Linking Knowledge with Action

Theory of change for project investments in Science

Although the projects supported by the Science program range widely across conservation, they share a theory of change which we call Linking Knowledge with Action (LKwA). The theory is that knowledge is useful and used when it is *jointly produced* by participants in the decision process and experts with technical and domain knowledge. Knowledge produced in this way is more likely to be salient, credible, and legitimate. These attributes increase the probability that decisions will be effectively informed by science. This theory contrasts with a more widely held belief, that scientific knowledge produced with little or no participation by decision makers can be influential in informing decisions and reforming decision-making rules and institutions. LKwA is a common element of the projects selected for investment in the Science program. With an explicit theory of change the Foundation can identify indicators and hypotheses used to monitor project performance and to evaluate the Science program.

The problem

The use of scientific knowledge in decision-making in governments and other large organizations remains problematic (Clark et al 2006), even though science has been recognized as an important element of decision making and policy since the mid-20th century. Decision-making is driven by considerations different from those that shape scientific discovery (Price 1965). As a result, what counts as "good" information and "good" use of information is not the same to scientists and those in the decision process. Linking Knowledge with Action proposes a way to diagnose these differences and suggests ways to manage the tensions of this intrinsically difficult relationship.

Science is the pursuit of *reliable* knowledge. Publication of results in a peer-reviewed journal is the basic guarantor of science good enough for other scientists to rely on it in their own investigations. Gathering reliable knowledge is a meticulous process, with rigorous standards of evidence and disclosure of methods. Often, acceptance of new knowledge takes years of expert debate, replication of observations, and refinement of methods, as happened with the plate tectonic theory of the earth's crust.

Decisions are typically made under deadlines and amid controversy. Although decision makers seek knowledge to justify and to guide their choices, often the knowledge that is usable is the knowledge that is available—however frail its basis in science. To be useful, knowledge should be scientifically credible, but it must be timely and relevant in the eyes of those in the decision process. The long-persisting public debate over global warming, for example, contrasts strikingly with the consensus among scientists about the basic dynamics of the global climate system. Scientists are convinced that changing the concentration of greenhouse gases in the atmosphere will change the climate; that is reliable knowledge. Yet political discussion continues over

whether climate change is a legitimate and urgent problem, with arguments about how warnings from scientists should be balanced against economic development or unusually cold weather in a capital city.

Such disconnects reflect deep differences between science and action. Reliable knowledge is essential in a complex and dynamic world. Decisions need to be made responsibly, and that means that decision makers cannot wait but need knowledge that is "good enough." Linking knowledge with action thus requires *continuing management* of the tensions between science and decision-making, so as to honor both the demands of action and the rigor of science.

Useful knowledge

The goal of Linking Knowledge with Action is knowledge that is useful and used to advance conservation and sustainability. As shown in Figure 1, LKwA is built around *joint production* of knowledge by users from the world of decision-making, working with scientists who bring specialized knowledge of geographic and disciplinary domains and mastery of analytical and other technical skills. Joint production means that research should aim to answer the questions facing decision makers, and that decision makers should grasp both the content and limitations of the scientific knowledge available to inform decisions.

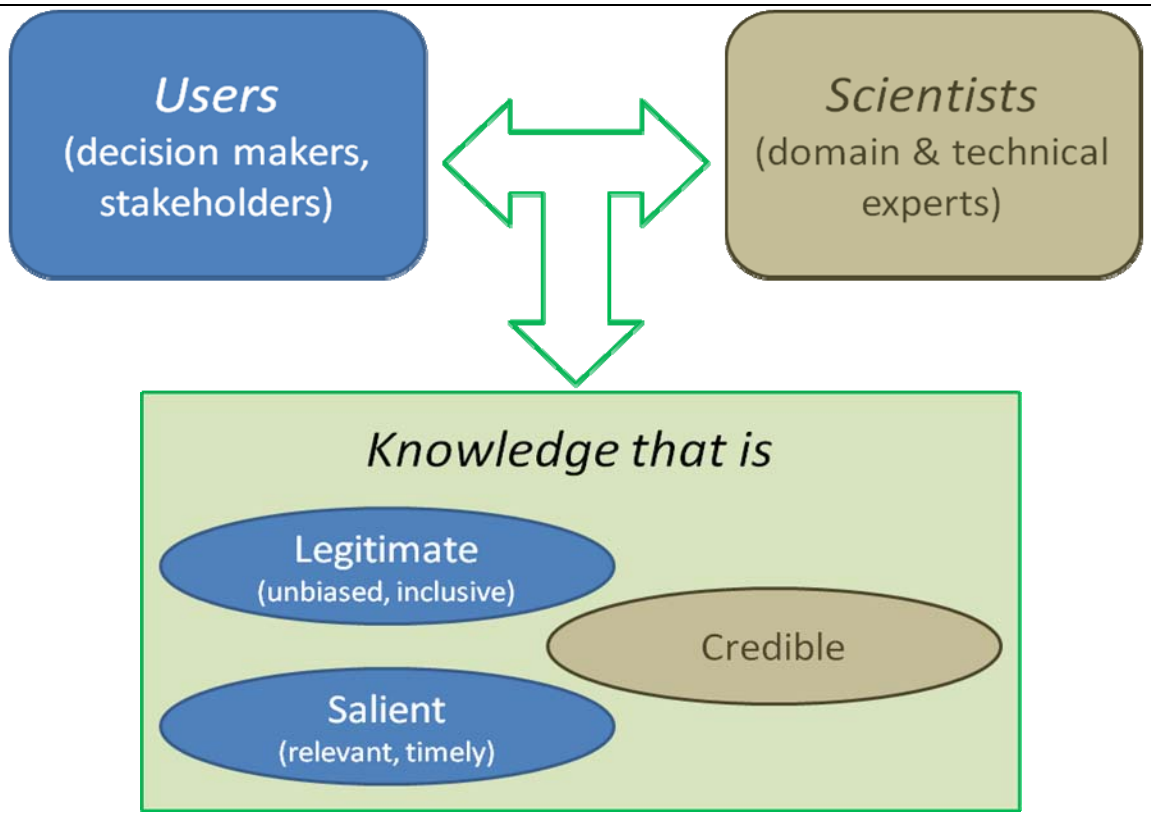

Figure 1. **Goals of Linking Knowledge with Action**

Usable knowledge has three attributes, which often cannot be optimized at the same time. Decision makers need *credible* information: knowledge that has passed the tests of academic validation where it is available. In many decision-making situations, however, it is equally or more important that the information be *salient*—that it be relevant and timely. Decisions also need to withstand challenge, and that means the information on which the decisions are based needs to be *legitimate*: gathered in ways that assure that the information is correct, complete, and unbiased. Legitimacy can often be strengthened by exposing research to peer review, by involving a wide range of stakeholders as research questions are defined, by relying on syntheses of knowledge carried out by independent scientists who have no political or financial interest in arriving at a preordained result, and by funding such syntheses from similarly independent sources. Credibility, salience, and legitimacy can often reinforce one another, but they are also often pulling in different directions, so that a central task of LKwA is making knowledge good enough to inform and to improve decision-making.

The Science program invests in opportunities yielding measurable impact on decision making within one to three years. This demanding screen is intended to speed learning of what works and what does not work to bring about better use of knowledge. Grantees accordingly need to identify decisions, together with research users and scientists who can partner to achieve definable outcomes within this time-limited project approach. The Foundation selects a small portfolio of projects each year, as explained in *How to Suggest New Projects* [link]. These choices are guided by the strategic priorities of the Conservation and Science program's work in California and the West, the Gulf of California, and the western Pacific, as well as our work in marine fisheries, agriculture, and climate. Current projects are summarized in a companion document [link to *Science Subprogram Projects*].

Managing the tensions between decision-making and science

The arrow in Fig. 1 marks social interactions that can address the tension between the needs of decision-makers and stakeholders, on one side, and the scientific community, on the other. By unpacking those interactions, LKwA highlights attributes that can be monitored during the implementation of projects, so that the Science program staff can learn quickly from the experience of its grantees. Grantees may also find monitoring of use internally, and their reactions to this framework will help to shape the trajectory of future grantmaking.

We have identified six characteristic elements of Linking Knowledge with Action. We believe that these together play an instrumental role in creating a knowledge process that key stakeholders and decision makers regard as legitimate, credible and salient. Table 1 identifies the elements and questions to ask about progress in achieving those elements. The logic models in the project summaries [link to *Science Subprogram Projects*] show how these elements take shape in concrete situations. Some elements may already be present at the beginning of a project, such as a ripe situation, while others would be strengthened or built in the course of the project, such as joint production of knowledge.

Grantees and users of knowledge are asked to provide monitoring information for two purposes: to report on their progress in implementing the grant, and to aid in monitoring the performance of the Science program in implementing LKwA. For the latter purpose, monitoring is designed to facilitate comparisons among projects. Since the Science program continues to evolve, our objective is not uniformity of reporting but enough consistency to enable comparison among projects that are vary in their goals, approaches, and context.

LINKING KNOWLEDGE WITH ACTION **GOAL: Decision makers, key stakeholders, and scientific experts are aware of the tensions facing effective use of science in decision-making, and take steps to manage those tensions, with the aim of producing knowledge that is used because it is salient, credible, and legitimate.**	
Elements	***Questions to guide monitoring***
Ripe situation	✓ Are there openings for rethinking where decision makers are seeking new information? Has commitment to existing options and understandings weakened? ✓ Can new information be provided in time for the decision-making window? ✓ Are there good prospects that new information will be influential—for example does the balance between power and knowledge in decision-making favor knowledge?
Spanning the boundary between action and knowledge	✓ Does a *boundary organization* (Guston 2001) exist or can it be readily created as part of an initial convening? A boundary organization is accountable to both decision-making and scientific worlds (in different ways); it can organize the creation of an assessment or other "boundary object" that combines science and decision-making information in a useful form; and it can provide incentives for constructive contributions from both decision-making and scientific participants. If there is no explicit boundary organization, are these functions effectively realized? ✓ Are scientific experts trusted by decision makers? by stakeholders? by other scientists with relevant expertise? ✓ Are actors who can influence success (including those who can say "no" to use) engaged by scientists or those working at the boundary? ✓ Do stakeholders agree that the questions to be investigated are important, even when they disagree on desirable answers?

Capacity of actors	✓ Do researchers have the capacity to conduct the inquiry? If the questions to be answered require an interdisciplinary approach, is the research team capable of integrating knowledge across disciplines, and integrating academic and experiential knowledge? ✓ Do those conducting the research have the interest and capacity to work with decision makers and stakeholders? ✓ Are participants aware of the challenges of salience, credibility, and legitimacy? Are they willing to work with the boundary organization to address those challenges? ✓ Are decision makers and key stakeholders willing and able to inform communication strategies needed for effective use of the knowledge produced? ✓ Are early adopters of the knowledge identified? Are they able to use it and communicate their experiences to other decision makers and stakeholders?
Joint production of knowledge	✓ Does knowledge process secure effective collaboration from decision makers, stakeholders, and researchers? ✓ Do potential users believe that the information process took account of concerns and insights of relevant stakeholders and was procedurally fair (Legitimate)? ✓ Do potential users believe that the scientific knowledge is relevant to their decision-making and timely in its availability (Salient)? ✓ Do potential users believe that the information has taken into account issues of data reliability, appropriate methods and validity of inferential claims, consideration of alternative hypotheses, and other issues of scientific credibility (Credible)? ✓ Do legitimate potential early adopters participate in knowledge process?
Behavior of decision makers and key stakeholders changes	✓ Are there changes in issue framings, discourse, and agendas related to the issue? ✓ Are there changes in behavior and policies of relevant actors? ✓ Are there changes in actor goals, interests, beliefs, strategies and resources? ✓ Is there increased willingness and capacity to learn? ✓ Are there changes in institutions that enable and constrain interactions among actors?

Knowledge process and products **positively influence the situation**	✓ Does the scale of knowledge gained match issue domains in likely use settings? ✓ Does the knowledge spread through likely use settings? ✓ Have the participants gained capacity to contribute to knowledge and understand information? ✓ Did the process build a relationship between users (decision makers), those who can influence the decision (stakeholders) and those who conduct the inquiry? ✓ Does implementation reflect learning?

Table 1. Monitoring progress in Linking Knowledge with Action.

It is important to bear in mind that LKwA is not a single process, to be undertaken in a linear fashion. Instead, it is the pragmatic working out of relationships among those in a decision process and scientists with potentially relevant knowledge. These actors come to the joint production of useful knowledge with significantly different goals, capabilities, and incentives. That is the source of the tensions that needs managing. The management of those tensions is LKwA.

Evaluating the theory

LKwA is a *theory* of change, and the implementation of the Science program's grantmaking is a test of that theory's applicability and validity in conservation. The Foundation is using a real-time approach to evaluating the program and its theory of change. Grantees, research users, and other interested parties are being called upon to provide information for real-time evaluation.

Indicators to be observed are tailored to each grant, in collaboration with the grantee and users of knowledge. The indicators are designed in light of the questions in Table 1, so as to enable comparison across projects. For example, in monitoring the ripeness of the situation, a user might identify the schedule on which new knowledge is needed for decision-making, and researchers would report on their ability to meet that schedule as a grant proceeds. Similarly, in monitoring joint production of knowledge, users might report their judgments of whether grantees are conducting their work in a way that will be legitimate, by taking into account the concerns of stakeholders and by following fair procedures. Such indicators might be measured in a brief survey, with follow up conversations if issues surface.

As we learn about the challenges facing LKwA, the theory of change should evolve; Table 1 is a starting point, rather than a statement of what each project should strive to achieve. Success of the Science program is defined to a significant degree by the learning that the Foundation and its grantees gain over time.

It is important to understand that what is being evaluated is the Science program, rather than specific grants, grantees, and research users. It is useful, accordingly, to identify the elements of the program evaluation.

- During the development of a grant proposal, program staff will articulate how the project advanced by that grant would align with LKwA.
- When the Foundation board approves a grant, the grant notification letter will identify information that should be provided by the grantee to inform the Foundation about the grant's role in advancing the project goals and surprises it may be producing about the theory of change.
- The Foundation will undertake supplemental monitoring of science-policy interactions, both within and beyond the scope of the Science program, to maintain awareness of the shifting context for LKwA.
- Grantee reporting, together with information about the broader context, will contribute to real-time evaluation in several ways: in the annual reconsideration of priorities and selection of new projects; in internal reporting to the Foundation's board, including an annual appraisal of the Science program to Foundation management; and, occasionally, in reports and publications summarizing our emerging experience in using LKwA to guide grantmaking.
- Over time, the theory of change is likely to be amended. Prospective changes will be discussed with grantees and research users, as well as on the Science program's web page.

Strategic investments in science for decision-making

By advancing Linking Knowledge with Action as an explicit theory of change, the Science program is articulating a set of concepts that can be tested and improved by experience. LKwA is a model of how scientific knowledge can enter into decision-making, and how scientific research can be guided by the needs of users while also achieving credibility and legitimacy. The reliable coupling of science with decision-making has proved elusive, despite the ever stronger case for sound science in the search for sustainability (National Research Council 1999) and the need for adaptive management of ecosystem services and other resources.

In testing LKwA, information from grantees, research users, and others will be of critical importance. The Packard Foundation is committed to partnership with its grantees. In the Science program that partnership includes examining the concepts that guide grantmaking.

Sources cited

Clark, William C., Ronald B. Mitchell, and David W. Cash 2006. Evaluating the Influence of Global Environmental Assessments. Chap. 1 of *Global Environmental Assessments: Information and Influence*, eds. R.B. Mitchell, W.C. Clark, D.W. Cash & N.M. Dickson, Cambridge: MIT Press.

Guston, David H. 2001. Boundary Organizations in Environmental Policy and Science: An Introduction. *Science, Technology, & Human Values*, 26:399-408 (Special Issue: Boundary Organizations in Environmental Policy and Science).

National Research Council 1999. *Our Common Journey: A transition toward sustainability*. Report of the Board on Sustainable Development. Washington, D.C.: National Academy Press. Online: http://lab.nap.edu/catalog/9690.html

Price, Don K. 1965. *The Scientific Estate*. New York: Oxford University Press.