Expression of Interest: IRDR Center of Excellence

Submitted by Prof. Dr. Jörn Birkmann

Institute for Spatial and Regional Planning

Department for civil engineering and environmental management

University of Stuttgart, 70569 Stuttgart, Germany

Joern.birkmann@ireus.uni-stuttgart.de

In cooperation with (associated partners):

Renn, Ortwin, Prof. Dr. and Piet Selke, Dr.; University of Stuttgart, SOWI, Stuttgart

Rhyner, Jakob, Prof. Dr. and Dr. Matthias Garschagen, Dr., United Nations University, Institute for Environment and Human Security, Bonn,

Thieken, Annegret, Prof. Dr., University of Potsdam

Wenzel, Friedemann, Prof. Dr., Michael Kunz [CEDIM] PD Dr. and Tina Kunz-Plapp, Dr., all KIT

Name:

IRDR Center on Critical Infrastructures and Strategic Planning

Preamble

The proposal and expression of interest was intensively discussed within a core group in Germany (see submitting institution and associated partners) that aims to operate as a network engaging other similar institutions in the area of risk reduction related to Critical Infrastructures (CI) and Strategic Planning.

Beside several meetings and discussions among the core partners, the proposal and content was also presented and discussed within the scientific committee of the DKKV (National Platform for Disaster Risk Reduction in Germany), which serves as the IRDR National Committee.

Hence, the expression of interest is the result of a broader discussion and coordination. The start of the discussion dates back 2 years. The proposal and expression of interest aims to promote the establishment of a successful network of national and international partners interested in promoting integrated research on DRR in the field of Critical Infrastructures and Strategic Planning. The University of Stuttgart and the IREUS Institute in particular, function as a focal point in this network and as the core partner and host of the ICoE and the Expression of Interest.

Description of the organization requesting IRDR ICoE

The Institute of Spatial and Regional Planning (IREUS) at the University of Stuttgart is requesting this specialized ICoE to support integrated research on the resilience of Critical Infrastructures, their management and the increasing dependency of societies on the functioning of Critical Infrastructures (CI). The ICoE will be established at the interdisciplinary institute of Spatial and Regional planning (IREUS) and it should be headed by Prof. Dr. Jörn Birkmann. It is however, envisaged that the ICoE is functioning as a network with the strong involvement of all network partners, namely the United Nations University - Institute for Environment and Human Security in Bonn (Prof. Dr. Rhyner and Dr. Garschagen), the Karlsruhe Institute of Technology (KIT) with a strong commitment of CEDIM (Center for Disaster Management and Risk Reduction Technology) (Prof. Dr. Wenzel and PD Dr. Kunz) and the University of Potsdam (Prof. Dr. Thieken) as well as the Institute for Social Science, Department of Technical and Environmental Sociology at the University of Stuttgart (Prof. Dr. Dr. h.c. Renn).

The IREUS institute – which is requesting the ICoE on behalf of the entire network - is an interdisciplinary research, graduate and undergraduate training center that focuses on the understanding on how spatial and socio-economic development patterns influence disaster risk and risk accumulation. In addition, the institute conducts research on integrated assessment approaches regarding vulnerability, risk and climate change adaptation with a special emphasis on infrastructure and urban development. Beside the involvement in different international research projects and expert groups, such as the IPCC and UNESCO, the staff of the institute is heading courses for graduate and PhD students, such as the international master program on integrated infrastructure planning, which is attended by various students from developing countries and countries in transition.

In addition, to basic research, the institute supports local, state and federal governments as well as international organizations to improve risk reduction efforts, adaptive planning approaches and resilience building in the context of planning and designing new urban and rural areas as well as different infrastructures. In this context the activities of the institute provide an important bridge function between cross-sectoral urban and spatial planning approaches and rather specialized emergency management plans, tools and the respective agencies. Cooperation partners in governmental institutions, UN agencies, the civil society and the private sector are important components of the activities of the institute.

Key Personnel:

IREUS is led by a Director (Dr. Jörn Birkmann) with a complement of 12 faculty, staff and affiliated researchers who work with IREUS on various projects and in interdisciplinary teaching courses. The disciplines of the researchers encompass, among other subjects, geography, spatial planning, civil engineering, environmental management and hydrology as well as political science and law. In addition to Dr. Birkmann, key full- time personnel on the core budget include Dr. Richard Junesch, Dr. Stefan Fina as scientific staff and Ms. Iris Petersen, Administrative Assistant, as well as Mr. Peter Kindl, Technical Assistant. The full-time personnel work with the broader research staff (e.g. the positions funded by third party funding) to develop proposal, conduct research and teaching activities and to produce high quality publications in the area of risk and vulnerability, urban and infrastructure development as well as integrated planning and assessment approaches.

Funding Sources:

IREUS is funded through a combination of state funds (from the University of Stuttgart) and through external or so- called third party funds. These third party funds and grants have been secured from the DFG (National Science Foundation), European Union, Federal Ministry for Science and Education as well as the Federal Office for Civil Protection and Disaster Assistance, among others.

Linkages:

IREUS is an internationally recognized center which deals with planning and assessment methods for infrastructure development in urban and rural areas focusing particularly on new challenges to make infrastructure and urban development more resilient in the context of environmental change and extreme events as well as dynamic societal vulnerability patterns. Research results are presented to a broader international community for example with regard to Critical Infrastructures to partners in Europe and Asia, such as the Disaster Risk Management Institute of India. IREUS regularly has guest scholars and students from all over the world: at present IREUS hosts Prof. Dr. Lutiane Almeida from Brazil and Prof. Young-Oh Kim from South Korea as guest scholars. Both scientists conduct research in the area of Disaster Risk Reduction at the IREUS institute in Stuttgart.

Professional activities for the past years:

The activities of the institute and of researchers at IREUS have focused on four broad areas:

- global, national and local risk and vulnerability patterns combining societal and natural science perspectives,
- the assessment of risk and resilience dynamics in urban areas,
- the further enhancement of evaluation and monitoring tools regarding vulnerability and risk (climate proofing, strategic environmental assessment (SEA, EIA),
- and the development methods to assess the vulnerability of Critical Infrastructures to natural hazards and extreme events.

The IREUS institute and its researchers are well- known experts in the area of vulnerability assessment, climate change adaptation, Critical Infrastructure assessment and spatial as well as strategic planning. The IREUS institute explores particularly the interrelation between spatial development trends, strategic urban and spatial planning, disaster risk reduction and climate change adaptation. Overall, the network combines unique and excellent research competences in Germany to deal with Critical Infrastructure resilience and strategic planning approaches.

For example at present the institute and its staff is involved in three international research projects that deal with the Transformation and risk configuration of urban coastal areas (TRUC project), the assessment of the vulnerability and criticality of Critical Infrastructures to natural hazards and extreme events (INTACT) and the development of specific tools to better prepare for rare and extreme events in selected urban areas (PEARL). In addition to vulnerability assessment approaches and new scenario methods, the IREUS institute also examines in these projects the role of Critical Infrastructures for resilience building on the one hand and for the destabilization of

communities on the other. In national research projects staff of the IREUS institute examines changing structures and governance regimes in Critical Infrastructure management, for example due to the major shift in energy policies in Germany after the Fukushima crisis. In this regard also the resilience of centralized versus decentralized Critical Infrastructure services are examined and discussed. Finally, the institute aims to enhance the knowledge on how cascading risks might emerge due to these changes and transformation processes in CI in Germany.

In the last five years Prof. Birkmann has chaired and contributed to important expert groups of UNESCO/IOC and the Academy of Spatial Planning in terms of vulnerability assessment, risk management and Critical Infrastructure adaptation. He has been IPCC Lead Author for the IPCC Special Report on Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation. In addition, he was Lead Author for the fifth Assessment Report of the IPCC, particularly responsible for the chapter 'key vulnerabilities and emergent risks'.

The researchers at the IREUS institute, namely Dr. Welle and Prof. Birkmann, are also known for their work in terms of the identification of global risk patterns and root causes of disasters, as outlined in the WorldRiskIndex (WRI). This research is continued at the IREUS institute in close cooperation with the UN-University (UNU-EHS) in Bonn and the Alliance Development Works.

Furthermore, all network partners (associated partners) are well-recognized experts - nationally and internationally - in their working fields. For example, Prof. Ortwin Renn is an established researcher and expert on risk governance and the evaluation of risks linked to new technologies. Prof. Annegret Thieken is an expert on flood risk and risk management (see in detail website: www.geo.uni-potsdam.de/mitarbeiterdetails-1232/show/387/Annegret_Thieken.html). She chairs the German Committee for Disaster Risk Reduction (DKKV), which also functions as the national committee for IRDR in Germany. CEDIM at the Karlsruhe Institute of Technology is a research cluster within the KIT and a think tank that is known for its work on natural hazards modelling, cascading risk and engineering solutions for risk reduction (see in detail website: www.cedim.de). The United Nations University Institute for Environment and Human Security is as a UN institution already well- established internationally and linked to various UN agencies. UNU-EHS explores particularly urbanization processes and risk patterns as well as environmentally induced migration patterns and the role of ecosystem services in DRR (see in detail website: www.ehs.unu.edu).

Procedure

The proposal or expression of interest for an International Center of Excellence of IRDR has been discussed among the partners in core group meetings in 2015. In addition, several bilateral meetings have been conducted to develop the proposal and expression of interest from Germany for an ICoE on "Critical Infrastructures and Strategic Planning". The proposal for an IRDR International Center of Excellence was also presented and discussed at the last DKKV meeting which was held in Bonn on the 10th of May 2015. In this regard, the proposal was supported and various members of the scientific board of DKKV indicated their interest to support the initiative and to participate in selected activities.

Vision and Plan for incorporating IRDR objectives

Critical Infrastructures (CI) play a key role in building resilience and reducing vulnerability of people to natural, natural-technical and human-induced hazards. Past failures of CIs, such as in the Fukushima crisis in Japan, or in the context of the black-out in the Münsterland, Germany, as well as the failure of CIs during Hurricane Katrina in New Orleans or during Hurricane Sandy in New York - underscore the multifaceted nature of crises and disasters linked to the failure of Critical Infrastructures and its essential services for people at risk. While the examples above are from the global North, various problems and challenges are also reported from failures of CIs in the global South, such as from India and Indonesia to name just two countries.

Linkages to the core objectives of IRDR

Next to the resilience of technical systems, the vulnerability and dependency of people on Critical Infrastructures (e.g. elderly, people hospitalized, etc.) is key for integrated research on disaster risk. Strong linkages can also be made to other programs and working groups of IRDR such as to the data group in terms of contributing to improved standards for characterizing cascading risks linked to CI failure and the overall improvement of the access to data from providers of Critical Infrastructures. In addition, issues around the governance of Critical Infrastructures and respective mismatches and shortcomings can also be linked to the work of the IRDR working group on the FORIN Methodology and the RISK Interpretation research. For example, major problems in the governance of CI, such as the lack of supervision, corruption and the lack of implementation of safety and security standards in the construction and design of CI might be regarded in some crises as important drivers and root causes of disaster risk.

Consequently, the topic of Critical Infrastructures and Strategic Planning provides an excellent subject that can be linked to various working groups of IRDR and the core goals of IRDR. Moreover, major global trends such as urbanization and climate change will further increase the importance of Critical Infrastructure services for promoting human security and the functioning of settlements and socio-technical systems exposed to extreme events and creeping hazards. Therefore, integrated and transdisciplinary research on DRR should give CI and strategic planning processes a more prominent role. The protection of CI in crises and against natural hazards are also core goals in national and international declarations for disaster risk reduction, however, the research on the resilience of CI is still fragmented and often not really integrative or interdisciplinary. In this regard, the ICoE can serve as an important nucleus for a stronger integrated and transdisciplinary research in this area. That means, while risks to specific hazards, such as floods or tsunamis are well explored, major gaps still exist in terms of the knowledge and understanding of the complex interactions and interdependencies between Critical Infrastructure resilience, human security and adaptive and strategic planning approaches before and after crises.

At a global level the Resilience of Critical Infrastructure Services is receiving increasing attention, particularly, since more and more people are living in complex urban structures that cannot function without the services of Critical Infrastructures. In this regard it is important to note that the number of people in urban areas will further increase until 2050 by 2,5 billion and about 35% of this growth will take place in China, India and Nigeria according to new statistics of UN DESA (UN DESA 2014).

Consequently, the intended ICoE on Critical Infrastructures and Strategic Planning can provide an important network mechanism between national and international researchers in the field of Critical Infrastructure and planning research and the different working groups of IRDR, particularly the working group on Data, on risk interpretations and on FORIN.

North-South Dimension of CI often neglected

Until now, experiences regarding Critical Infrastructure resilience and CI failure are not sufficiently shared between so-called developed countries, countries in transition and developing countries. For example, various approaches on CI transfer are defined and framed as technological transfer from the global North to the global South – as often done in modern development paradigms – and hence do not account for the multiple needs of co-learning and institutional adaptation. Resilient solutions demand a co-evolution of technological advances, organizational changes, adequate and effective governance structures and adaptive behavior. Hence, wider questions of flexible and adaptive governance and "strategic planning" - including the adjustment of institutions - need to be addressed in order to allow for context-specific configurations of Critical Infrastructure. This research line can also be taken up jointly with other ICoEs for example those that deal with resilience and transformation as well as risk assessment (UK, Colombia).

- ***These aspects can contribute significantly to an improved understanding of decision making in complex and changing risks contexts focusing on CI and strategic planning approaches (IRDR objective 2).***

Critical Infrastructure providers still view risks to CI mainly as a challenge of technology, however, integrated research on disaster risks in the context of IRDR requires a more comprehensive understanding of Critical Infrastructures and its aim to improve human security. This urges governance issues onto the agenda, including, for instance, questions of access, political responsibility, cost sharing, fairness or conflict mediation.

Past disaster losses in urban and rural areas were particularly severe when Critical Infrastructures (electricity, access to water, sanitation…) fail and could not be re-established within a short time frame. In addition, especially vulnerable groups (e.g. elderly, infants, people with medical treatments, economically marginalized) are highly dependent on Critical Infrastructure services, particularly electricity and water supply. The increasing dependency of societies on Critical Infrastructure services has also contributed to risk accumulation and the threat of cascading risks once a hazard event (flood, drought, heat wave, earthquake, human management failure, etc.) impacts such facilities and services. Due to interconnecting services and technologies the probability of common mode failures has considerably increased thus making traditional risk assessment methods become less sufficient for dealing with multiple crises symptoms in the context of CI.

- ***Therefore, the new ICoE can also contribute to the work of IRDR on new methods for risk identification and the characterization of vulnerability and risk to CI failure in this specific field.***

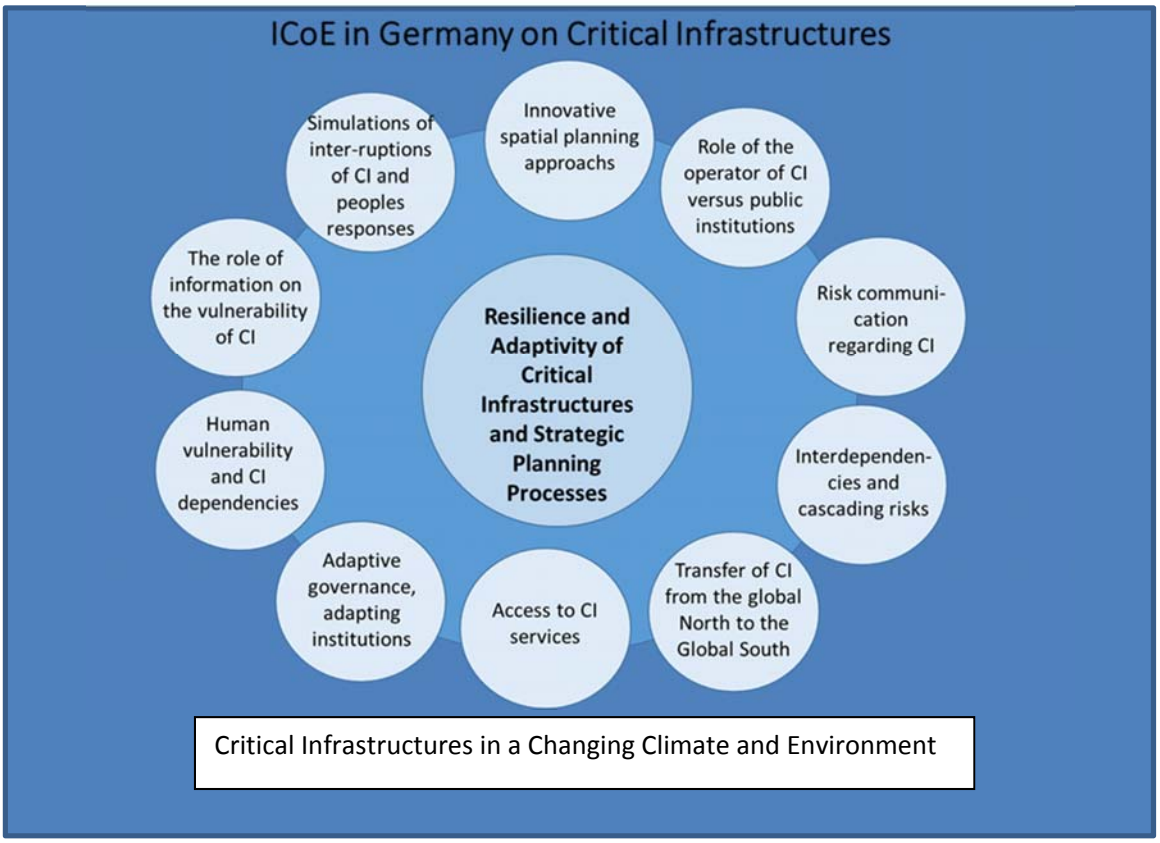
That means, the topic of Critical Infrastructures and strategic planning as a center piece - allows to explore various interconnectivities and interdependencies to human vulnerability, the analysis of root causes of crises and disasters, risk accumulation, urban planning as well as the challenge

of risk governance and risk interpretation in the interface between private and public domains. Consequently, various linkages and potential synergies between the existing working groups of IRDR and the proposed ICoE are evident.

Vision to develop the IRDR ICoE and its research plan

The IRDR International Center of Excellence aims at exploring the resilience of Critical Infrastructures from various perspectives in order to provide a comprehensive platform for this evermore-important topic and to substantially advance the depths and breadths of the currently narrow approaches. It strategically combines the different sets of expertise of the network partners. In this regard, the analysis of the resilience of Critical Infrastructures, such as energy, water, transport, health services, will not primarily focus on technical details of the respective systems, but rather on cross-cutting and interdisciplinary challenges that are, for example, linked to the identification of interdependencies and cascading risks between Critical Infrastructures or to the shifting governance implications, including new organizational requirements and behavioral adaptations. Figure 1 outlines a first result of the brainstorming session by the core partner and associated partners of this proposal in terms of the sub-topics that should be addressed within the scope of the ICoE on Critical Infrastructures and Strategic Planning once it is established.

Figure 1: ICoE as a network on Critical Infrastructures and Strategic Planning



Against this background the ICoE will, among other issues, focus on the following questions:

- Which contributions does CI make to human security and DRR? What are past achievements, current limits and potential future trends?
- How to operationalize the concept of risk, vulnerability and resilience for different Critical Infrastructures and their management?
- How to assess transformation processes around different Critical Infrastructures, their governance and their criticality in terms of the dependencies of different population groups and economic activities on these services?
- How to better understand the vexing role of CI as manifestations of socially negotiated risk and modernization paradigms?
- What are important trends and characteristics of the development of Critical Infrastructures in Germany and other selected countries worldwide?
- How does the increasing dependency of people on Critical Infrastructure services in countries of the global North and the global South affect vulnerability and risk profiles in urban and rural areas?
- Which groups are particularly dependent on Critical Infrastructure services in different regions?
- Which lessons can be learned from past crises and disasters linked to Critical Infrastructures and the planning of urban areas and respective infrastructure networks for example in Germany?
- How do newer international guidelines, e.g. of the European Union or IMF funding schemes, influence the consideration of disaster risk in the design and management of Critical Infrastructures and urban-/ spatial-planning?

Concrete Development Steps and activities envisaged in 2015 and 2016

- Establishment of the IRDR International Center of Excellence on Critical Infrastructure Resilience as a network of key partners in Germany (synergies of fragmented research activities among the partners and in coordination with the 4 working groups of IRDR)
- Provision of office space and personnel at the IREUS institute (secretariat/Director)
- Development of a stronger profile of integrated research on disaster risk and resilience of Critical Infrastructures among the partners and within the respective universities
- Joint drafting and submission of one to two opinion articles in international academic journals to establish the topic and kick-start a scientific and political debate.
- Exchange of scholars from institutions involved and with international centers (e.g. invitation of experts from North- and Latin-America and/or Asia to Stuttgart and Karlsruhe for example)
- Development of core pillars for a joint doctoral program on CI resilience and joint master courses on CI-resilience, for example in the international master program Integrated Infrastructure Planning and in conjunction with the graduate college: Natural hazard and environmental protection at University of Stuttgart (Birkmann/Renn)
- Conduction of an international workshop on CI resilience with a special focus on the interface between technical-engineering and social-science perspectives

Medium term goals and activities for 2016- 2020

- Establishment of a joint publication series (working paper with IRDR ICoE Logo)
- Securing funding for joint research activities in Germany and (selected) countries in transition as well as developing countries.
- Establishment of an ICoE workshop series on the topic of the resilience of Critical Infrastructures among the partners of the network – currently namely: University of Stuttgart, UNU-EHS, KIT, University of Potsdam and DKKV.
- Integration of private companies interested to participate in research on risk and resilience of Critical Infrastructures, particularly operators of CI.

Identification of Funding and Other Support

The Rectorate of the University of Stuttgart will provide a recurring commitment of 35.000 US Dollar p.a. for the first two years to support the ICoE (and IREUS) should it be so designated by IRDR. In addition, the IREUS institute will provide one staff position (70.000 US Dollar per year) and administrative personnel 50% position (25.000 US Dollar per year) to ensure the functioning of the ICoE at the University Stuttgart. In addition, other network-partners such as CEDIM /KIT will contribute to the funding of the ICoE in Germany and its activities. For example, CEDIM will contribute 20% of a senior researcher position to the ICoE that means about 25.0000 US Dollar annually.

Additional funds have been secured for specific activities. For example in fall 2015 an international workshop can be conducted on integrated research on disaster risk and Critical Infrastructures as well as strategic planning if the ICoE is to be designated. For this activity funding has been secured from the DFG. Also, UNU-EHS will provide funding for an international workshop of the ICoE once it is established. However, it is expected (as formulated in the TORs for an IRDR ICoE) that additional fundraising would be undertaken jointly with the IRDR IPO and the support of SC members once the ICoE has been established.

ANNEX I: Profiles of the different university partners involved in the ICoE

No	Partner	Competence	Contribution
1	University of Stuttgart, Institute of Spatial and Regional Planning (IREUS); Joern BIRKMANN/ Professor of Spatial and Environmental Planning, Director of the IREUS Institute	Vulnerability and resilience indicators to assess Critical Infrastructures Role of Critical Infrastructures in planning processes at different levels Assessment methods to capture the interdependencies of CI	Coordination of the network and core activities, e.g. secured funding for a workshop on the assessment and innovative planning approaches of Critical Infrastructures
2	University of Stuttgart, Institute of Sociology; Ortwin RENN/ Professor of Environmental Sociology and Technology Assessment; in addition Prof. Renn is also adjunct Professor for "Integrated Risk Analysis" at Stavanger University (Norway) and Affiliate Professor for "Risk Governance" at Beijing Normal University.	Risk Assessment of new technologies, Assessment of the sustainability of infrastructure systems, Assessment of the sustainability and social compatibility of transformations in Critical Infrastructures such as the energy system	Governance of Critical Infrastructures, Participation of the general public in the design and development of Critical Infrastructures Sustainability and social compatibility of transformations in Critical Infrastructures
3	United Nations University – Institute for Environment and Human Security (UNU-EHS); Prof. Dr. Jakob RHYNER, Director of UNU-EHS) and Vice-Rector of the United Nations University and Dr. Matthias GARSCHAGEN Head of Vulnerability Assessment, Risk Management and Adaptive Planning at UNU-EHS	Assessing the dependency of urban areas and Rural-Urban systems on CI. Assessment of needs for institutional adaptation and adaptive governance when CI technologies are transferred globally and across different risk management paradigms; evaluation of different options for transformational change in CI management	synergies and challenges in the context of transferring CI from the global north to the global south
4	University of Potsdam, Prof. Dr. Annegret THIEKEN	Flood damage assessment: data collection, analysis and model development Flood risk analysis and mitigation (including the risk assessment for CI and uncertainty analysis)	Consequence assessments of CI failure in the context of floods; probabilistic modelling and uncertainty analysis

		Multi-risk analyses and mapping Statistical methods, GIS	Multi-Hazard analysis to understand CI hazard exposure
	Karlsruhe Institute of Technology (KIT), Prof. Dr. Friedemann WENZEL, PD Dr. Michael KUNZ, both Center for Disaster Management and Risk Reduction Technology CEDIM	Estimation of hazard and risk (earthquake, storm, flood, severe convection); techno-economic risk and loss assessment including indirect effects; Decision support systems in case (1) of failure of Critical Infrastructures or (2) nuclear accidents (RODOS). Impact of climate change on the resilience of Critical Infrastructures; Early warning of extreme hydro-meteorological events; near real-time disaster analyses Interdisciplinary competence of the currently 14 Institutes at KIT participating in CEDIM, in particular geophysics, meteorology and climate research, industrial production, nuclear and energy technologies, regional sciences	Expertise on modelling and assessment of extreme events and their impacts; Application of impact models and decision support systems;