



The role of integrating natural and social science concepts for risk governance and the design of people-centred early warning systems. Case study from the German-Indonesian Tsunami Early Warning System Project (GITEWS)

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The development of early warning systems are one of the key domains of adaptation to global environmental change and contribute very much to the development of societal reaction and adaptive capacities to deal with extreme events. Especially, Indonesia is highly exposed to tsunami. In average every three years small and medium size tsunamis occur in the region causing damage and death. In the aftermath of the Indian Ocean Tsunami 2004, the German and Indonesian government agreed on a joint cooperation to develop a People Centered End-to-End Early Warning System (GITEWS).

The analysis of risk and vulnerability, as an important step in risk (and early warning) governance, is a precondition for the design of effective early warning structures by delivering the knowledge base for developing institutionalized quick response mechanisms of organizations involved in the issuing of a tsunami warning, and of populations exposed to react to warnings and to manage evacuation before the first tsunami wave hits. Thus, a special challenge for developing countries is the governance of complex cross-sectoral and cross-scale institutional, social and spatial processes and requirements for the conceptualization, implementation and optimization of a people centered tsunami early warning system.

In support of this, the risk and vulnerability assessment of the case study aims at identifying those factors that constitute the causal structure of the (dis)functionality between the technological warning and the social response system causing loss of life during an emergency situation: Which social groups are likely to be less able to receive and respond to an early warning alert? And, are people able to evacuate in due time? Here, only an interdisciplinary research approach is capable to analyze the socio-spatial and environmental conditions of vulnerability and risk and to produce valuable results for decision makers and civil society to manage tsunami risk in the early warning context. This requires the integration of natural / spatial and social science concepts, methods and data: E.g. a scenario based approach for tsunami inundation modeling was developed to provide decision makers with options to decide up to what level they aim to protect their people and territory, on the contrary household surveys were conducted for the spatial analysis of the evacuation preparedness of the population as a function of place specific hazard, risk, warning and evacuation perception; remote sensing was applied for the spatial analysis (land-use) of the socio-physical conditions of a city and region for evacuation; and existing social / population statistics were combined with land-use data for the precise spatial mapping of the population exposed to tsunami risks.

Only by utilizing such a comprehensive assessment approach valuable information for risk governance can be generated. The results are mapped using GIS and designed according to the specific needs of different end-users, such as public authorities involved in the design of warning dissemination strategies, land-use planners (shelter planning, road network configuration) and NGOs mandated to provide education for the general public on tsunami risk and evacuation behavior.

The case study of the city of Padang (one of the pilot areas of GITEWS), Indonesia clearly show, that only

by intersecting social (vulnerability) and natural hazards research a comprehensive picture on tsunami risk can be provided with which risk governance in the early warning context can be conducted in a comprehensive, systemic and sustainable manner.