Beyond Basic and Applied:

Using a Typology of Research Activities and Attributes to Inform the Production of Usable Science

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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

The facts are coming! The facts are coming!

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."
National Research Council, 2005.

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

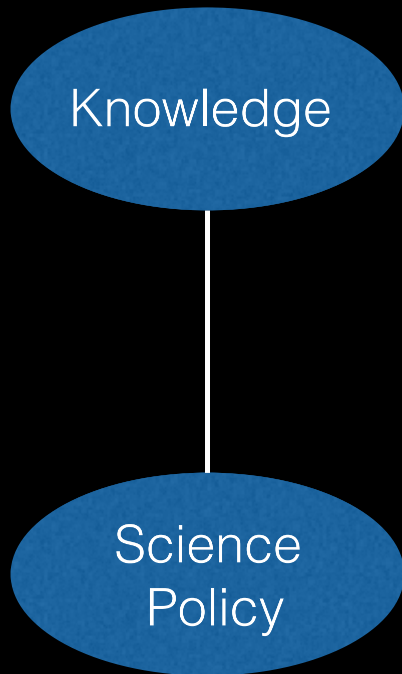
Limitations: basic and applied

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	

Criteria
- Motivation
- Temporal delay

"Unfettered" research

Motivations for research: Creating New Knowledge



= Basic and Applied

Science policy = decisions about research priorities

Limitations: basic and applied

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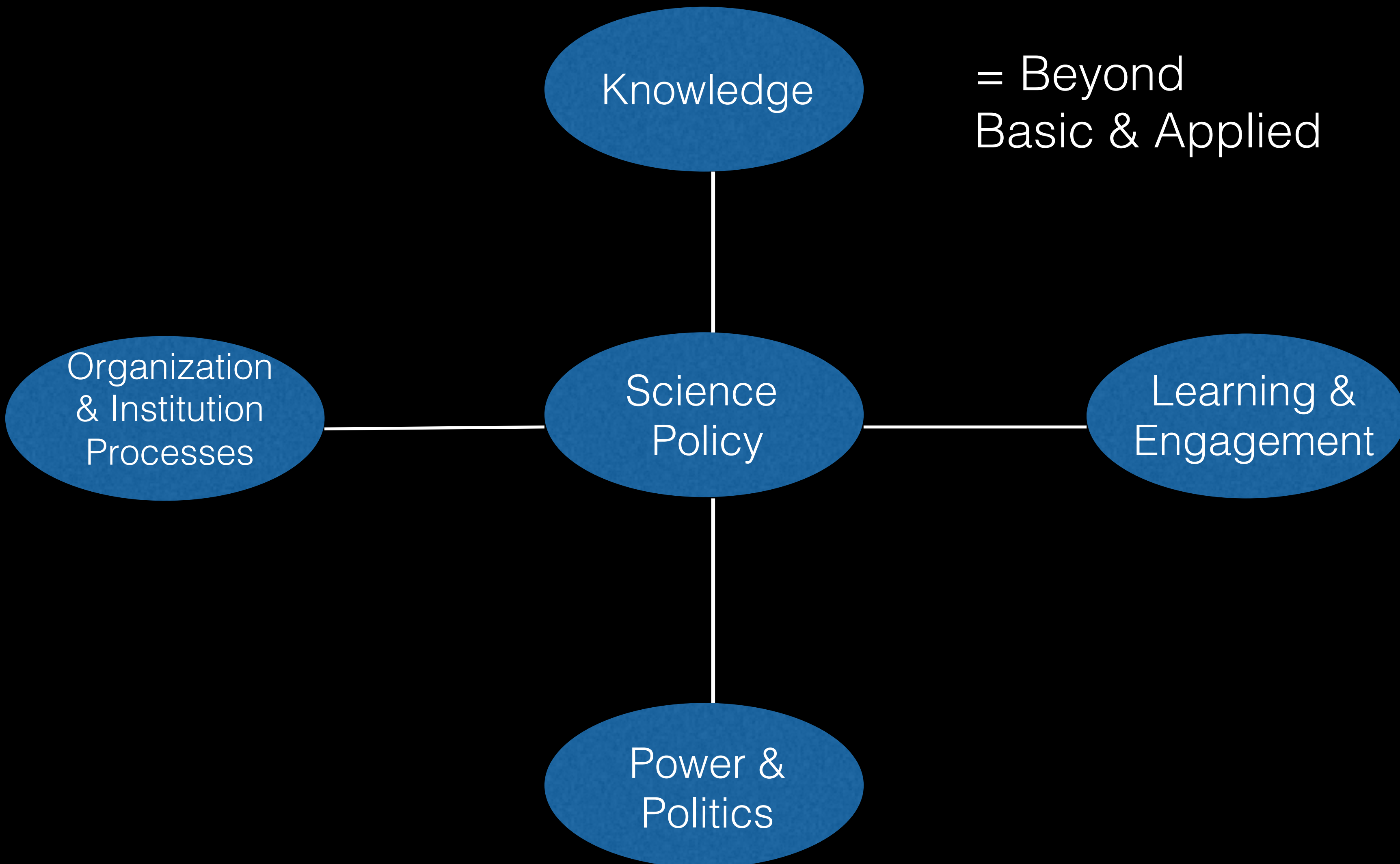
Motivations for research: Creating Usable Science

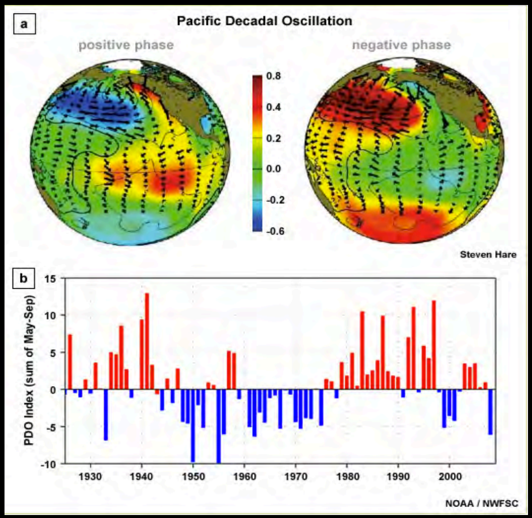
= Beyond
Basic & Applied



Limitations: basic and applied

Can we shape research?
Should we?

We already do



Typology: activities and attributes

- Heuristic
- Activities and attributes
- Spectra of evaluative criteria
- Science values and user values
- Not weighted equally

Activity	Attributes	Spectra of Research Criteria	
Knowledge	Expertise	Epistemic	Experiential
	Discipline	Singular, Narrow	Trasndisciplinary, Diverse
	Relevance	General	Contextual
	Knowledge Content	Explicit	Tacit
	Uncertainty	Reduce	Manage
	Goals of Research	Exploration	Outcome-Oriented
	Time Delay	Distant	Proximate
Learning & Engagement	Learning	Theoretical	Social, Practical
	Knowledge Exch.	Restricted, Linear	Iterative, Influential
	Social Capital	Negligible	Significant
	Network Part.	Homogeneous	Heterogeneous
	Knowl. Brokers	General	Specialized
Power & Politics	Representation	Researchers	Users
	Boundary Mgmt.	Low	High
Organization & Institutional Processes	Human Capital	Hard Skills	Soft Skills
	Accessibility	Constrained	High
	Flexibility	Constrained	Responsive
	Outputs, Outcomes	Narrow	Diverse
	Evaluation, Effect.	Science-Centric	Public-Value Oriented

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?

Activity	Attributes	Spectra of Research Criteria
Knowledge	Expertise	Epistemic — Experiential *Who has the credibility to produce knowledge?*
	Discipline	Singular, Narrow — Trasndisciplinary, Diverse *How discipline-driven are knowledge production activities?*
	Relevance	General — Contextual *How is the research relevant to solving the specific problem?*
	Knowledge Content	Explicit — Tacit *What are the qualities and transferability of the knowledge?*
	Uncertainty	Reduce — Manage *How do researchers address the problem of uncertainty?*
	Goals for Research	Exploration — Outcome-Oriented *What are the epistemic goals of research?*
	Time Delay	Distant — Proximate *What is the expected timeframe for using the knowledge?*

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Knowledge	Expertise	Epistemic — Experiential

Who has the credibility to produce knowledge?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Knowledge	Discipline	Singular, Narrow			Transdisciplinary, Diverse	

How discipline-driven are knowledge production activities?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Knowledge	Relevance	General ... Contextual

How is the research relevant to solving the specific problem?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Knowledge	Knowledge Content	Explicit				Tacit

What are the qualities and transferability of the knowledge?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Knowledge	Uncertainty	Reduce … Manage

How do researchers address the problem of uncertainty?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Knowledge	Goals for Research	Exploration … Outcome-Oriented

What are the epistemic goals of research?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Knowledge	Time Delay	Distant … Proximate

What is the expected timeframe for using the knowledge?

Activity	Attributes	Spectra of Research Criteria
Learning & Engagement	Learning	Theoretical … Social, Practical *How do the research outputs change the knowledge system?*
	Knowledge Exchange	Restricted, Linear … Iterative, Influential *To what extent, and how, is knowledge exchanged?*
	Social Capital	Negligible … Significant *How important is the development and deployment of social capital?*
	Network Participation	Homogeneous … Heterogeneous *Who participates in the knowledge network?*
	Knowledge Brokers	General … Specialized *What skills are needed to facilitate the exchange of knowledge?*

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Learning & Engagement	Learning	Theoretical			Social, Practical	

How do the research outputs change the knowledge system?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Learning & Engagement	Knowledge Exchange	Restricted, Linear … Iterative, Influential

To what extent, and how, is knowledge exchanged?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Learning & Engagement	Social Capital	Negligible			Significant	

How important is the development and deployment of social capital?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Learning & Engagement	Network Participation	Homogeneous Heterogeneous

Who participates in the knowledge network?

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Learning & Engagement	Knowledge Brokers	General → Specialized

What skills are needed to facilitate the exchange of knowledge?

Activity	Attributes	Spectra of Research Criteria
Power & Politics	Representation	Researchers … Users *Whose interests are represented in the shaping of research agendas?*
	Boundary Management	Low … High *To what extent must efforts be made to actively manage the boundary?*

Activity	Attributes	Spectra of Research Criteria 1 2 3 4 5
Power & Politics	**Represent-ation**	**Researchers** ... **Users**

Whose interests are represented in the shaping of research agendas?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Power & Politics	Boundary Manage- ment	Low				High

To what extent must efforts be made to actively manage the boundary?

Activity	Attributes	Spectra of Research Criteria
Organization & Institutional Processes	Human Capital	Hard Skills — Soft Skills *What kinds of skills and training are needed to do the work?*
	Accessibility	Constrained — High *How accessible to users are the researchers and their organizations or institutions?*
	Flexibility	Constrained — Responsive *How easy is it to alter research to better respond to users' needs, and changes in those needs?*
	Outputs, Outcomes	Narrow — Diverse *How various are the research outputs and outcomes?*
	Evaluation & Effectiveness	Science-Centric — Public-Value Oriented *What factors shape the evaluation of research?*

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Organization & Institutional Processes	Human Capital	Hard Skills			Soft Skills	

What kinds of skills and training are needed to do the work?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Organization & Institutional Processes	Access-ibility	Constrained				High

How accessible to users are the researchers and their organizations or institutions?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Organization & Institutional Processes	Flexibility	Constrained			Responsive	

How easy is it to alter research to better respond to users' needs, and changes in those needs?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Organization & Institutional Processes	Outputs, Outcomes	Narrow				Diverse

How various are the research outputs and outcomes?

Activity	Attributes	Spectra of Research Criteria				
		1	2	3	4	5
Organization & Institutional Processes	Evaluation, Effective-ness	Science-Centric			Public-Value Oriented	

What factors shape the evaluation of research?

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Power & Politics	Representation	Researchers				Users
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Manhattan Project

Activity	Attributes	Spectra of Research Criteria 1	2	3	4	5
Knowledge	Expertise	Epistemic				Experiential
	Discipline	Singular, Narrow				Transdisciplinary, Diverse
	Relevance	General				Contextual
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Typology Project

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. McNie
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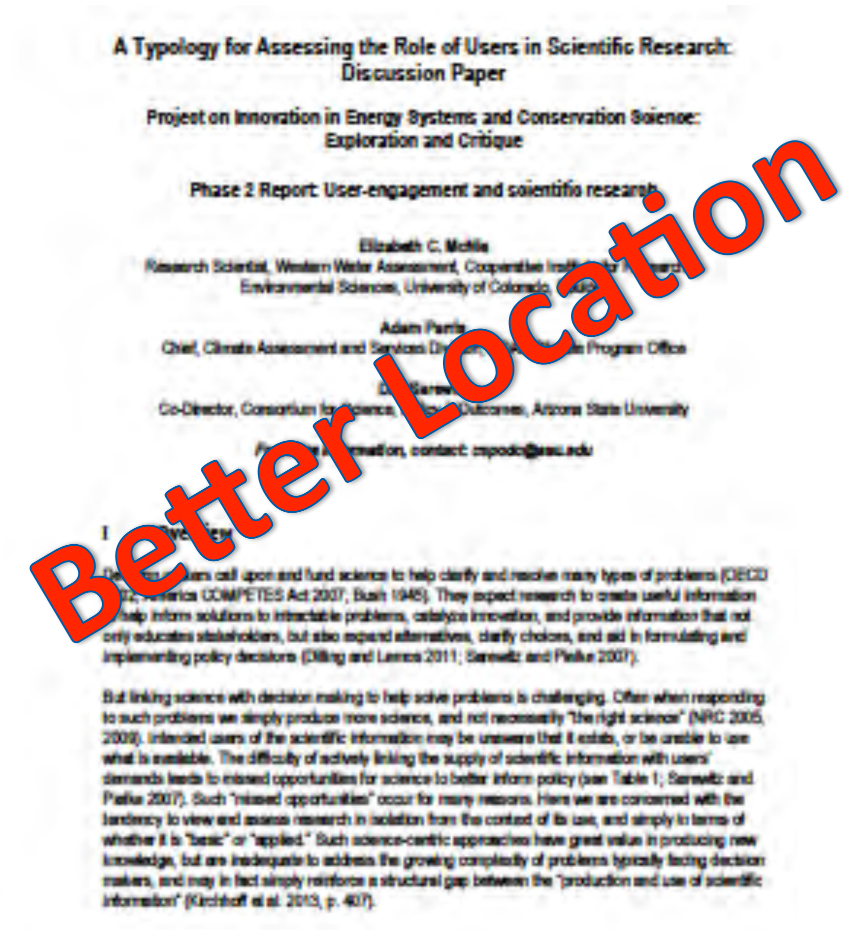
I Overview

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 Lemos 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, 2009). Intended 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 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" (Kirchhoff et al. 2013, p. 407).

Typology Project



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SW Monsoon Fire Support

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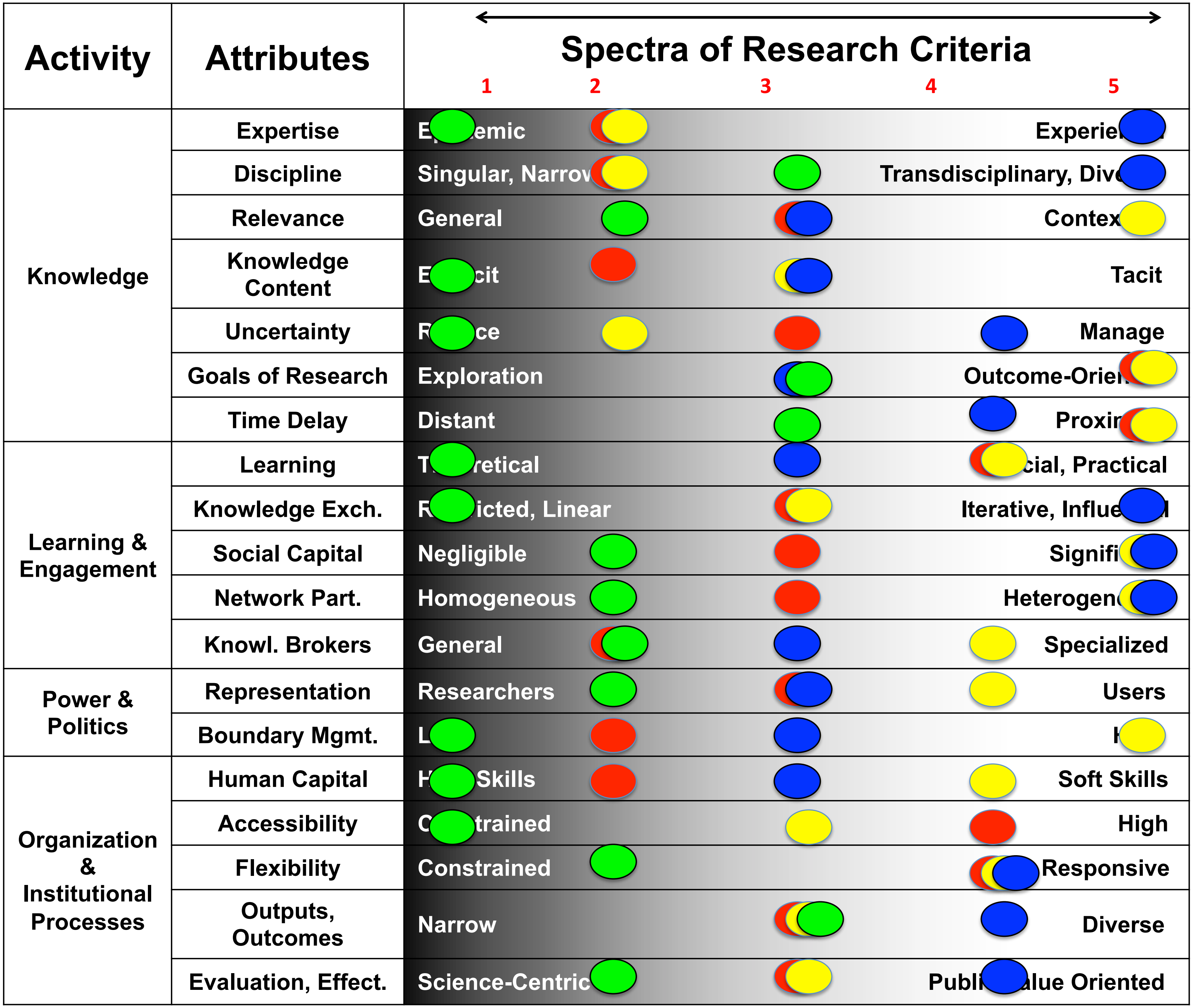

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Thank You!

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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/