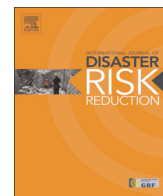




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# The Disaster-Knowledge Matrix – Reframing and evaluating the knowledge challenges in disaster risk reduction



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## ABSTRACT

Within the context of disaster risk reduction, including climate change adaptation, significant thematic discourse has been dedicated to the difficulty of implementing research-based knowledge in policy and practise. Not only has the discussion focused on the causes of this issue, but many recommendations for enhancing the use of information and knowledge have also been made. The authors first frame the knowledge challenges and, second, introduce a systematic means to identify the factors hindering the use of information and knowledge. The approach proposed allows determining core barriers in the co-production, exchange, and use of knowledge. Subsequently, we illustrate where further advancement is needed in the field of knowledge development, means of transmission and use for disaster risk reduction. We suggest a method that analyses cases considering the success or failure of information flows from and to different stakeholder groups. The aim is to identify causes for knowledge fragmentation at different phases in the disaster management continuum, and, subsequently, to strengthen both individual and institutional learning, as well as to determine social and functional changes required to address pressing issues of disaster risk reduction, including climate change adaptation, in a competent manner.

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## 1. Introduction

In general, increasing knowledge of natural hazard-related risk and its relation to changes over time (e.g. through the impact of climate change or land use dynamics) ultimately leads to better understanding, improved management, and finally to risk reduction and adaptation. However, knowledge is unique to a person's mind and is often confused with information, which is merely a means of documenting and sharing knowledge. The rapid increase in research-based knowledge has led to an increased fragmentation of knowledge. Knowledge fragmentation has advantages in that it means that advanced, specialised expertise in various fields exists. However, linking and aggregating state-of-the-art knowledge, as well as the targeted provision of knowledge for evidence-based, informed decision-making is insufficient. This is reflected by the immense enlargement of disaster-related research and the increase of scientific activities that have so far had limited impact

on reversing the upward trend in disaster damage, precisely expressed by White et al. [1] as “knowing better and losing even more”. Obviously, there are gaps: between what is known about disaster risks, on the one hand, and how research findings are translated into policies and programmes, on the other; differences in understanding what households and communities consider to be disaster events and appreciating locally developed coping and prevention measures.

Today, a huge variety of information resources and knowledge systems with regard to the assessment and management of natural hazards attempt to increase the uptake of knowledge: governmental programmes and research projects, academic journals and public reports, research institutes and advanced technology, all supported by scientists, private companies, practitioners, and non-governmental organisations (NGOs) from various fields. Additionally, there is the vast knowledge related to the experience of communities, families and individuals that is not always

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capitalised on. A differentiated view on the knowledge production and sharing processes can facilitate an increased use of knowledge for improved disaster risk reduction (DRR), including climate change adaptation (CCA). As climate change is understood to be one driver of disaster risk amongst many creeping environmental and social changes, climate change adaptation is integrated into disaster risk reduction as a contributing factor [2]. For this reason, when the term DRR is used here, it always includes CCA.

This in turn points towards the production of information and use of knowledge and raises the possibility that progress is being blocked by barriers: How does risk-related research-based knowledge relate to the apparent growing toll of losses? Is human knowledge and understanding of the causes of the losses inadequate despite the increasing research effort, or is it that existing knowledge is not applied or not used effectively? Is it that communication methods are inadequate for the task and that information transferred is not transformed into knowledge that can be acted on? The synthesis of these latter questions points to yet another problem: information may be available, but this does not necessarily imply that it is known, accepted and acted on. The diverse distribution of disaster risk-related knowledge can lead to good decision making by some, unfavourable decision-making by others. And we are often not sure how to characterise good decision-making as the long-term consequences of decisions are most often unknown.

Although a growing literature on ‘knowledge-to-action’ has been addressing the gap between the scientific community and the policy community from different perspectives e.g., [3–8], only punctual efforts have been undertaken to study the gap between risk interpretation and action [9]. Many aspects of the complex interface between information sharing, knowledge-making and decision-making are still unexplored and better appraisal is needed to effectively integrate information, knowledge, and expertise into the efforts directed at DRR, in particular with regard to mechanisms for positive exchange between science, policy, practise, and the public.

The current focus on the knowledge gap between science and policy needs to lead to an increased understanding on how barriers in knowledge implementation can be identified and overcome. An increase of research-based knowledge is not as significant as improving mechanisms for its increased application. Our findings show that barriers to knowledge sharing, transformation and implementation are generally greater than the means to overcome them. Understanding knowledge, its production, and use is very central in this process, as the aim is to implement knowledge in policy and practise by all stakeholders involved in DRR. Identifying where fragmentation of knowledge exists, as well as its causes, represents a primary aim of this study. Or, as Hayek [10] stated, the challenge is to understand how to utilise “knowledge which is not given to anyone in its totality”. This is not only true for DRR, but is equally essential for CCA, a process growing in significance and recognition of its importance in the public arena. For this reason, it is important that synergies between DRR and CCA are identified so that identical or similar objectives are approached in a common effort.

The main objectives here are to explore the complex interaction of knowledge, decision-making, and implementation, and to understand and identify what hinders the use of knowledge to make appropriate decisions for risk mitigation. The first section of this paper shows how a differentiated view on information and various types of knowledge can facilitate improved decision-making. The second section discusses current deficits in knowledge production in the fields of DRR and delineates current challenges for both science and policy. We finally introduce an analysis tool, aiming to support the assessment of the knowledge production, sharing and implementation process, and in complement,

a rapid interpretation system that visualises where information is (not) reaching target stakeholders and being acted on. A case study of the 2013 flood event in Salzburg, Austria, will provide a concrete example of how barriers can be reduced and overcome to enhance disaster risk management in the public sector, and how these can be rapidly visualised. Additionally, a case study in southern Mexico provides evidence on how a DRR initiative may not work if effective communication and knowledge exchange between decision-makers and disaster-affected people is not given.

## 2. Is reframing knowledge a solution?

It is important to understand the nature of knowledge. In so doing, understanding of knowledge production processes, the co-existence of different types of knowledge, and the causes hindering the transfer and use of information that can increase knowledge can be improved. Questions raised by Mittelstrass [11] illustrate that in a society where information technology has paved the way for an evolving information society, knowledge is increasingly being replaced and confused with providing information, which may remain untapped or unused, thus legitimising a discussion on data, information, knowledge, and wisdom: “From knowledge to wisdom? Which wisdom could that be, if its concept of knowledge is only that of information again?” [11, p. 22].

A closer look at what knowledge is can improve understanding of the intrinsic barriers within the knowledge process itself. Horigan [12, p. 75] describes this process as follows: “Knowing always involves a knower knowing something. It involves a relationship between a knower and the known. It is an act which joins a mind with an object in a relationship which is unique and incomparable with any other. There is no such thing as knowledge without something known and a knowing subject knowing it. Each and every act of knowing is a synthesis of object and subject.” At first, this description may seem utterly plausible. However, two major preconditions are required of the knower: awareness of the knowable object, and an incentive or willingness by the subject to be open to receiving or obtaining and understanding the knowable object, which is at that point the act of knowledge, or cognition. The known is thus appropriated by the knower so that (depending on the form of knowledge) it is understood and applicable, either through the use of this acquired knowledge in concrete actions or as guidance for decision-making. In this relationship between the object and subject, good communication is intrinsically important; it implies not simply transmission of information but information reception, understanding and action, or if one chooses, inaction, and which in either case has become the basis of an informed decision, constituting knowledge, for better or for worse, rather than one based on lack of information or knowledge. Knowledge may be lost through inability to express the known or the lack of capacity to understand the known.

According to Aristotle [13], three forms of knowledge may be distinguished depending on its telos, i.e., the purpose it serves: theoretical, productive, and practical knowledge. Theoretical, or speculative knowledge, is the pursuit of truth by means of contemplation for its own sake, i.e., because it fulfils the intellect. The purpose of productive knowledge is to know how to produce something. Practical knowledge relates to action, and is the necessary ingredient for making correct decisions, though prudence, the ability to correctly apply knowledge, is presupposed. This type of knowledge is of great importance in the context of DRR. Practical knowledge is such knowledge, which is used, or can be used, given the circumstances, and has an effect in a decision-making context. Based on Aristotle's *Metaphysics* [13, 981<sup>b</sup>1], practical knowledge amounts to experience, or “knowledge of particulars”,

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