Beyond Basic and Applied: Using a Typology of Research Activities and Attributes to Inform the Production of Usable Science

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Cooperative Institute for Research in Environmental Sciences
University of Colorado, Boulder

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Outline

I  Goal
   Usable Science

II  Challenges
   Linking Science With Policy

III  Limitations
   Basic and Applied

IV  Typology
   Activities and Attributes

V  Examples
   Applying the Typology
Goal: usable science

Science is called upon to serve society
Goal: usable science

Useful information:
• Salient
• Credible
• Legitimate
• Expands Alternatives
• Clarifies Choices
• Achieve societal goals
Challenges: linking science with policy

- Cultural barriers
- Information lacks context
- Multiple knowledges & expertise
- Integration into decision systems

“When science is gathered to inform environmental decisions, it is often not the right science.”
Challenges: linking science with policy

RESPONSE:

*Intended users of scientific information must be engaged in the process of knowledge production*

- Needs assessments
- Early, iterative and ongoing engagement
- Attention to process
- Social learning
# Limitations: Basic and Applied

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<thead>
<tr>
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<th>Jeffersonian</th>
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<tbody>
<tr>
<td>Applied</td>
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<td>Use-Inspired</td>
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<td>Fundamental</td>
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## Criteria
- Motivation
- Temporal delay

“Unfettered” research
Motivations for research: **Creating New Knowledge**

$\text{Knowledge} \quad \text{=} \quad \text{Basic and Applied}$

$\text{Science Policy}$

$\textit{Science policy} = \textit{decisions about research priorities}$
Limitations: basic and applied

Ad hoc          Jeffersonian
Applied        Mode 1
Background     Mission-Oriented
Baconian      Newtonian
Basic          Normal Science
Clinical       Oriented-Basic
Committed      Pure
Curiosity-Driven Pure-Basic
Curiosity-Oriented Purposive-Basic
Developmental  Strategic
Directed       Tactical
Experimental   Uncommitted
Free Basic     Use-Inspired
Fundamental   


Motivations for research: **Creating Usable Science**

- Knowledge
- Science Policy
- Organization & Institution Processes
- Power & Politics

= Beyond Basic & Applied

- Learning & Engagement
Can we shape research? Should we? We already do

Limitations: basic and applied
Typology: activities and attributes

- Heuristic
- Activities and attributes
- Spectra of evaluative criteria
- Science values and user values
- Not weighted equally
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<td>Singular, Narrow to Trasndisciplinary, Diverse</td>
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<td>General to Contextual</td>
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<td>Reduce to Manage</td>
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<td>Exploration to Outcome-Oriented</td>
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<td>Researchers to Users</td>
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<td>Low to High</td>
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<td>Human Capital</td>
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<td>Evaluation, Effect.</td>
<td>Science-Centric to Public-Value Oriented</td>
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Examples: applying the typology

1. Agroforestry in Sumatra
2. Manhattan Project
3. This Typology Project
4. SW Monsoon Fire Support
Is a coffee tree a tree?
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<td><em>What are the epistemic goals of research?</em></td>
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**Who has the credibility to produce knowledge?**
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*How discipline-driven are knowledge production activities?*
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- **Learning**: How do the research outputs change the knowledge system?
- **Knowledge Exchange**: To what extent, and how, is knowledge exchanged?
- **Social Capital**: How important is the development and deployment of social capital?
- **Network Participation**: Who participates in the knowledge network?
- **Knowledge Brokers**: What skills are needed to facilitate the exchange of knowledge?
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**What skills are needed to facilitate the exchange of knowledge?**
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#### Spectra of Research Criteria

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**Hard Skills**

**Soft Skills**

**What kinds of skills and training are needed to do the work?**
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A Typology for Assessing the Role of Users in Scientific Research: Discussion Paper

Project on Innovation in Energy Systems and Conservation Science: Exploration and Critique

Phase 2 Report: User-engagement and scientific research

Elizabeth C. Mohle
Research Scientist, Western Water Assessment, Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder

Adam Parle
Chief, Climate Assessment and Services Division, NOAA Climate Program Office

Dan Barlow
Co-Director, Consortium for Science, Policy & Outcomes, Arizona State University

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I Overview

Decision makers call upon and fund science to help clarify and resolve many types of problems (OECD 2002, America COMPETES Act 2007, Bush 1945). They expect research to create useful information to help inform solutions to intractable problems, catalyze innovation, and provide information that not only educates stakeholders, but also expand alternatives, clarify choices, and aid in formulating and implementing policy decisions (Dilling and Levine 2011; Sarewitz and Pickle 2007).

But linking science with decision making to help solve problems is challenging. Often when responding to such problems we simply produce more science, and not necessarily "the right science" (NRC 2005, 2009). Indeed users of the scientific information may be unaware that it exists, or be unable to use what is available. The difficulty of actively linking the supply of scientific information with users' demands leads to missed opportunities for science to better inform policy (see Table 1; Sarewitz and Pickle 2007). Such "missed opportunities" occur for many reasons. Here we are concerned with the tendency to view and assess research in isolation from the context of its use, and simply in terms of whether it is "basic" or "applied." Such science-centric approaches have great value in producing new knowledge, but are inadequate to address the growing complexity of problems typically facing decision makers, and may in fact simply reinforce a structural gap between the "production and use of scientific information" (Kirkpatrick et al., 2013, p. 467).
A Typology for Assessing the Role of Users in Scientific Research: Discussion Paper

Project on Innovation in Energy Systems and Conservation Science: Exploration and Critique

Phase 2 Report: User-engagement and scientific research

Elizabeth C. Michie
Research Scientist, Western Water Assessment, Cooperative Institute for Water Science, Environmental Sciences, University of Colorado

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I. Introduction

Increasingly, industries call upon and fund science to help clarify and resolve many types of problems (CEC Act 2007, Bush 1945). They expect research to create useful information to help inform solutions to intractable problems, catalyze innovation, and provide information that not only educates stakeholders, but also expand alternatives, clarify choices, and aid in formulating and implementing policy decisions (Dilling and Larsen 2011; Sarewitz and Pielke 2007).

But linking science with decision making to help solve problems is challenging, often when responding to such problems we simply produce more science, and not necessarily "the right science" (NRC 2005, 2006). Interested users of the scientific information may be unaware of it, or be unable to use what is available. The difficulty of actively linking the supply of scientific information with users' demands leads to missed opportunities for science to better inform policy (see Table 1; Sarewitz and Pielke 2007). Such "missed opportunities" occur for many reasons. Here we are concerned with the tendency to view and assess research in isolation from the context of its use, and simply in terms of whether it is "basic" or "applied." Such science-centric approaches have great value in producing new knowledge, but are inadequate to address the growing complexity of problems typically facing decision makers, and may in fact simply reinforce a structural gap between the "production and use of scientific information" (Kirkhoff et al. 2013, p. 40).
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The table above illustrates the spectra of research criteria across different activities, with a gradient from 1 (least) to 5 (most) for each attribute.
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Thank You!

Elizabeth McNie
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Western Water Assessment
http://wwa.colorado.edu/

CSPO Washington DC
Typology homepage
http://cspo.org/program-areas/science-and-technology-policy/