Scientific positioning on new European integrated risks science

PEPR RIsques – IRiMa's position paper

Risks and crises management contexts

Ongoing global changes expose human societies to an unprecedented increase in risks and disasters linked to the combined impacts of climate change and human activities—landslides, various types of flooding, avalanches, climate extreme events, hazards linked to melting ice and permafrost, and fires. This new nature of risk can also lead to serious technological disasters (industrial fires, chemical or radioactive incidents) and significant environmental threats, as revealed by recent multiple crises: the Hurricane Katrina, recent California and French wildfires, Storm Alex, floods in Central Europe and southeastern France, mudslides in Germany. " With €44.5 Billion a Year, Europe's weather-related damage costs more than doubled from 2020 to 2023, posing systemic risks to businesses and the finance sector" says the Financial Time. In this context, political initiatives, from the local to the international level, are converging on the need for immediate action, particularly around the "Disaster Risk Reduction (DRR) - global change - sustainable development" nexus: see, for example, the Paris Agreement on Climate Change[1], the Sendai Framework[2], the Sustainable Development Goals[3], and the UNECE Convention on Industrial Accidents[4].

The rise of factors influencing climate change and the economic development of countries is at the heart of current environmental and geopolitical concerns. Several interconnected factors (industrial development, energy demands, deforestation, urbanization, …) contribute to the worsening of global warming while influencing the economic trajectory of nations. This interconnectedness makes the consequences of climate change not only more severe, but also more difficult to anticipate and manage.

Factors that influence climate change and economic development generate multiple and interdependent impacts, as they interact with each other in a complex system in which each element can amplify or modify the effects of the others. This can create high impacts disasters (high intensity-low probability disasters, cascading effects, high exposure areas, …) leading to social tensions such as inequality, people migrations, etc. To cope with situation, a systemic approach must be adopted, integrating environmental, social, economic and technological dimensions[5].

[1] https://www.diplomatie.gouv.fr/en/french-foreign-policy/climate-and-environment/the-fight-against-climate-change/2015-paris-climate-conference-cop21/cop21-the-paris-agreement-in-four-key-points/
[2] https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030
[3] https://sdgs.un.org/goals
[4] https://unece.org/environmental-policy-1/industrial-accidents
[5] https://doi.org/10.1111/ddi.13136

Understanding the situation of research in risks management

The research community dealing with risk management is often organized along disciplines — such as geosciences, humanities, numerical sciences, and applied sciences—rather than thematic or problem-driven structures. This traditional organization limits flexibility and hampers the development of cross-cutting approaches needed to address complex issues like natural and technological risks. Integrated risk science, by its very nature, cuts across multiple fields. It combines knowledge from physical sciences, engineering, social sciences, and data science to assess, model, and mitigate risks. However, because research programming is usually defined within disciplinary silos, integrated risk science often struggles to find a natural home or consistent funding stream.

This structural rigidity leads to fragmentation. For example, geoscientists may focus on natural hazard modelling, while humanities study societal impacts, and engineers develop technical responses — often without meaningful interaction. The result is a lack of common language, shared methodologies, and collaborative culture between these domains. Furthermore, interdisciplinary collaboration is often discouraged by evaluation systems that reward disciplinary expertise and publications. This makes it difficult to build coherent, multi-disciplinary teams or long-term research agendas around risk-related themes.

Overcoming these barriers requires structural changes in how research is organized, funded, and evaluated, with an emphasis on transversal, challenge-oriented collaboration. For example, in Horizon Europe, risks are addressed in two different clusters, the environment and the security one, unfortunately separating the CCA (Climate Change Adaptation) and DRR (Disaster Risk Reduction) research communities[6].

The case of France

The France 2030 risks (IRiMa) Program[7] on is designed within this global context, with interdisciplinary requirements aiming at strengthening multi-risk and cross-cutting approaches. The scientific positioning of the program is inspired by the international framework mentioned above, while also complementing it by drawing on recent prospective analyses from French research institutes and recent roadmaps developed by French public sector organizations and coordinated by the Ministry of the Environment, as well as on the research to be produced. The IRiMa program aims to understand the natural and social processes that generate environmental and technological risks in order to contribute to building an ambitious national strategy for risk and disaster management in a context of global change. IRiMa is based on identifying key knowledge gaps and practices in risk management to address:

1. the need for a new integrated risk management framework to define and quantify the interdependence of natural, social, and industrial/economic risks across their assessment, management, and governance;

2. the need for strong integration of the geoscience and environmental scientific communities, engineering, applied mathematics, digital science and technology, and human and social sciences

[6] https://doi.org/10.1007/978-3-030-22759-3_124-1
[7] https://www.pepr-risques.fr

working on natural, environmental, and technological risks, for example, to better understand cascading effects;

3. the need for better coordination between geosciences, the environment, health, and human and social sciences for more comprehensive risk management with stakeholders, decision-makers, operational spheres, and citizens;

4. the need to take into account the changing aspects of hazards, vulnerabilities, adaptive capacities, and risks driven by climate change and human activity in order to consider evolutionary and emerging risks.

Recently, in June 2025, the Belmont Forum has launched the call RESILIENCE[8] in the topic of integrated and multidisciplinary risks management. This initiative, in the spirit of IRiMa, shows that, at international level this approach is supported by the community of actors.

Such an initiative would benefit from being conducted at European level to develop a new science of multidisciplinary risk management.

Proposals within the European R&I framework

The observation is therefore made on the urgency of managing risks in a holistic way and the difficulty for researchers to find financing instruments which take into account this aspect of disciplinary integration. The France 2030 IRiMa program provide a favourable context to solve this issue at national level. Let's look at what Europe can contribute at international one.

The European Union's flagship research and innovation program for the period 2021–2027, with a total budget of around €95.5 billion. It is the successor to Horizon 2020 and aims to boost scientific excellence, technological innovation, and address global challenges such as climate change, health, digital transformation, and societal resilience.

The objectives and the content of the future Framework Program 10 (FP10) are still in progress, but some points can be derived from the European R&I days agenda (16 sept. 2025)[9]. In particular, discussions should focus on competitiveness for startups and SMEs, technological infrastructures, numerical transition and AI innovations, high-level science and discovery, quality of life and health, cities of the future. In such a scheme, environmental issues, climate change and the risks associated with them are barely visible and one might think that they will receive little or no funding in the future program.

However, some possibilities could exist to defend these important topics and develop innovative research. The following proposals show how risk sciences (and related environmental and climatic issues) are compliant with the FP10 evolution and how they could find a place in the European Strategy for Research and Innovation:

- Improve competitivity of insurance and reinsurance sectors: this issue aims at preparing the future financing reimbursement plans by improving the understanding of rapid evolutions of climatic and environmental conditions, by developing accurate models for risk assessment and

[8] https://belmontforum.org/archives/open-opportunity/resilience-cra-vulnerability-and-resilience-management-for-socio-environmental-systems-in-exposed-territories/
[9] https://research-and-innovation.ec.europa.eu/events/european-research-and-innovation-days_en

by progressing in impacts physical and economical evaluations. This should give to insurance compagnies new tools to cope with the future, install resilience in exposed territories and reduce social stress during disasters;

- Develop a research and innovation network to coordinate new ways of thinking in risk management: This multi actor network (scientific, humanities, private sector, local to national authorities) should be a strategic instrument for identifying new challenges, tipping points, rising opportunities in the domain of risk sciences so that the Commission will have a new instrument to orient strategic research fields in this domain, and so transfer the related developments to end-users, policy and decision-makers;
- Create transverse calls mixing CCA, DRR, and crises management: in front of the difficulty that should arise to address risk management issues in the future FP10 pillars, we propose to create transverse calls dedicated to these issues, may be through a specific Mission. The content of these calls should be issued from the R&I network presented above with the concern of bringing together CCA, DRR research communities, operational risk managers, and decision makers.

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