

COMMENTARY:

Knowledge and adaptive capacity

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Knowledge could represent both a powerful determinant and indicator of adaptive capacity.

Climate change adaptation has, over the last decade, become an increasingly important topic in international policy discussions. In the research community, considerable work has been devoted to adaptation, and especially to understanding the factors that determine an individual, community, organization or nation's ability to adapt to the effects of climate variability and change. This research has produced important insights into the nature of adaptive capacity, and yet the concept remains difficult to bound and measure. Here we suggest that knowledge, broadly defined, represents both an important determinant and indicator of adaptive capacity. In addition to making this case, we propose some strategies for measuring and assessing knowledge in this context.

Adaptive capacity and its indicators

The concept of adaptive capacity remains contested, but can be broadly defined as the ability of individuals, communities, organizations, nations and other actors to adapt to the current and likely future effects of changes in the global climate^{1–5}.

Finding reliable ways to measure adaptive capacity has been a top priority for researchers and policymakers, because the capacity to adapt is a necessary condition of successful adaptation¹. Numerous indicators have been developed — including 'education, income, and health' as well as access to financial, technological and institutional resources¹. However, early research on vulnerability and adaptive capacity indices failed to adequately justify the indicators selected to track adaptation potential^{6,7}.

Recent literature has attempted to overcome these limitations by articulating specific determinants of adaptive capacity and identifying the processes through which those determinants interact. In a recent paper⁸, Eakin *et al.* frame the

relationship between socio-economic development and climate risk reduction as an interaction between 'generic' and 'specific' capacities and explore how those capacities might complement or undermine each other in different contexts. Similarly, the Local Adaptive Capacity (LAC) framework, developed in part by the Africa Climate Change Resilience Alliance, seeks to understand how different determinants of adaptive capacity influence each other at the household and community levels⁹. Both the LAC framework and the work of Eakin *et al.* argue that no single determinant of adaptive capacity is sufficient to explain the concept completely.

Knowledge and adaptive capacity

There appears to be growing agreement that knowledge represents an important determinant of adaptive capacity. Within several well-publicized research frameworks, knowledge is closely associated with many other determinants of adaptive capacity². Within the LAC framework, for instance, knowledge is not only a dimension of adaptive capacity in itself, but is also represented within each remaining dimension proposed by the framework. Moreover, four out of the six factors that Adger *et al.*⁴ associate with adaptive capacity rely to some extent on knowledge. Knowledge also features prominently at the policy level, and the IPCC considers a 'lack of knowledge' to be a possible constraint on adaptation². Furthermore, since the Marrakesh Accords in 2001, most international frameworks for capacity building related to climate change have emphasized the importance of producing and sharing high-quality knowledge^{4,10}.

In light of this work, we argue not only that knowledge is a powerful determinant of adaptive capacity, but also that framing adaptive capacity in terms of knowledge empowers actors to define adaptation on their own terms. This invites policy

solutions that prioritize the production of useful climate change knowledge and its effective communication to actors at all scales. It is important to note that the nature and usability of knowledge varies across scales, since priorities and decision-making processes vary from actor to actor, and that any reliable assessment of knowledge should be scale-specific¹¹.

Knowledge is not merely the possession of information. Producing knowledge requires interpreting information and organizing it into a set of evidence-based beliefs about particular phenomena. Climate change knowledge includes evidence-based beliefs about the causes and effects of current, location-specific environmental conditions, as well as probable changes in those conditions. Such knowledge helps people and groups to (1) make sense of environmental changes; (2) take up a normative position with respect to those changes; and (3) respond to those changes in ways that serve their interests. Because we are concerned with the use value of knowledge, we believe that both empirical and local traditional knowledge of weather patterns, environmental conditions, and likely effects of particular hazards fit our criteria for knowledge^{1,10}.

We believe that knowledge, broadly defined, is a powerful determinant of adaptive capacity for several reasons. First, and most generally, knowledge allows humans to make sense of their world, and it is on the basis of this understanding of the world that we evaluate possible actions and select those we believe to be best or most useful. The better an actor's knowledge of current and probable future environmental changes, the more likely it is that they will be able to respond to those changes in ways that best serve their particular interests.

Knowledge also gives actors predictive power, allowing them to better prepare for likely future changes. Knowledge about the

observed and potential effects of climatic changes allows policymakers at all levels, institutional actors, communities, and individuals to anticipate environmental changes and plan effective responses to them. This predictive power also helps people deal with current climate variability, since “increased awareness of the potential impacts of future climate change may, in some instances, lead to the implementation of adaptation options in order to reduce vulnerability or capitalize on opportunities”²².

Furthermore, at the community level, and especially in poor and vulnerable communities, knowledge empowers people to participate more effectively in local, national and international conversations about climate change adaptation. Knowledge gives the poor and vulnerable a better understanding of the kinds of resources and interventions that will be most useful to them and, in the case of scientific knowledge, the information and vocabulary required to communicate their vulnerabilities to actors with conventionally greater decision-making power.

Finally, knowledge influences other determinants of adaptive capacity, especially at the institutional, sub-national and national scales. Money, technology and responsive institutions can provide a general infrastructure for dealing with uncertain environmental changes, but it is when actors know which problems their money and technology will have to address that financial and other resources become most effective. Knowledge lays the groundwork for successful adaptation by making it possible for actors to shift their focus from short-term to long-term solutions, invest more in adaptation, move from a passive acceptance of environmental changes to a willingness to pursue possible solutions and, in general, shift from a reactive to a proactive approach to adaptation.

The IPCC rightly notes that access to information about climate change does not, by itself, expand adaptive capacity². In order for climate change information to have value, actors must be able to transform that information into knowledge that allows them to modify their behaviour in adaptive ways. Knowledge of a problem, such as climate change, and of possible solutions can enable people to take adaptive measures by helping them to determine which actions are most likely to produce a desired outcome and to build the sense of self-efficacy required to take those actions.

Even so, limits to adaptation exist. In some cases, financial, technological, infrastructural, cultural and other constraints make successful adaptation

impossible¹¹. Actors with low ‘generic’ capacities, like education and economic productivity, often face limits to adaptation that no amount or types of knowledge can overcome⁸. Diminished generic capacities can, moreover, reduce the usability of knowledge by limiting opportunities for its application. For this reason, knowledge might be most useful as an indicator of adaptive capacity for actors whose generic capacity exceeds a certain minimum threshold, since these actors are most likely to have opportunities to incorporate climate change knowledge into their decision-making processes.

Measuring knowledge

Based on the framework outlined here, we plan to implement a research project to determine whether or not knowledge functions, in practice, as a useful indicator of adaptive capacity. The outcome of the research will, we hope, include a knowledge scale that can be used to assess the climate change knowledge of individuals, communities, institutions or nations.

Evaluating an actor’s useable knowledge should involve examining not just what they know or think they know, but how they came to know it.

There are, we argue, two basic ways of measuring knowledge. We can measure knowledge inputs — whether and to what extent an actor receives information about climate change and its effects — and knowledge outputs — evidence, behavioural or otherwise, that represent whether actors have a greater or lesser understanding of climate change. Measurable outputs might include an actor’s understanding of climate change concepts as assessed through a test. Knowledge inputs, on the other hand, include access to information, as well as opportunities for vicarious learning, direct learning (learning-by-doing) and for sharing knowledge. Many factors influence knowledge inputs, including the perceived relevance of information to an actor, the perceived credibility of that information including the trustworthiness of its source, and the quality and degree of communication between knowledge producers and knowledge users¹². Examples of knowledge inputs might include the amount and quality of training a community has received or the quantity of climate change research a government has conducted or commissioned.

Because the process by which knowledge is produced and communicated determines, to a large extent, its quality and usability, evaluating an actor’s useable knowledge should involve examining not just what they know or think they know, but how they came to know it^{12,13}. For this reason, we suggest that measuring inputs may actually represent the best way to determine whether or not the knowledge an actor possesses is likely to be effectively deployed.

Regardless of what items we choose to measure, or how we choose to measure them, developing a useful knowledge scale presents some unavoidable challenges. Evaluating knowledge is difficult, and putting too much stock in a single ‘knowledge score’ as an indicator of adaptive capacity would be unwise. We believe, however, that having even a rough measurement can help researchers better assess adaptive capacity and give policymakers a better sense of the projects and interventions that might help people deal effectively with the effects of climate change. □

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