest in different working environments within critical infrastructures?

Evaluation and Comparison of Protective Factors
(1) What organizational and individual protective factors contribute to the resilience of health personnel, and how can these be applied to other sectors of critical infrastructure?
(2) What international models and practices for promoting resilience could be adapted to the Austrian context?

Development of Intervention Strategies
(1) What preventive and reactive measures can be developed to strengthen the mental health and resilience of employees?
2) How can these measures be effectively implemented and evaluated to ensure their effectiveness?

Role of Organizational Framework Conditions
(1) How do working conditions, levels of training, and communication structures affect the resilience of employees in critical infrastructures?
(2) What changes are necessary to create resilience-promoting work environments?

Long-Term Strategies to Enhance Job Appeal in Critical Infrastructures
(1) What long-term strategies can be developed to increase the attractiveness of jobs in critical infrastructures and thereby reduce the psychosocial stress of employees?
(2) How can such strategies contribute to the sustainable security of supply and social stability?

4.4.5 CRISIS SECURITY AND RESILIENCE

Influence of Global Changes on Local/Regional Disaster Preparedness
(1) How do global changes, such as climate change and geopolitical developments, affect disaster preparedness at the local and regional levels?
(2) What adaptation strategies can be developed to address these global influences?

Antifragility Against "Black Swans"
(1) How can societies and systems be better prepared for unforeseen and rarely occurring extreme events ("Black Swans")?

Consideration of Animal Care in Disaster Situations
(1) How can the care and protection of animals in disaster situations be integrated into disaster preparedness plans?
(2) What specific measures and resources are necessary for this?

Utilization of Public Infrastructure for Disaster Management
(1) How can public infrastructure, such as tunnels and underground structures, be utilized for disaster management?
(2) What assessments are necessary to effectively plan and implement shelters and similar facilities?

Ensuring the Functionality of Response Organizations
(1) How can the functionality and readiness of response organizations be ensured in crisis situations?
(2) What measures and precautions are required to maintain operational capability under crisis conditions?

Conceptualizing a Future-Proof Supply Strategy for Emergency Services
(1) How can the actual supply needs (fuel, food, water, electricity, communication tools, etc.) of authorities and organizations responsible for security be reliably assessed for a 14-day period?
(2) To what extent do seasonal factors affect the supply needs of crisis-relevant organizations?
(3) How can these fluctuations be accounted for in the planning of stockpiling and logistics?
(4) How can a robust supply strategy be developed for emergency services and other crisis-relevant organizations to ensure reliable supply for at least 14 days?
(5) What logistical and infrastructural adjustments are required to ensure efficient and resilient supply in crisis situations?

Compensation for Digital Infrastructure Failures with Analog Backups
(1) How can the failure of digital infrastructures be compensated by redundant, non-electrically dependent structures and resources?
(2) What analog backup systems can be effectively used in disaster situations?

Ensuring Access to Medications in a Disaster
(1) How can it be ensured that the population has access to necessary medications during a disaster?
(2) What logistics and supply strategies are required for this?

Building and Utilizing Redundancies and Reserves in Resources
(1) How can important redundancies and reserves in resources and know-how be identified, utilized, and expanded when needed?

Supporting Local-Level Flood Disaster Preparedness
(1) What measures are necessary to support flood disaster preparedness at the local level?

(2) What needs and benefit analyses are required to develop application-oriented solutions?

Identification of Relevant Infrastructure in Flood Situations
(1) Which relevant infrastructures are particularly affected by flood events?
(2) What measures are necessary to improve the protection of critical infrastructure against flood events?

Enhancing the Resilience of Critical Infrastructures
(1) How can the resilience of new and existing critical infrastructures, including water, transport, telecommunications, educational institutions, and healthcare facilities, be enhanced?
(2) What public and private investments are needed to strengthen the resilience of these infrastructures?

Cybersecurity in Disaster Management
(1) How can critical infrastructures and communication systems be protected from cyberattacks during a disaster?
(2) What specific security protocols and strategies are required to ensure the integrity and availability of data critical to disaster management?

Emergency Supply After Supply Chain Failures
(1) What preparations are necessary to effectively establish and maintain emergency supplies after severe disruptions to supply and distribution chains?
(2) How can logistical and technological challenges be overcome?

Strategies for Ensuring Supply During Crises
(1) What preventive measures can authorities and businesses take to ensure supply security even under crisis conditions?
(2) How can resilience strategies be developed to ensure both the maintenance of supply and rapid response to unforeseen events?

Management of Out-of-Stock Situations and Bullwhip Effects
(1) How can businesses effectively manage out-of-stock situations and minimize bullwhip effects during crises?
(2) What logistical and operational adjustments are necessary to mitigate the impacts of supply disruptions?

Involving the Public in Crisis Prevention
(1) How can awareness and individual responsibility for the need to stockpile Fast Moving Consumer Goods (FMCG) during crises be strengthened?
(2) What information and education strategies are effective in preventing irrational behavior?

Distribution of Available Resources
(1) On what basis can available resources be rationed and distributed according to need during crises to ensure fairness and efficiency?
(2) What resource allocation models are suitable for meeting the needs of critical sectors and the population?

Development of a Flexible and Resilience-Oriented Distribution System
(1) How can a modern entitlement system for critical supplies be designed to flexibly respond to various crisis scenarios, including blackouts and conflicts?
(2) What technical and organizational requirements are necessary to keep such a system functional in the event of widespread failures of information and communication technologies?
(3) What measures are required to ensure digital security and data protection in such systems?

Integration into Existing Infrastructures and Systems
(1) How can the new entitlement system for critical supplies be integrated into existing administrative and logistical structures?
(2) What technical and logistical challenges must be overcome in implementing a nationwide system?

Monitoring and Adapting to Future Needs
(1) How can the system be designed to reflect current and future needs for essential goods and preproducts?
(2) How can the products and services to be managed be regularly evaluated and updated to ensure relevance and efficiency?

Compensating for Failures in ICT Systems
(1) Through what strategies and technologies can the failure or shortage of critical components in information and communication technology (ICT) systems be compensated?
(2) What role does redundancy and diversification of technology play in this?

4.4.6 POLITICS AND ADMINISTRATION

Intersectoral and Interdisciplinary Cooperation
(1) How can different sectors and disciplines collaborate more effectively to ensure comprehensive and coherent disaster preparedness?
(2) What mechanisms and platforms are necessary to promote exchange and cooperation between government agencies, the private sector, academia, and civil society?

Adjustment of Legal Framework Conditions
(1) What adjustments to legal and regulatory frameworks are needed to enable effective and flexible disaster preparedness?
(2) How can international best practices and standards be integrated into national preparedness plans?
(3) How should approval procedures in the industrial sector be adjusted to adequately reflect and regulate changes due to climate change?

Development of Policies and Plans for Disaster Preparedness
(1) How can key institutions be involved in the development or review of policies, plans, and programs for disaster preparedness?
(2) How can various climate change scenarios and their impacts on disaster risk be incorporated into these policies and plans?

Adjustment of Administrative Structures to Networked Crises
(1) How can Austria's administrative structure and responsibilities be adapted for disaster preparedness in response to the new challenges of networked crises?
(2) What structural changes are needed to ensure an effective response to these complex crisis scenarios?

Provision of Resources for Disaster Preparedness
(1) How can necessary resources be allocated at all administrative levels for the development and implementation of disaster preparedness strategies and plans?
(2) What financing models and mechanisms can support the sustainable financing of disaster preparedness?
(3) How can public-private partnerships (PPP) contribute to the financing of preparedness measures?

Political Concepts for Disaster-Induced Human Mobility
(1) How can political concepts and programs be developed to address disaster-induced, human mobility and strengthen the resilience of affected individuals?

Enhancing Resilience of Businesses and Protecting Livelihoods
(1) How can the resilience of businesses and the protection of livelihoods and production means in supply chains be improved, and how can disaster risk management be integrated into business models?
(2) How can industries adjust their locations to increase resilience to new operational threats posed by climate change?

Revision of Building Codes for Resilient Settlements
(1) How can the revision of existing or the development of new building codes and standards be promoted to make them more applicable in local contexts, especially in informal and marginalized human settlements?

Integration of Disaster Preparedness into Financial Instruments
(1) How can the integration of disaster preparedness considerations into financial and fiscal instruments be promoted?

Embedding Disaster Risk Assessments into Land Use Policy
(1) How can the systematic integration of disaster risk assessments into land use policy development and implementation, including urban planning and land degradation, be promoted?

Risk Transfer between State and Private Sector
(1) To what extent can risk transfer between the state and the private sector support disaster management?
(2) What roles should the state assume, and which can be transferred to the private sector, particularly regarding the involvement of insurance companies?

Optimizing Cooperation between State and Insurance Industry
(1) What incentives and instruments are necessary to optimize cooperation between the state and the insurance industry?
(2) How can effective collaboration with insurers be designed from a governmental perspective, and what risks are associated with this?

Solutions for Conflicts of Interest Due to Different Legal Requirements
(1) How can solutions and compromises be found for conflicts of interest arising from different legal requirements (e.g., EU directives)?
(2) How can satisfactory solutions be achieved even with differing objectives, such as those in sustainable energy generation and ecology?

4.4.7 RECOMMENDATIONS AND KEY TAKEAWAYS

A critical review of the current integration of mass movements, avalanches, and earthquakes into disaster protection plans is crucial. The development of strategies to standardize and integrate these risks into the plans should be prioritized to create synergies and minimize redundancies. It is important to create and maintain redundancies in supply infrastructures to ensure supply security. The establishment of metrics to evaluate the effectiveness of disaster protection measures is essential. Likewise, the use of artificial intelligence to improve disaster protection should be researched and promoted. Disaster preparedness should consider all population groups to ensure that no one is excluded.

The development of effective early warning systems that use modern communication tools is of paramount importance, as is research into warning systems for gravitational mass movements and avalanches. Local authorities should strengthen their evacuation capacities to act quickly and efficiently in case of emergencies. The use of cutting-edge technologies for real-time hazard assessment in natural disasters is another important step.

Critical accompanying research on disaster protection exercises, as well as the use of technological developments and artificial intelligence to optimize exercises, is indispensable. New training and exercise concepts should be developed to actively involve the population and thereby improve disaster preparedness.

Strategies to address imbalances and leverage structural changes in the volunteer sector can enhance effectiveness in disaster protection.

The development of adaptation strategies to global changes such as climate change and geopolitical developments is of great importance. Intersectoral and interdisciplinary cooperation should be promoted to ensure comprehensive disaster preparedness. This is only possible if sufficient resources are provided at all administrative levels.

4.5 STRENGTHENING COPING CAPACITY

This chapter addresses the question: What research priorities should be set to improve crisis and disaster management capabilities in Austria? In this context, it aims to design a strategic research agenda focused on identifying and developing innovative solutions and technologies in disaster management. Special attention is given to optimizing collaboration between various actors in crisis management, including the efficient coordination and integration of different stakeholders. The role of technology, particularly in robotics and digitalization, is considered a crucial aspect for enhancing the efficiency and effectiveness of disaster management measures. By setting specific research priorities, the goal is to contribute to strengthening capacities and capabilities for disaster management, thereby improving the resilience and responsiveness of communities and organizations in crisis situations.

4.5.1 DIGITIZATION AND TECHNOLOGY IN DISASTER MANAGEMENT

Deployment of New Technologies for Locating Avalanche Victims
(1) Which new technologies, including GPS, UWB ranging, and lambda receivers, could contribute to improving location systems for avalanche victims?
(2) How can these technologies be integrated into existing rescue systems to enhance the efficiency and accuracy of avalanche victim location?

Real-Time Remote Sensing and Monitoring in Disaster Situations
(1) Which remote sensing methods and monitoring systems can be used during disaster situations to provide real-time information to decision-makers for hazard and risk assessment?
(2) To what extent can such systems be automated to shorten response times and improve data quality?

Identification of CBRN Hazards
(1) How can the identification of toxic industrial materials and chemical warfare agents in the field be improved?
(2) How can the identification of contamination residues be improved using different detection methods?
(3) How can the sensitivity of detection methods be enhanced?

CBRN-Specific Equipment for Emergency Responders
(1) What equipment concepts are needed to improve the capability of civilian response organizations for CBRN events?
(2) How can personal protective equipment (PPE) for responders in CBRN situations be improved?
(3) How can response capabilities to CBRN events be enhanced through specialized equipment or technologies?

Decontamination Systems
(1) How can vehicles and equipment be designed to enable rapid decontamination of individuals and areas?

Management of Mass Poisonings and Injuries
(1) What procedures and techniques are most effective in ensuring optimal medical care during mass incidents involving CBRN agents?

AI Technologies in Disaster Management
(1) How can AI technologies contribute to rapid mapping, event documentation, and rapid assessment in disaster situations?
(2) Which specific AI models and algorithms could be developed or optimized for such tasks?

Development of Monitoring Systems for Avalanche Victim Search
(1) Which monitoring systems, particularly radar and drone technologies, can be developed or improved to optimize the search for avalanche victims?
(2) How can the collaboration between such technological systems and rescue teams be designed to maximize the effectiveness of search and rescue operations?

Holistic digital multi-hazard approach
(1) How can digital technologies and approaches support a holistic multi-hazard approach in disaster management?
(2) What types of data and analyses are required to effectively manage and prevent different types of disasters?

Safety and Efficiency of Robots in Collaboration with Humans
(1) How can robotic systems be developed and secured to work safely and effectively in collaboration with humans during disaster response?

Potential and Risks of Robotic Systems and AI in Disaster Management
(1) What potential do robotic systems, AI, and digitalization offer to improve disaster management?
(2) What risks and challenges are associated with the use of such technologies, particularly concerning inadequate trust or distrust?
(3) How can a balanced relationship between technology reliance and manual competence be achieved in disaster scenarios?

Advances in Technology to Improve Disaster Response and Evidence
(1) What new or improved technologies, such as unmanned aerial vehicles (UAVs), can enhance efficiency in disaster response and improve evidence collection?

4.5.2 COORDINATION AND LEADERSHIP OF DIASTER RELIEF OPERATIONS

Decision-Making Under Uncertainty
(1) How can decision-makers in disaster situations be supported to make effective decisions under high uncertainty and time pressure?
(2) What roles do simulation-based scenario analyses and decision support systems play in this process?

Determining Resilience and Vulnerability Factors in Disaster Situations
(1) How can specific resilience and vulnerability factors in various disaster situations be effectively identified and analyzed?

(2) How can these factors be integrated into strategies and measures for disaster response and preparedness to improve community and infrastructure resilience?

Response to Disasters During Infectious Disease Outbreaks
(1) What measures and protocols can be developed to respond to disasters during infectious disease outbreaks without increasing the risk of infection?
(2) How can coordination between disaster relief efforts and public health services be optimized to ensure both effective disaster management and infection control?

Protection of Health, Care, and Rescue Personnel in Crises
(1) What strategies and measures can be taken to protect health, care, and rescue personnel from increased stress during crises and disasters?
(2) How can the mental and physical health, as well as the working conditions, of these professionals be effectively supported and improved in extreme situations?

Utilization of Health Resources During Health Crises
(1) How can resources from various sectors of the healthcare system (e.g., hospitals, private practices, research institutions) be mobilized and utilized effectively during health crises?
(2) What models and strategies can be developed to enable a rapid and flexible response to changing needs and resource requirements in health crises?

Promoting Coordination Among Response Organizations
(1) What measures and mechanisms can be developed to improve coordination and collaboration between different response organizations?

Differentiated Assistance Based on Specific Needs
(1) How can a differentiated understanding of the needs of various social groups be achieved and translated into adequate needs planning and assistance offers?

Reducing Health Crises as a Result of Disasters
(1) What preventive measures and interventions can be developed to minimize health crises resulting from disasters?

Analysis and Improvement of National Situation Reports
(1) What factors are currently considered in the creation of national situation reports, and where is there room for improvement?
(2) What is necessary to create meaningful national situation reports, and how can these be effectively utilized by different organizations, such as administrations and fire departments?
(3) How can the continuous relevance of situation reports be ensured to provide the most relevant information to responders at the scene?

Use of Social Media and Crowdsourcing in Disaster Management
(1) How can social media and crowdsourcing be effectively used for data collection for situational assessment, and what risks are associated with these methods?

4.5.3 PARTICIPATION AND COOPERATION OF THE PUBLIC

Integration of Civilians in Disaster Management
(1) What specific challenges and barriers prevent the effective implementation of civilian integration into disaster management, despite the development of various concepts for structured and safe involvement?
(2) How can these challenges and barriers be systematically identified and overcome to improve civilian participation in areas such as spontaneous aid, civilian disaster management, and neighborhood assistance?

Protection and Utilization of the Information Space for Counter-Narratives
(1) How can the information space be protected effectively to minimize disinformation and hostile influences?
(2) What strategies and tools are necessary to actively use the information space for disseminating counter-narratives?

Equal Task Distribution in Disaster Management
(1) How can concepts for equal task distribution in disaster management be developed that focus on competencies rather than structural characteristics such as gender and diversity?
(2) What strategies can be applied to ensure the effective and efficient involvement of all available personnel capacities in disaster response?

Increasing Risk Awareness and Willingness to Cooperate During Disasters
(1) What strategies and methods can be developed to increase the risk awareness and willingness to cooperate of the population during a disaster?
(2) How can communication between disaster management authorities and the public be improved to achieve a better understanding of risks and necessary actions?

Adherence to Crisis and Disaster Measures by the Public
(1) What factors influence the adherence to crisis and disaster measures by the public?
(2) How can these factors be captured and addressed to achieve more effective implementation of measures in crisis situations?

Understanding Social Differentiation, Cohesion, and Solidarity in Crises
(1) How can social differentiation, cohesion, and solidarity in crises and disasters be better understood and studied?
(2) What role do these factors play in crisis management, and how can they contribute to strengthening community resilience?

Involvement of Volunteers in Disaster Response
(1) How can volunteers be effectively integrated into disaster response efforts?
(2) What training, support measures, and structures are necessary to optimize volunteer participation and effectiveness?

Deployment of Robotic Systems in Disaster Management
(1) How can robotic systems be utilized to improve disaster management capabilities?
(2) What specific functions and capacities should these systems have to be effective in various disaster scenarios?

Improving Volunteer Management and Integration of Spontaneous Helpers
(1) How can volunteer management and the integration of spontaneous helpers in disaster situations be improved?
(2) What processes and conditions are necessary to ensure efficient and effective participation by volunteers?

Structural Adjustments for Societal Crisis Management
(1) What structural (societal, technical, organizational, legal, etc.) adjustments are needed to improve societal crisis management capabilities in interconnected crises and disruptive events?
(2) How can such adjustments be implemented to enable a quick and effective response in complex crisis scenarios?

4.5.4 CRISIS COMMUNICATION

Barriers to Crisis Communication at Different Levels
(1) What specific barriers exist for crisis communication at the levels of intraculturality (within a culture), interculturality (between different cultures), and intersemiotic (non-verbal, multimedia, and mediatized communication)?
(2) How can factors such as cultural backgrounds (especially in the context of migration), prior experiences, and other relevant aspects be taken into account when designing effective crisis communication?
(3) What concrete measures and actions can be taken to overcome these communication barriers?

Effective Communication Strategies in Disasters
(1) Which communication strategies are particularly effective in disaster situations, and how can general safety communication be improved?
(2) Which technical communication channels remain available and reliable under extreme conditions like disasters, and how can their use be optimized to ensure effective communication?
(3) How can general safety-related technical communication be improved, especially concerning the availability and utilization of technical channels?

Use of Social Media in Managing Natural Events
(1) In what ways can social media be utilized before, during, and after a natural event to minimize harmful impacts, and what specific strategies are most effective for this purpose?

4.5.5 COLLABORATION AND INTEROPERABILITY

Promotion of International and Interdisciplinary Cooperation in Disaster Management
(1) What strategies and measures can be developed to promote international and interdisciplinary collaboration in disaster management?
(2) How can obstacles to effective cross-border and cross-disciplinary cooperation be identified and overcome?

Improvement of Cooperation Between Response Organizations and Other Disaster Management Actors
(1) What approaches can be pursued to strengthen cooperation between various response organizations and other disaster management actors, including the general public?
(2) What strategies and techniques can be used to promote communication and coordination within multidisciplinary response teams?
(3) How can different areas of expertise and perspectives within these teams be effectively integrated and utilized to enable a comprehensive response to disasters?
(4) How is the collaboration and communication between various response organizations, such as fire departments, emergency services, police, or military, structured, and is there an overarching planning approach that supports this coordination?
(5) How can communication and coordination mechanisms between these groups be improved to enable a more efficient response to disasters?

Improvement of Coordination at Different Administrative Levels
(1) How can the coordination among various institutions and entities at federal, state, and municipal levels be made more effective in the context of disaster management?

4.5.6 RECOMMENDATIONS AND KEY TAKEAWAYS

To strengthen disaster defense in Austria, it's crucial to focus on various research priorities and develop innovative solutions. A strategic research agenda should be created to identify and develop new technologies and solutions for disaster management. Special attention should be given to optimizing collaboration among different stakeholders, as well as to the role of technology, particularly robotics and digitalization.

In the field of digitalization and technology, research should focus on new technologies for locating affected individuals, as well as real-time remote sensing and monitoring. Integrating AI technologies into disaster management and developing monitoring systems for avalanche rescue are additional important aspects.

Coordination and leadership in disaster response require support for decision-makers under uncertainty and the identification of resilience and vulnerability factors. Special attention should be given to responding to disasters during infectious disease outbreaks and protecting health, care, and rescue personnel.

Public participation and cooperation also play a crucial role. It is essential to actively involve civilians in disaster management and ensure an egalitarian distribution of tasks. Additionally, risk awareness and the willingness of the population to cooperate should be strengthened.

Emergency and crisis communication is central to disaster management. Developing effective communication strategies that consider various barriers, as well as utilizing social media and crowdsourcing, is of utmost importance in disaster response.

Collaboration and interoperability between various disaster management stakeholders need to be improved, both nationally and internationally. This includes promoting international and interdisciplinary cooperation, enhancing coordination among response organizations and other stakeholders, and optimizing the interaction of various institutions at different administrative levels.

4.6 BUILD BACK BETTER

The section "Build Back Better" addresses a central challenge in disaster management: how to rebuild infrastructure, society, and other key areas efficiently and effectively after disaster events. This chapter focuses on identifying and establishing research priorities aimed at accelerating and improving the post-disaster rebuilding process. Among these are innovative approaches to infrastructure restoration, methods to support the social and economic recovery of affected communities, and strategies to enhance resilience against future events. By setting specific research priorities, this field contributes significantly to improving societies' ability to recover from disasters and prepare for future events.

4.6.1 LEARNING FROM PAST EVENTS

Systemic Causes of Disasters and Rebuilding
(1) How can pre-catastrophic socio-structural conditions and social issues be identified to avoid unintended consequences, such as the exacerbation of existing vulnerabilities, during the rebuilding process?
(2) How can the identification of pre-disaster socio-structural conditions and social issues help avoid unintended consequences, such as the exacerbation of existing vulnerabilities, during the rebuilding process?
(3) What multidisciplinary approaches are needed to develop a holistic understanding of disaster risk and resilience that considers both natural and social dimensions?

Critical Reflection on the Concept of Learning
(1) How do societal inequalities and power dynamics influence the understanding and implementation of learning processes after disasters?
(2) How can "socially desirable" change be promoted within a context-dependent, critically reflective framework without exacerbating existing inequalities?

Understanding Disaster-Driven Change and Continuity
(1) How do change and continuity manifest in response to disasters at individual, organizational, and societal levels?
(2) What factors determine whether a disaster leads to structural changes, policy-related shifts, or the reinforcement of existing practices?

Developing New Protective Measures After Disasters
(1) What approaches and methods can be used to learn from past disasters and adapt or develop new protective measures?
(2) How can these measures be integrated into existing risk management and disaster protection plans?

Lessons from the Ukraine War for the Resilience of Societies and Infrastructures
(1) Why did massive power outages in Ukraine not lead to societal collapse?
(2) How was the supply of essential goods and services maintained in Ukraine despite the war and widespread destruction?
(3) What conclusions can be drawn from Ukraine's experiences for designing robust infrastructure and resilient societies in Central Europe?

Psychosocial Effects of Disaster Experiences
(1) How do disaster experiences affect the mental health of those affected, and how can preventive and follow-up measures be optimized?
(2) What impacts do crises and disasters have on social relationships and community structures, and how can social cohesion be promoted during times of crisis?

4.6.2 CRITICAL INFRASTRUCTURE RECOVERY

Involvement of Action Planners in Restoration
(1) What roles and responsibilities do different action planners have in the restoration process following disasters?
(2) How is the coordination and optimization of collaboration between national authorities, local communities, and private actors managed to ensure effective reconstruction measures?

Support for Affected Populations After Disasters
(1) Which existing methods and facilities are crucial for the care and support of affected populations following disasters?
(2) How can these approaches be developed further, to enhance the resilience and well-being of communities?

Construction Processes Under Restricted Conditions
(1) How can construction processes be adapted to function efficiently under severely restricted conditions, including limited resources?
(2) What innovative construction techniques and materials can contribute to accelerating the reconstruction process?

Restoration of Lost Data
(1) What methods and technologies can be used to effectively restore lost data after disasters or system failures?
(2) What best practices exist for data management and data protection in crisis situations?

Promotion of Collaboration in Reconstruction
(1) How can collaboration between various institutions, authorities, and stakeholders, including affected communities and businesses, be promoted in the context of disaster reconstruction?
(2) Which coordination mechanisms and platforms are particularly effective for this purpose?

Guidelines for Reconstruction Preparation
(1) What guidelines and standards should be developed for land use planning and improving construction standards to incorporate lessons learned from previous disaster events and reconstruction programs?
(2) How can the exchange of experiences and insights be institutionalized?

Integration of Disaster Risk Management into Reconstruction
(1) How can the integration of disaster risk management into restoration and rehabilitation processes following disasters be promoted?
(2) How can opportunities be utilized during the recovery phase to build capacities for reducing disaster risk?

Construction Processes Under Restricted Conditions
(1) How can construction processes be adapted to function efficiently under severely restricted conditions, including limited resources?
(2) What innovative construction techniques and materials can contribute to accelerating the reconstruction process?

4.6.3 RESTORATION OF SOCIETY

Involvement of Action Planners in Restoration
(1) What roles and responsibilities do different action planners have in the process of restoration after disasters?
(2) How is the collaboration between national authorities, local communities and private actors coordinated and optimized to ensure effective reconstruction efforts?

Support for Affected Populations after Disasters
(1) What existing methods and facilities are crucial for the care and support of affected populations after disaster events?
(2) How can these approaches be developed further to strengthen the resilience and well-being of communities?

Promotion of Collaboration in Reconstruction
(1) How can collaboration between various institutions, authorities, and stakeholders, including affected communities and businesses be promoted in the context of post-disaster reconstruction?
(2) What coordination mechanisms and platforms are particularly effective for this purpose?

Long-Term Psychosocial Support
(1) How can the long-term psychosocial support for disaster survivors be improved to address post-traumatic stress disorders and other mental health issues?
(2) How can measures to promote psychological resilience be integrated into recovery strategies to support the long-term recovery of affected populations?

Economic Recovery and Livelihoods
(1) Which strategies are most effective for accelerating economic recovery after disasters and restoring people's livelihoods?
(2) What role does supporting small businesses and local markets play in this?

Data Management and Information Flow
(1) How can the flow of information and data management be optimized during reconstruction to support decision-making processes and ensure transparency?

International and Intersectoral Collaboration
(1) How can the international and intersectoral collaboration in disaster recovery be improved to create synergies and use resources efficiently?

Economic Resilience and Recovery
(1) What strategies can strengthen the economic resilience of communities and contribute to a swift recovery after disasters?

Inclusive Reconstruction
(1) How can reconstruction processes be designed to reduce socioeconomic inequalities and promote the inclusion of marginalized groups?

Sustainability in Reconstruction
(1) How can the reconstruction be leveraged to achieve sustainability goals while improving resilience to future disasters?
(2) What role do green technologies and renewable energies play in this?

4.6.4 DISASTER WASTE MANAGEMENT

Classification and Characterization of Disaster Waste
(1) How can disaster waste be effectively classified and characterized to optimize proper treatment, recycling, and disposal?

Technologies for Waste Treatment and Recovery
(1) What new technologies and processes can be developed or adapted to promote the efficient treatment and recycling of disaster waste, particularly considering the diversity and volume of the waste?

Reduction of Disaster Waste
(1) What preventive measures and strategies can be implemented to reduce the amount of waste generated during disasters?

Health and Safety Risks
(1) How can the health and safety risks associated with the collection, treatment and disposal of disaster waste be minimized?

Reuse and Recycling of Disaster Waste
(1) How can program and policies be designed to maximize the reuse and recycling of materials from disaster waste, contributing to resource efficiency and sustainability?

International Cooperation (collaboration) and Standards
(1) How can international cooperation and the development of common standards improve disaster waste management, especially in countries with limited resources?

Long-Term Disposal Strategies
(1) What long-term strategies are necessary to manage disaster-related waste volumes while ensuring environmental protection and sustainability?

Reconstruction after Armed Conflicts
(1) How can the removal of hazardous remnants, such as unexploded ordnance, be improved after armed conflict? How can the disposal of ordnance after armed conflicts be improved?

Long-Term Decontamination Strategies
(1) What long-term decontamination strategies can be developed to minimize the impacts of large-scale radiological contamination?

4.6.5 RECOMMENDATIONS AND KEY TAKEAWAYS

To promote collaboration in reconstruction efforts, coordinated platforms and working groups at national and local levels are necessary. These should bring together various institutions, authorities, communities, and businesses to plan and implement reconstruction measures. By establishing transparent communication channels and regular exchange meetings, information and resources can be shared efficiently, and common goals can be defined.

Guidelines for reconstruction preparation are crucial. Policies and standards for land use planning, which must take disaster experiences and risks into account, need to be developed to enhance the resilience of infrastructure and communities. Training programs and informal events can help promote adherence to these standards and raise awareness of the importance of robust reconstruction planning.

The integration of disaster risk management into reconstruction requires the involvement of disaster risk management experts in the planning and execution of reconstruction activities. This ensures the identification and reduction of risks during the rebuilding process. Training programs for disaster preparedness should also be incorporated into reconstruction efforts to increase awareness of preventive measures and strengthen resilience against future disasters.

For societal reconstruction, local coordination centers are needed to facilitate collaboration between different stakeholders and prioritize the needs of the affected population. Providing psychosocial support services to disaster victims, including counseling, therapy, and community activities, is essential to promote mental health and well-being.

In disaster waste management, guidelines should be developed for the effective classification and handling of waste to ensure environmentally friendly disposal and recycling. Research and development of new waste treatment and recycling technologies are also important to improve the efficiency and sustainability of waste management.

5 FRAMEWORK CONDITIONS AND IMPLEMENTATION

Austrian disaster research and management face numerous challenges and opportunities that necessitate thorough analysis and targeted actions. Analyzing the current situation reveals clear strengths, such as excellent research institutions, a diverse geographical landscape, robust technological infrastructure, and political support for disaster preparedness and management. Additionally, there is a high level of public awareness and education, along with well-established international collaboration within research fields. However, several weaknesses are also evident, including fragmentation of research, limited financial resources, inequalities in resource distribution, challenges in data integration, and a lack of interdisciplinary and transdisciplinary collaboration.

Despite these challenges, many opportunities exist. Technological advancements, particularly in artificial intelligence, can enhance prediction and response to disasters. Austria can leverage its position as a leader in climate change research to develop new insights and solutions. Strengthened international cooperation can improve understanding and management of global disasters. Furthermore, interdisciplinary and transdisciplinary approaches offer the potential for more holistic solutions, while public-private partnerships can enhance research capacities.

However, the uncertainty surrounding climate change poses a significant challenge, as do funding gaps and data privacy concerns related to the increasing use of technology. The potential brain drain of experts presents another challenge that could impact research capacities. To address these issues and capitalize on opportunities, several recommendations are proposed. These include strengthening the research landscape through a unified strategy and improved coordination, diversifying funding to reduce reliance on governmental support, promoting interdisciplinary and transdisciplinary collaboration, and increasing public engagement in research and management processes.

Implementing the Science Plan in Austria requires a coordinated and multi-tiered approach that involves various stakeholders and develops a long-term vision for disaster research and management in the country. Initially, ministries, regional representatives, universities, research institutions, and other relevant organizations should collaborate to create a comprehensive strategy that outlines key objectives, priorities, and actions for the coming years.

This strategy must be grounded in evidence-based insights and a broad consensus within the academic community, providing a clear roadmap for executing the Science Plan. It should consider the various dimensions of disaster research and management, including preventive measures, early warning systems, response capabilities, recovery, and resilience building.

To support implementation, adequate funding is crucial. Both federal and regional governments should allocate resources to support research projects, infrastructure investments, and capacity building. At the same time, public-private partnerships should be promoted to mobilize additional resources and enhance the efficiency of research activities.

Close collaboration among science, policy, operational organizations, and civil society is also essential. By sharing information, expertise, and resources, synergies can be created, maximizing the effectiveness of research and management efforts.

To ensure that research findings translate into concrete actions and policy decisions, effective knowledge and technology transfer is critical. This can be achieved through targeted programs and mechanisms that facilitate the exchange of knowledge and technologies among different stakeholder groups. Examples include promoting partnerships between research institutions and industry, establishing innovation centers, and providing funding for technology transfer projects.

Additionally, fostering interdisciplinary and transdisciplinary research and collaboration should play a central role. By bringing together various disciplines, such as natural sciences, engineering, social sciences, and humanities, more comprehensive solutions can be developed that better address the complex causes and effects of disasters.

Finally, public engagement is vital. Citizen participation and education can not only raise risk awareness but also bring valuable local knowledge and experiences into research and management processes. Effective communication about scientific findings, risks, and recommendations is essential to enhance public awareness of disaster risks and the need for adaptive measures, while also building trust in policy and decision-making processes. This requires clear and accessible communication using various channels and formats to reach diverse audiences, including public information events, training sessions, media outreach, online platforms, and social media.

Establishing a dedicated academic discipline in disaster research and management in Austria could significantly strengthen national research capacities and address disaster risks. This would necessitate a systematic and interdisciplinary approach that integrates various fields, including geosciences, engineering, social sciences, health sciences, and environmental sciences. Such an approach would lay the groundwork for developing specialized educational and research programs that equip professionals with the knowledge and skills necessary for effective disaster prevention, response, and recovery. Support could come from establishing chairs, research groups, and graduate programs at universities and research institutions. Additionally, creating a dedicated academic discipline would facilitate collaboration among various stakeholders, including authorities at all levels of government, operational organizations, and businesses. This would enhance the exchange of knowledge and experiences and support the development of joint strategies and solutions for managing disaster risks.

Overall, implementing the Science Plan in Austria requires a long-term, coordinated, and participatory approach grounded in evidence-based insights, financial support, interdisciplinary collaboration, and public involvement. Only through such a holistic approach can the challenges in disaster management be effectively addressed.

PARTICIPATION AND THANKS

A strategic working group was set up in the Disaster Competence Network Austria, which is responsible for the development of the Science Plan.

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