

Local knowledge in climate related natural hazards

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Abstract

The topic of local knowledge has received increased attention in recent years in relation to societal resilience and climate adaptation. The importance of raising the status and increase the adoption of local knowledge in risk governance can be argued for from both normative and theoretical positions, as it relates both to political/democratic expectations and scientific recommendations. Local knowledge, however, is not easy to capture. It comes in many forms and can be understood in many ways. Different scientific traditions and fields approach local knowledge from different angles, and with different purposes. In this paper, we discuss how local knowledge is addressed in the field of safety, and how it is addressed in other research fields like participatory research, anthropology and science and technology studies – and we discuss this in the context of climate adaptation. Being fully aware that the different fields partly overlap in their treatment of a particular topic like local knowledge, the idea is not as much to point to differences as to explore how safety research draws, and potentially can draw further, on insights and perspectives from adjacent research fields, offering e.g. methods and epistemologies useful for safety science. The paper adopts a *research on risk* approach to local knowledge, implying that we undertake our investigations on the intersection between the field of safety and other, adjacent research fields. The paper is developed as part of a research project on climate adaptation and natural hazards in Arctic environments.

Keywords: local knowledge, climate change, natural hazards

1. Introduction

Climate change is increasingly understood as a driver of complex and interacting risks that challenge established approaches to safety management, risk governance, and societal resilience (IPCC 2022). In many contexts, particularly those characterised by rapid environmental change and high uncertainty, formal risk assessments and technical models are insufficient on their own to capture the full spectrum of vulnerabilities and adaptive capacities involved (Renn 2008). As a result, local knowledge has received growing attention in recent years as a potentially crucial resource for climate adaptation and resilience-building.

The importance of local knowledge in risk governance can be justified from both normative and theoretical perspectives. Normatively, the inclusion of local knowledge aligns with democratic ideals of participation, legitimacy, and

procedural justice in decision-making processes related to risk and safety (Fiorino 1990; IRGC 2017). Theoretically, a growing body of research points to the limitations of expert-driven and model-based approaches when addressing uncertain, dynamic, and context-dependent risks, such as those associated with climate change (Stirling 2010). In such settings, experiential, place-based, and practice-oriented forms of knowledge may complement scientific expertise by providing insights into environmental change, early warning signals, and feasible adaptation strategies (Haavik et al., paper in review).

Despite this growing recognition, local knowledge remains a conceptually elusive and methodologically challenging notion within safety and risk research. Local knowledge takes many forms, ranging from experiential observations and embodied skills to culturally embedded practices and informal rules for coping with risk. Moreover, different scientific traditions

approach local knowledge from distinct analytical angles and with different purposes. Within safety science and risk research, local knowledge is often treated instrumentally—as merely contextual information, stakeholder input, or supplementary data—without a systematic conceptualisation of how such knowledge is produced, validated, and integrated into risk-related decision-making (Hermans et al. 2022). In the case of crisis management, for example, “plans often revolve around preparedness strategies that target the state level, or how local authorities normatively should perform, not how local communities respond to the crisis” (Karlsen, 2026 (forthcoming)).

1.1 Research context

The context for the paper is a research project that explores the role of local knowledge in relating to climate change related nature risks in arctic environments. Snow avalanches and thawing permafrost are examples of phenomena that changes with changing climate. Average temperatures rise significantly faster in Arctic areas than in lower altitudes (Rantanen et al., 2022), and this does not only lead to new types of nature risks, but also new mechanisms for ‘old’ nature risks, meaning that existing and ‘standardised’ risk evaluation may show insufficient. Rapid climate change may also have the somewhat surprising effect to outdate local, experience-based knowledge.

In the project, we address these challenges by investigating local knowledge and its significant for dealing with nature hazards in arctic environments. The themes explored in this paper builds on learnings from a previous research project on climate related risks in the Arctics (Johannessen, Andreassen, Haavik, Taarup, & Kruke, 2025; Johannessen & Haavik, 2024) and seek inspiration from how local knowledge is understood and discussed in different scientific fields to which the topic of climate adaptation is relevant.

2. Local knowledge in safety and risk science

In safety and risk science, local knowledge is often understood as situated and experiential knowledge that develops through everyday

engagement with hazardous systems. Research on high reliability organisations, resilience engineering, and safety-II has repeatedly shown that safe performance depends on local adaptation, informal coordination, and practitioner expertise that cannot be fully captured by formal rules or procedures (Hollnagel, 2014). This body of work challenges rational-technical models of risk by demonstrating that safety is actively produced through work-as-done, rather than simply ensured through work-as-imagined. In doing so, it brings local knowledge to the fore as a critical resource for managing uncertainty and variability in complex systems.

At the same time, local knowledge tends to be treated in a rather instrumental way within much of the safety and risk literature (Hermans et al. 2022). Rather than being examined as a form of knowledge in its own right, with particular epistemic characteristics, it is often framed as contextual input to existing analytical frameworks. In practice, this means that local knowledge is typically mobilised to inform risk assessments, preparedness planning, or decision-making processes, while relatively little attention is paid to how such knowledge is produced, how it comes to be seen as legitimate, or how it interacts with other forms of expertise. Thus, it is not the local dimension as such that is important, but rather that one seeks *facts* to inform the standardised risk analyses, wherever the facts be localised.

This orientation is closely linked to some of the dominant characteristics of safety and risk research as a field. With strong roots in engineering, systems thinking, and quantitative analysis, safety science has long emphasised formalisation, standardisation, and comparability (Rasmussen 1997). These features are central to the development of robust risk models and management tools, but they also make it difficult to engage with forms of knowledge that are situated, tacit, and closely tied to specific contexts. As a result, local knowledge often needs to be translated or simplified in order to fit existing risk frameworks, with the possibility that important aspects of such knowledge are filtered out in the process (Stirling 2010).

Although participation and stakeholder involvement are increasingly discussed in relation to risk governance, the normative and political dimensions of local knowledge are not always made explicit. Questions of whose knowledge is acknowledged, how different knowledge claims are balanced, and how power relations shape processes of inclusion and exclusion often remain in the background. When local knowledge is addressed through participatory approaches, the focus is frequently on improving the effectiveness or acceptance of risk management measures, rather than on critically examining underlying assumptions about knowledge and expertise (Almklov, Rosness, & Størkersen, 2014).

These tensions become particularly visible in the context of climate adaptation. Climate-related risks are characterised by long time horizons, deep uncertainty, and changing environmental conditions, all of which challenge established approaches to prediction and control. Safety and risk research has responded to these challenges through concepts such as resilience and adaptive capacity, within which local knowledge is often presented as an important resource^a. However, there is still limited discussion of how local knowledge actually contributes to the formation of risk concepts, or how it is negotiated in practice in relation to scientific models and expert assessments.

Taken together, this suggests that while local knowledge is increasingly recognised as important within safety and risk research, its role remains conceptually underdeveloped. Local knowledge is valued, but often in pragmatic terms, and without sustained engagement with its epistemic, social, and political dimensions. This opens up a space for drawing more explicitly on insights from adjacent research traditions that have long engaged with questions of knowledge production, legitimacy, and uncertainty—a space that the next section seeks to explore.

3. Local knowledge on the intersection between safety and other research fields and traditions

3.1 Anthropology and local knowledge

Anthropology as a field is occupied with studying how social processes and meaning construction unfold in societies, and in particular how it does so differently (or similarly) in different societies (Eriksen, 2015). Anthropology is always *contextual*. As such, local knowledge lies at the very heart of anthropology. Whereas the approach to local knowledge in safety science is always purpose-oriented, anthropologists study local knowledge in a more ‘open’ manner. As anthropologists in general do not presume any unified goals of social processes and meaning construction, these must be studied in their own right as a point of departure, before they can inform analyses of preconditions, and effects. What counts as valid or useful knowledge about risk is culturally contingent. Anthropological perspectives on risk, developed among others by Mary Douglas (Douglas, 1985; Douglas & Wildavsky, 1983), have inspired the field of safety to address cultural dimensions, of which knowledge is a central component, and thus, when the ‘cultural turn’ arrived safety science in the mid 80ies, new intersections between safety and anthropology emerged.

From an anthropological perspective, knowledge – and all the sensory input to it, including vision – is a cultural phenomenon (Goodwin, 1994). Unfortunately, as often when concepts travel between different fields of research and practice, a certain degree of conflation was evident when concepts of culture (and knowledge) were shaped in safety science. In writings on safety culture today, for example, one can see how the process of entification (Larsen, 2010) have left its traces on culture in safety research – where it is more often than not treated as a measurable phenomenon and a management tool (Bye, Aalberg, & Røyrvik, 2020)^b.

A general challenge when concepts are translated between scientific fields, is to make

^a The vocabulary may differ, and often local knowledge is hidden behind other terms like

heuristics, adaptations and trade-offs – practices that presume local expertise.

^b But see e.g. Antonsen (2017).

sure that the concept is not too harshly circumscribed and decontextualised before travelling. In the case of local knowledge and anthropology, a critical luggage to bring is the anthropological method. Culturally contingent knowledge is for anthropologists inextricably linked to the anthropological method of understanding it.

So central is participant observation to the anthropological method of empirical fieldwork that it is almost defining the field as well as any prose formulation. In qualitative safety research, however, the methodological repertoire is rich, but less systematically developed Gould and Macrae (2021). Due to the field's multidisciplinary, a very large range of methods have found its way to, and been developed within, the field, and although methodological eclecticism in the field of safety has some strengths to it, it is also a weakness that may come into expression, for example in the study of local knowledge.

3.2 STS and local knowledge

There is a rich tradition for exploring the relation between the local and the global in science and technology studies (STS). In *Down to earth*, Latour (2018) is not willing to use local/global as a dichotomy, as the are traps associated with this – illustrated by the movements towards a purely global point of view and a purely local point of view. The *purely* global perspective offers universality, but lures with escapism, and abstracts away material conditions, inequalities, ecosystems and lived dependencies. The *purely* local perspective, on the other hand, pays too little attention to the global entanglements it is unavoidably weaved into in terms of scientific knowledge production, economic relations and more (Haavik et al., paper in review).

The local, in terms of the situated and contextual, has always had a prominent position in STS writings (Haraway, 2013), and with its roots in the sociology of knowledge (Merton, 2017), epistemological dimensions have often

been 'up front'. In his investigations of knowledge, Latour has been particularly interested in the process of knowledge production (see e.g. Latour & Woolgar, 1986). Through a rich variety of case studies (Latour, 1993, 1999), he has demonstrated how established knowledge is the result of chains of 'translations'^c where each step contributes to extending the networks that contributes to the stabilisation of knowledge. Which actors (individuals, professions, institutions etc) and artefacts are eligible and 'allowed' to contribute to the knowledge building is depending on the politics of knowledge; although science like to think of – and *present* – itself as apolitical, science in action is not that 'pure'. An example that relates to climate adaptation and nature risk is the local knowledge of the snow clearers that play an important role in evaluating snow avalanche risk in northern Norway (Solli & Ryghaug, 2014). Similarly, local snow observers with idiosyncratic epistemologies play an important role in avalanche warning on Svalbard (Johannessen & Haavik, 2024).

In STS writing, the main objective with elaboration of local knowledge is not necessarily an anthropological objective of describing it and giving it credit, but to show how it becomes recognised, stabilised, marginalised, or transformed as it circulates across knowledge infrastructures, decision-making arenas, and institutional settings.

3.3 Participatory research and local knowledge

Whereas anthropology primarily seeks to understand local knowledge through long-term immersion and contextual interpretation, and STS focuses on analysing how knowledge is produced, stabilised, and made authoritative within socio-technical systems, participatory research is defined by its intervention-oriented character (Reason & Bradbury 2008). Rather than treating local knowledge as a form of data to be extracted or validated against external standards, participatory research foregrounds knowledge production as a situated, relational, and iterative process involving researchers and local actors

^c One example of such translation could be when a physical phenomenon is translated into a measured value in a laboratory. Another example

is when such measurements are combined with other elements and translated into a scientific conference paper.

alike (Norström et al. 2020). In doing so, it provides tools for engaging with the epistemic, social, and political dimensions of local knowledge that tend to remain implicit in much safety and risk research.

At its core, participatory research encompasses a family of approaches—including participatory action research, co-production, and collaborative inquiry—that share a commitment to involving those affected by a problem in the research process itself (Parsons et al 2025). While these approaches differ in scope and ambition, they all challenge a strict separation between knowledge producers and knowledge users. Knowledge is instead understood as emerging through interaction, dialogue, and joint problem framing.

Participatory research offers a methodological approach to local knowledge that is particularly relevant in the context of increasing calls for whole-of-government and whole-of-society approaches to climate adaptation and risk governance. These approaches reflect a growing recognition that complex and uncertain risks cannot be managed by expert institutions alone, and that societal resilience depends on the mobilisation of local capacities, trust, and participation across multiple actors and levels of governance (Määttä 2021).

For the study of local knowledge in safety and risk contexts, participatory research offers several advantages. First, *it* foregrounds questions of legitimacy, democratic participation, and epistemic justice in the production and use of knowledge about risk. Rather than treating local knowledge solely as an instrumental input to improve risk assessments or management outcomes, participatory approaches emphasise the right of affected actors to participate in defining problems, articulating relevant knowledge, and influencing decisions that shape safety and livelihoods. Second, it allows researchers to examine how participation is organised and enacted within whole-of-society arrangements, making visible how knowledge claims are negotiated, validated, and translated across actors and governance levels. *In this sense, participatory research is not only a way of including local knowledge, but also a way of*

studying how inclusion and exclusion take place.

Third, participatory research introduces a reflexive dimension that is often underdeveloped in safety and risk science. By engaging directly with local actors, researchers are required to reflect on their own assumptions about risk, expertise, and relevance. This reflexivity is particularly important in climate adaptation research, where scientific uncertainty is high and where externally defined risk categories may not align neatly with local experiences and priorities. Participatory research does not eliminate asymmetries of power or expertise, but it provides a framework for making them explicit and subject to discussion.

4. Results and discussion

4.1 Systematising different fields’ conceptualisation of knowledge

Based on the previous section’s elaboration of how local knowledge is conceptualised in different research fields within the social sciences, we may systematise the perspectives and render them available for comparison and possibly interdisciplinary combination. Table 1 offers such schematic systematisation:

Table 1. Different fields’ conceptualisation of local knowledge

Research field	How local knowledge is conceptualized	Primary purpose	Key contributions to understanding local knowledge
Safety and risk science	Situated, experiential, and practice-based knowledge embedded in <i>work-as-done</i> , informal coordination, and local adaptations	Instrumental: Ensuring safe performance under conditions of uncertainty and variability	Demonstrates that safety is actively produced through local adaptation; highlights the importance of tacit and distributed knowledge
Anthropology	Culturally embedded, dynamic knowledge learned and reproduced through	Interpretive and descriptive: understanding how people know, act, and adapt within	Offers deep insight into how local knowledge is produced, transmitted, and

	everyday practices and social relations	specific cultural and social contexts	transformed over time
Science and Technology Studies (STS)	Situated and co-produced knowledge shaped by technologies, institutions, and power relations	Analytical and critical: examining how knowledge is produced, stabilised, authorised, and marginalised	Explains how certain forms of local knowledge are incorporated into risk governance while others are marginalized
Participatory research	Experiential knowledge of affected actors, linked to voice, recognition, and legitimacy	Normative and epistemic: enhancing democratic legitimacy, epistemic justice, and the quality of decision-making in complex risk contexts	Provides normative justification for including local knowledge; emphasizes institutional design and participation

4.2 Methods for studying local knowledge in climate adaptation

Different scientific disciplines not only have different views on what local knowledge is or can be, but also on how local knowledge makes a difference can make a difference in different contexts and at different scales. Methods for studying local knowledge varies accordingly, and for the field of safety science there can be much to gain by lending inspiration from other scientific traditions. Safety science being an interdisciplinary field may address local knowledge with different lenses and perspectives according to the scope or objective: small scale, large scale, short term, long term. Depending on scope, different methods could come into use. This would require a strengthened focus on epistemological considerations and qualitative research in the field. While several of the ‘classics’ of safety research are methodical exemplary, the methodical heritage is fragmented. As Gould and Macrae (2021) states:

“In-depth, up-close research that seeks to explain what happens in hazardous systems has produced a wealth of insights of both theoretical and practical value, but the methodologies associated with these modes of research are not

often considered in similar depth” (Gould & Macrae, 2021, p. 2)

With the interdisciplinary character of the safety field, many safety researchers bring with them a methodical repertoire from their ‘mother fields’ of sociology, engineering, psychology and other fields. While this may be a strength for the safety field, it is also potentially a vulnerability as it represents a possibility to be on different wavelengths and thus misunderstand, or not completely understand, each other ‘across fields’ in discussions where method is essential. There are therefor good arguments for continuing the ambition of Gould and Macrae (2021) and develop grounds for shared understanding of qualitative methods – in general, and for investigating local knowledge in particular – in the safety field.

4.3 ‘Owning’ or ‘sharing’?

While some scientific concepts are ‘core concepts’ in a field, other concepts may be part of the fields’ repertoire but reside in the fringe where it is shared with other scientific fields. Examples of ‘core concept’ of which safety science ‘own’ can be *defence in depth* (Reason, 1997) or *drift towards failure* (Rasmussen, 1997). *Sensemaking* (Weick, 1995) and *organisational culture* (Weick, 1987) are examples of fringe concepts that safety science share with or borrow from other scientific fields. Antonsen, Aven, and Haavik (2025) distinguish between *research in* risk science and *research on* risk science, the former addressing research on the core themes and concepts of safety science, and the latter addressing research on themes and concepts on the fringe of safety science.

We find local knowledge, and particular in the context of climate adaptation, to be a good candidate for *research on* risk science – that is, exploring the grounds for developing a transparent safety-oriented approach to local knowledge in relation to climate change and climate adaptation that communicates with anthropology, STS and participatory research.

5. Conclusion

Local knowledge has many connotations, as there are several ways of interpreting both ‘local’ and ‘knowledge’ (Haavik et al., paper in review). The

different approaches to local knowledge in different scholarly traditions, and the different ways in which local knowledge may hold significance, implies opportunities for safety scholars to lend methodical and epistemological inspiration from fields such as anthropology, STS and participatory research when addressing local knowledge. Since safety discourses have its own specific epistemological tensions to relate to with respect to focus on things that go *right* or things that go *wrong*, we believe it is important to be explicit and transparent on what is meant by local knowledge in the particular context discussed. Thus, the intersection between safety science and other fields that the research may be drawing on will be rendered visible, with the inviting effect this may have on other researchers to further explore the interdisciplinary theme of climate related natural hazards on the intersection between safety and other, adjacent fields.

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