Sustainability Science • Sustainability Science: A guide for researchers

Capacity to Link Knowledge with Action

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Knowledge, we argued in the [Chapter on Capacity to Measure](#), is one of the key resources on which society draws to grow well-being. The stock of knowledge capital, like the stock of all resources, can be both depleted and augmented through human activities. The sustainability science community, drawing on basic research across a wide range of disciplines, has built a growing stock of knowledge over the past 20 plus years with the goal of helping to guide sustainable development. At the same time, many agitators working on the front lines of action for sustainable development continue to lament the lack of knowledge they most need. The gap between what is known or knowable about sustainable development and what is applied on the ground has long been recognized but is receiving renewed attention in the scholarly community ([ICSU and ISSC 2015](#); [Liu et al. 2019](#); [Turnhout, Tuinstra, and Halffman 2019](#))).

1 Findings: Expertise, co-production, and trust

We turn in this section to the body of research relevant to understanding how a capacity to link knowledge with action determines the extent to which the potential of knowledge to support informed agitation for sustainability is realized in practice. Central to that literature is the realization that knowledge is more likely to influence practice when it emerges from a dialog between experts and decision-makers, rather than from one-way efforts in science communication. Who gets to participate in those dialogs—whose expertise and interests are recognized and whose are excluded—are therefore central questions that must be addressed in efforts to create trusted knowledge capable of bringing diverse and often conflictual parties together in pursuit of sustainable development goals.

Co-production: The most fundamental finding that research has brought to the challenge of linking knowledge with action is the idea of **co-production**.¹ The essence of the idea is that knowledge and society continually reshape one another ([Forsyth 2003, 104](#)). What questions are (not) asked, whose evidence is (not) considered, and which sorts of explanations (do not) carry weight are shaped not just by the research community but also by society's prevailing institutions and power relationships. Reciprocally, the knowledge so produced stabilizes and legitimizes some institutions and power structures while undermining others. The resulting co-production process is a dynamic one, subject to guiding interventions but also prone to the path dependence typical of other processes in the complex Anthropocene System. Co-production, its origins as a research focus, and its implications for sustainable development are the subject of a recent critical review [Wyborn et al. 2019](#), the conclusions of which square largely with our own. We therefore refer the reader interested in the antecedents of

co-production scholarship (e.g., action research, mode-2 science, post-normal science), its continuing controversies, and its current directions to that review. We focus here on the specific insights from co-production that inform the capacity to link knowledge with action in pursuit of sustainability.

A central preoccupation of scholarship informed by co-production is the question of who gets to participate in, and who gets excluded from, efforts to link knowledge with action. This work at its core is anti-elitist, critiquing and building alternatives to models of knowledge and action based on assumptions of single or hierarchically organized decision-makers informed by single experts or expert consensus. A principal focus has therefore been on enhancing participation and inclusiveness.

Sources of expertise: One objective of this effort has been to enhance available knowledge capital by tapping into multiple sources of expertise. This has involved efforts to bring together scholars to do interdisciplinary research with due attention to achieving mixes across genders, regions, and other attributes. But it has also entailed reaching beyond the community of scholars to include actors with relevant indigenous and local knowledge or knowledge gained from practice. The IPBES has been a leader in recent efforts to improve the diversity of expertise participating in assessments of nature–society interactions ([Pascual et al. 2017](#)). A recent review of its efforts, accomplishments, and remaining challenges provides an excellent perspective on contemporary thinking about participation and inclusiveness in sustainability efforts more generally ([Díaz-Reviriego, Turnhout, and Beck 2019](#)). Hurdles identified include reliance on established procedures for identifying experts, a bias toward natural science expertise, and the push toward consensus that too easily marginalizes views not of the mainstream.

Creating trusted knowledge: A second objective of enhancing participation and inclusiveness has been to strengthen the influence of knowledge on action by bringing decision-makers and other stakeholders to join experts in the co-production process ([Fischhoff 2018](#)). This approach to co-production involves the collaborative creation of knowledge that users come to perceive as trustworthy and thus something they will allow to influence their decisions. Trustworthiness has been explored as a relational property of co-production in which potential users come to see knowledge products as meeting the criteria of saliency, credibility, and legitimacy ([Daly and Dilling 2019](#)). Available evidence suggests that at least minimum levels of performance on each criterion are necessary to achieve influence ([Clark et al. 2011](#)). A balanced approach is needed. Going to extreme lengths to assure scientific credibility through peer review may be wasted effort if sufficient attention is not given to steps that would assure practical relevance to decision-makers or political legitimacy through a fair treatment of contested positions ([Turnhout, Tuinstra, and Halffman 2019](#)).

Relevant to both diversifying sources of expertise and creating trusted knowledge is the fact that participation is almost always expensive for participants. Obvious costs are time and other scarce resources. But reputational risks (for experts) and political risks (for stakeholders) can also be

important ([Oliver, Kothari, and Mays 2019](#)). The pursuit of sustainability, as we have emphasized throughout this Research Guide, is an inherently political activity conducted in the presence of strong incumbent interests and substantial power differentials among actors. Because knowledge is one dimension of power, experts seeking to inform agitation for sustainable development should know that they are players on a political field. This means that they are likely to be seen as taking sides in the political contest. It means that they should acknowledge that the incentives they face in deciding which questions to pursue with their research are likely to reflect the interests of the already rich or powerful. And it means taking responsibility for the fact that how they interact with other participants in the co-production process—particularly those representing marginalized knowledge and interests—has the potential to either undermine or strengthen those participants’ own positions ([Clark et al. 2016](#)). The focus of recent co-production scholarship on participation and inclusiveness is a welcome corrective to more elitist models of linking knowledge with action. Still needed, however, is work to identify effective strategies for navigating the political context of participation and for identifying just what sort of participation is most important at each stage of dynamic efforts to link knowledge with action ([Grillos 2019](#); [Wyborn et al. 2019](#)).

2 Building Capacity: Social learning, boundary work, and decision support

Building capacity to link knowledge with action for sustainability is a complex, multifaceted challenge. We highlight here several of the themes emphasized in recent extensive reviews of the topic ([van Kerkhoff and Lebel 2015](#); [Clark et al. 2016](#)).

Suitably trained researchers can significantly enhance their capacity to link knowledge with action for sustainable development. Experts of all sorts have long been informing agitators for sustainability without special training, serving as a reminder that the importance of informal and experiential knowledge should not be underrated. On-the-job training is almost certainly how most of today’s sustainability scientists have learned the substantive content, interdisciplinary skills, and political savvy that have helped them to contribute effectively to frontline action. And a growing number of courses and training programs are available ([Evans 2019](#)). Nonetheless, the urgency of the sustainability challenge, together with the complex and rapidly developing character of the field as sketched in this Research Guide, suggests that better and more accessible training programs are needed ([West, van Kerkhoff, and Wagenaar 2019](#)). Many approaches are being tried around the world ([Giangrande et al. 2019](#)). An effort to pool lessons from these ongoing experiments would almost certainly be useful, though here as elsewhere in the pursuit of sustainability the temptation to advance panaceas should be resisted. Different curricula, competencies, and pedagogies will almost certainly be best suited for different people and contexts.

Social learning: Support for continuous, contextualized social learning is also an important component of capacity for linking knowledge with action for sustainability. Many concepts of social learning are in play ([Social Learning Group et al. 2001](#)). We focus on learning that occurs above the level of the individual in the sense that societies learn about the threat of global warming or the opportunities of globalization. Lessons learned at the social level are remembered through embedding in the facts, technologies, rules, and norms that are embodied in the relevant system's knowledge capital and social capital. An ability to learn, rather than just know, is important because of the complex adaptive character of the Anthropocene System that we have emphasized throughout this Research Guide ([de Kraker 2017](#)). The ability to do this effectively, rather than becoming stuck in ruts of old but no longer valid knowledge, is hard to master. It has been shown to benefit from mind sets that recognize the complex adaptive character of the Anthropocene, and from the creation of organizational **safe spaces**² that encourage experimentation. Also important are the timely acknowledgment of error, an appreciation of the co-produced character of useable knowledge, and an abiding humility of researchers as we confront the tasks before us ([Suškevičs et al. 2017](#)).

Boundary work: Building capacity to link knowledge with action for sustainability also requires investing in organizations to carry out the **boundary work**³ of connecting experts and decision-makers ([Clark et al. 2011](#)). As expected, which forms of organization work best is context dependent. There are strong suggestions in the literature, however, that the degree of political contestation involved in choosing which actions to take makes a substantial difference in the form of the advisory system most likely to mobilize knowledge effectively. One of the most demanding situations is that in which research is called upon to advise contentious transnational or global negotiations, e.g., the Intergovernmental Panel on Climate Change (IPCC). A significant body of scholarship has examined the effectiveness of various arrangements for providing scientific assessments in such situations ([Kohler 2020](#)). It emphasizes the tensions that arise in arrangements to secure the credibility, saliency, and legitimacy of scientific findings for multiple users who almost always have different views of what they would like the science to say. The most vibrant area of experimentation in boundary work and organizations to carry it out is almost certainly taking place at the level of regions. Once viewed as extension work in agricultural and early industrial contexts, much of this effort is now grappling more explicitly with ideas about co-production under the umbrella term of decision support. Critical assessments have been carried out of experience with decision support organizations across a range of development activities ([Clark, Matson, and Dickson 2016](#)), but with special emphasis in the context of advice for dealing with climate change ([Palutikof, Street, and Gardiner 2019](#)). Findings are generally consistent with structuring decision support as a co-production process, entraining multiple forms of expertise, and engaging in continuing dialog with decision-makers and other stakeholders ([Webber 2019](#); [Cashore et al. 2019](#)). Like all organizations, decision support efforts are prone to getting caught in ruts and captured by particular interests (be they academic disciplines or particular users), as well as

simple exhaustion. If they are to guide development pathways toward sustainability over the long run, boundary organizations must themselves be learning organizations, assisted in their efforts by periodic external reviews ([Weichselgartner and Arheimer 2019](#)).

Remaining hurdles: Looking ahead, the co-production research noted above implies that sustainability science researchers face especially tough hurdles in their efforts to generate knowledge that can influence development pathways toward sustainability. One reason is that because knowledge creation is so intertwined with society and its power structures, the research that is likely to be most readily funded and adopted by decision-makers is research that supports (or at least does not threaten) current development pathways. For a lot of sustainability issues, these potential entanglements may be relatively unproblematic. But the risk is real that the knowledge most needed by marginalized groups or interests will not get produced, as exemplified by the continuing struggle for drugs to treat neglected diseases ([Ferreira and Andricopulo 2019](#)). An even deeper cause for concern highlighted by the co-production perspective is that when researchers persist and do create knowledge that threatens powerful interests vested in the status quo, they often induce pushback, personal attacks, or outright disinformation campaigns. Ongoing efforts to undermine research-based knowledge on the role of fossil fuels in driving the climate crisis and the role of junk food in driving the malnutrition crisis are well-known examples ([Farrell 2019](#); [Nestle 2016](#)). But the pervasive resistance to inconvenient truths has even darker sides that, in their more extreme forms, surface in the continuing campaigns of intimidation and murder facing local expert-activists seeking to expose illegal deforestation around the world ([Middeldorp and Le Billon 2019](#)). For all of these reasons, the co-production of knowledge must be at the center of efforts to build governance arrangements to support sustainable development. We delve further into these issues in [Section 2 of the Chapter on Capacity for Governance](#) and in our [Conclusions](#).

Footnotes

1. **Co-production:** knowledge and society continually shaping each other in a dynamic, path-dependent process [↪](#)
2. **Safe spaces:** institutional arrangements that encourage experimentation and the timely acknowledgment of error [↪](#)
3. **Boundary work:** process through which research communities organize their relations with new science, other sources of knowledge, and the worlds of action and policy-making [↪](#)

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