# GENERIC MULTI-RISK MODEL AND DECISION-SUPPORT TOOL FOR MITIGATION OF MULTIPLE HATURAL HAZARDS

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The number of people affected directly or indirectly by natural hazards is growing and more extreme events are being observed. Most of these extreme events are resulting from conjoint and cascading effects of multiple hazards, when hazards are following each other or influence the vulnerability of the region afflicted. The purpose of multi-risk assessment therefore includes establishing a ranking of the different types of plausible risk. However, currently there is no clear definition of "multi-risk", neither within the scientific community, nor in practice (Kappes et al., 2010). The only existing definition takes into consideration requirements for multi-risk to consider multiple hazards and multiple vulnerabilities (Marzocchi et al., 2012)

Coupled with this is the how decision-makers are faced with challenges on how to mitigate multiple risks, including taking into consideration their interrelations. Since the consideration of conjoint and cascading effects is a relatively young area of natural risk governance, up to now only a limited number of multi-risk models have been developed and the experience of practitioners on how to use them is limited. The reduction of risk is not only based on scientific knowledge about natural hazards and developed models and tools, but it is also shaped by political and cultural values, as well as by social and psychological factors (Assmuth et al., 2010). These factors are included into the concept of risk governance, which needs to incorporate the "insider" knowledge of stakeholders into multi-risk assessment models and their underlying parameters and outputs. It is also concerned with how information is collected, perceived and communicated, and how management decisions are taken (IRGG, 2010), including perceptions from stakeholders in shaping outcomes of risk assessments.

All of these points lead to the need for more sophisticated types of decision-support (DS) tools to help with the disaster response and mitigation process. Therefore, in this work, we analyze two types of DS tool and their practical usability for stakeholders, such as national civil protection platforms, and the United Nations Office for Disaster Risk Reduction. The first DS tool considered possibilities to provide risk ratings and ranks between different types of hazard and risk. This is an evaluation methodology based on the concept of risk the matrix for incorporating expert knowledge through stakeholders' interactions into multi-hazard scenario development (deliverable D 6.1 "Decision-analytic frameworks for multi-hazard

mitigation and adaption" of the MATRIX project). The second tool is a generic multi-risk model based on the concept of the so-called "virtual city", in which multi-risk scenarios are generated following simplified data and descriptions of the physical processes behind natural hazards. This is a generic probabilistic framework that implements hazard correlations in a comprehensive manner (Mignan et al., submitted).