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How to best involve different stakeholders in the design process of products and services to communicate multi-hazard information?

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In order to have an impact in practice, research approaches should reflect real conditions as much as possible and generate user-oriented findings. To this end, we need an interdisciplinary exchange among experts and authorities considering institutional structures. Moreover, a combination of innovative methods is required to assess the diverse public's needs and to generate useful findings for the design of products and services to communicate multi-hazard information. Furthermore, the findings should be communicated to the scientific community as well as to the authorities and the public. Our contribution demonstrates a successful approach for involving different stakeholders in the design process of products and services in a multi-hazard context.

For our research, we are using a participatory and user-centred systemic approach with a major emphasis on user requirements driving future developments. It can be understood as a multi-perspective bottom-up approach, involving not only scientists from different disciplines but also authorities (e.g. decision makers) and the public. A combination of qualitative and quantitative methods thereby allows to understand the wider social and structural context and thus to implement sustainable and suitable services and products.

A combination of various methods is used in this approach to assess the needs of the scientists, the public and the authorities. With surveys, we assess general patterns and needs and identify challenges and potentials. To compensate for the artificial setting questionnaires establish, we include experiments (e.g. conjoint choice experiments) into the surveys to test different options. With interviews or focus group discussions, we further deepen aspects that we quantitatively assessed in order to better understand people's beliefs behind their choices. Moreover, we apply interactive methods from the design thinking toolbox, such as user-driven prototyping. This methods allow an understanding of users' thinking and reveals needs and features that developers may not have thought of. Furthermore, we used the actor constellation – a role-play for jointly sorting out the relevance of various involved actors – to map the connections between the actors and to identify potential conflicts. To gain further insights and to contentiously enhance our products and services, we maintain a constant dialogue with different stakeholders.

An important aspect of this dialogue is the transparent and active communication of the findings to the scientific community as well as to the authorities and the public. For this purpose, we use

the following mechanisms: co-creation of knowledge with key stakeholders, open-access papers for scientific journals, personal contact with actors involved, presentation at conferences, non-scientific reports for authorities (in the national languages), blog posts, social media posts, and exchange of knowledge and experience via project platforms. In order to be successful, the information communicated should meet the target audiences' expectations.

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