Linking Knowledge with Action for Sustainable Development

Progress report from an international research program of the
Initiative on Science and Technology for Sustainability
Academy of Sciences of the Developing World (TWAS)
US National Academy of Sciences (NAS)
CGIAR (ICRAF / ILRI / CIFOR / ASB)

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The problem

- Growing (re)recognition that knowledge matters…
  - development "is built not merely through the accumulation of physical capital and human skill, but on a foundation of information, learning and adaptation" (World Bank);
- Science for development remains underinvested and unevenly distributed…
  - eg. How to manage mixed use landscapes sustainably
- It is seldom integrated into systems that support decision, action
  - eg. persistent mortality due to indoor air pollution from cook stoves
- But there are exceptions, from which we can learn...

Our studies have explored questions central to this Science Forum…

- What makes some knowledge systems more effective than others in harnessing science to promote development?
- What factors limit more effective engagement of science in development?
- What are promising modalities for mobilizing scientific research to support development?

Our approach

- Attempt to map the *systems* involved in mobilizing public R&D to support decisions, action…
  - **networks of actors and organizations that perform a number of knowledge-related functions that link knowledge and know-how with action.**
  - **including the incentives, financial resources, institutions, and human capital that give such systems *capacity* to do their work, and the *intention* to focus such work in some arenas rather than others.**
- Studied experience with such *knowledge systems* in health, energy, materials, conservation, agriculture…
- Agricultural work focused through a set of empirical case studies exploring range of issues, scales, places
  - USA, Europe, Mexico, Brazil, Argentina, Kenya, Tanzania, Nigeria, Uganda, Burkina Faso, Guinea, Mali, Cameroon, India, Thailand, Indonesia, Philippines, China …

Our findings so far…

Our studies revealed many different barriers that inhibited effective mobilization of science to support development action

Four, however, stand out:

1. Misconceptions regarding the relationship between basic research and problem solving
2. Fragmentation of the knowledge system
3. Inflexibility in a world of ignorance & surprise
4. Denial of linkage btw knowledge and power

1) Misconceptions: Basic research vs problem solving

- Science based programs continue to act as though basic research (aka “advanced science”) produces general knowledge that can then be “piped” or “extended” into solutions in specific field contexts…
- But evidence shows that such “panaceas” fail (much) more often than they succeed
- Need for a more historically accurate model of the relationship between basic research and problem solving…

Quadrant Model of Scientific Research

Research inspired by…

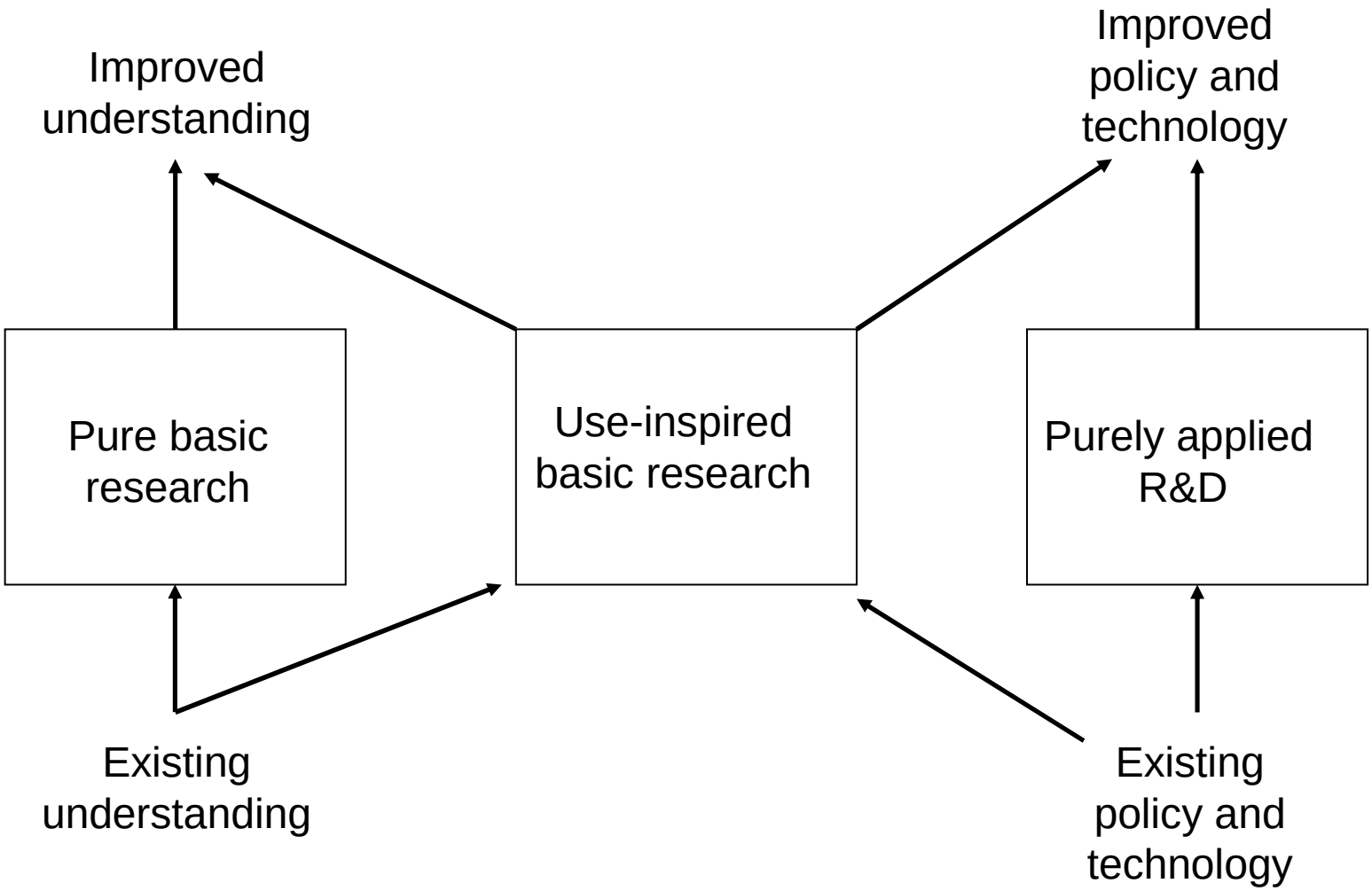
Quest for fundamental understanding?

Considerations of use?

	No	Yes
No	"Soaking and poking"	Pure applied research (Edison)
Yes	Pure basic research (Bohr)	*Use-inspired basic research (Pasteur)*

(redrawn from Stokes, 1997)

Knowledge System for Linking Research with Action

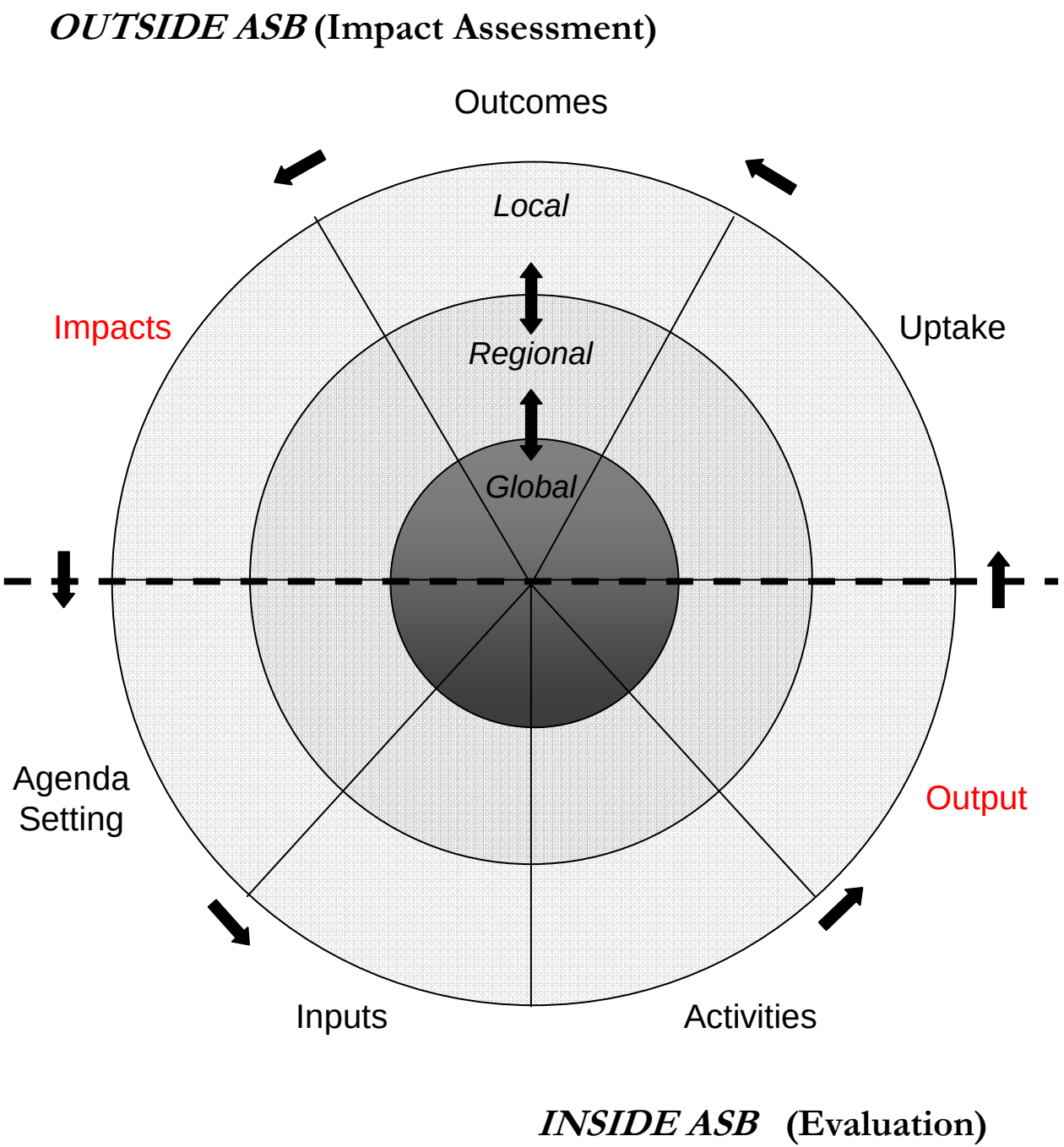


(redrawn from Stokes, 1997)

Use-inspired basic research

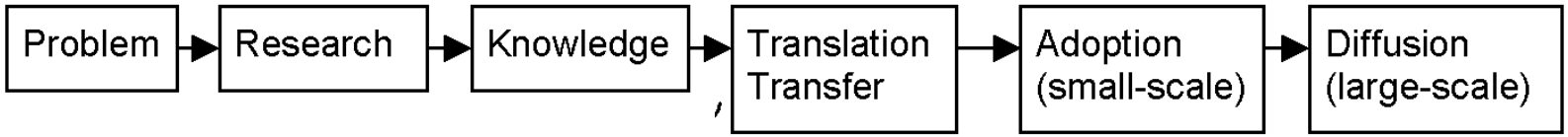
- Fostering research in “Pasteur’s Quadrant” is central to the quest for effectively harnessing science to serve sustainable development
- This requires managing a tension between
  - Capture by those who fall in love with the most exciting basic research… and
  - Capture by those who fall in love with creating particular solutions for particular places
- Resolution requires *dual evaluation* of research
  - Publication / citation counts to reward fundamental advances in understanding… PLUS
  - Outcome mapping (RBM) to reward specific solutions

Dual evaluation framework developed for CGIAR/ASB Assessment



2) Fragmentation (system is less than sum of its parts)

- Diagnosis (Why is there a problem?)
  - Different “partners” charged with different parts of the knowledge-action chain…

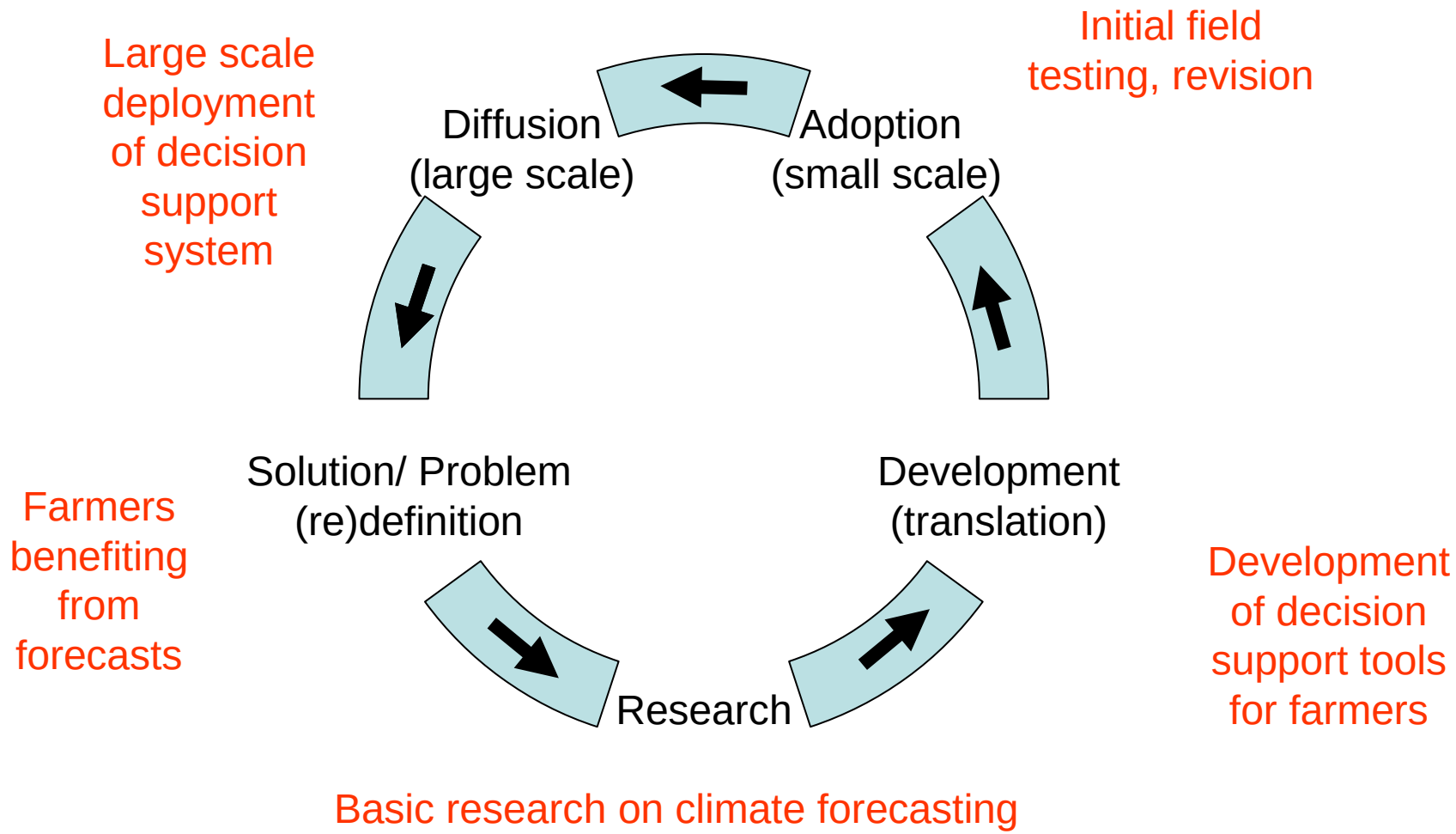


  - But sustainability often a public good, with weak incentives to complete the chain from basic research through Pasteur to final solutions
    - Ask a university to invent the automobile?

2) Fragmentation (system less than sum of its parts)

- Diagnosis (Why is there a problem?)
  - Sustainability often a public good (weak market tests)
- Process prescription (What needs to change?)
  - Systems integration to identify missing nodes, links; construct incentives to complete them
- Institutional implementation (How to do it?)
  - Adopting *supply chain* perspective to identify partners responsible for providing each of the needed parts
  - Adopt *Project-oriented management* to hold all accountable for integrating parts → solutions
    - eg. Ag extension systems in US midwest; Global Fund AIDS
    - IRI's efforts to make ENSO forecasts useful to farmers…

Project oriented management: Linking ENSO forecasts to farmers



3) Inflexibility (static systems, dynamic challenges)

- Diagnosis (Why is there a problem?)
  - Absence of forums to learn from others' experience
  - Incentives to hide failures rather than learn from them
  - Willful ignorance and motives to block learning
- Process prescription (What needs to change?)
  - From knowledge systems to *learning systems*
- Institutional implementation (How to do it?)
  - *Adaptive management* institutions, with capacity for
    - creating "safe spaces" needed for true experimentation…
    - Learning from failure…

“Safe spaces”?

- Successful programs recognize that efforts to link knowledge with action often involve radical institutional innovations that may antagonize the status quo, and thus need protection…
- Successful programs also recognize the importance of learning from errors, & the tendency of organizations to punish those who report on their failures
- Need for knowledge systems to create, and donors to support, “safe spaces” that protect innovators from hostile takeovers, encourage experimentation, and embrace error

“Embrace error / Failure?”

- Effective innovation requires the right to fail… often.
- Need for evaluation metrics that reward
  - not just “success” (which can always be constructed to match what’s measured)
  - but rather rapid identification and winnowing out of failures, thus “learning,” improvement
- What is the optimal failure rate for CGIAR projects? Which Center achieves it?

4) Denial of the linkage between knowledge and power

- Most science can be pursued with little thought for its relationship to power
- But when knowledge influences decisions or behavior, knowledge *is* power…
- The only question is *whose* interests science will serve…
  - Farmers? States? Business? Researchers?

Beyond denial…

- The determination of whose knowledge “counts” in development is also a determination of who has influence in shaping development
- The determination of research agendas is also a determination of who will (and won’t) get more power from results of research
- Because knowledge is power, decision makers (farmers, ministers) will be skeptical about letting themselves be influenced by scientific claims made by people who they don’t trust…
- How to do science so that it contributes to development that is both effective & equitable?

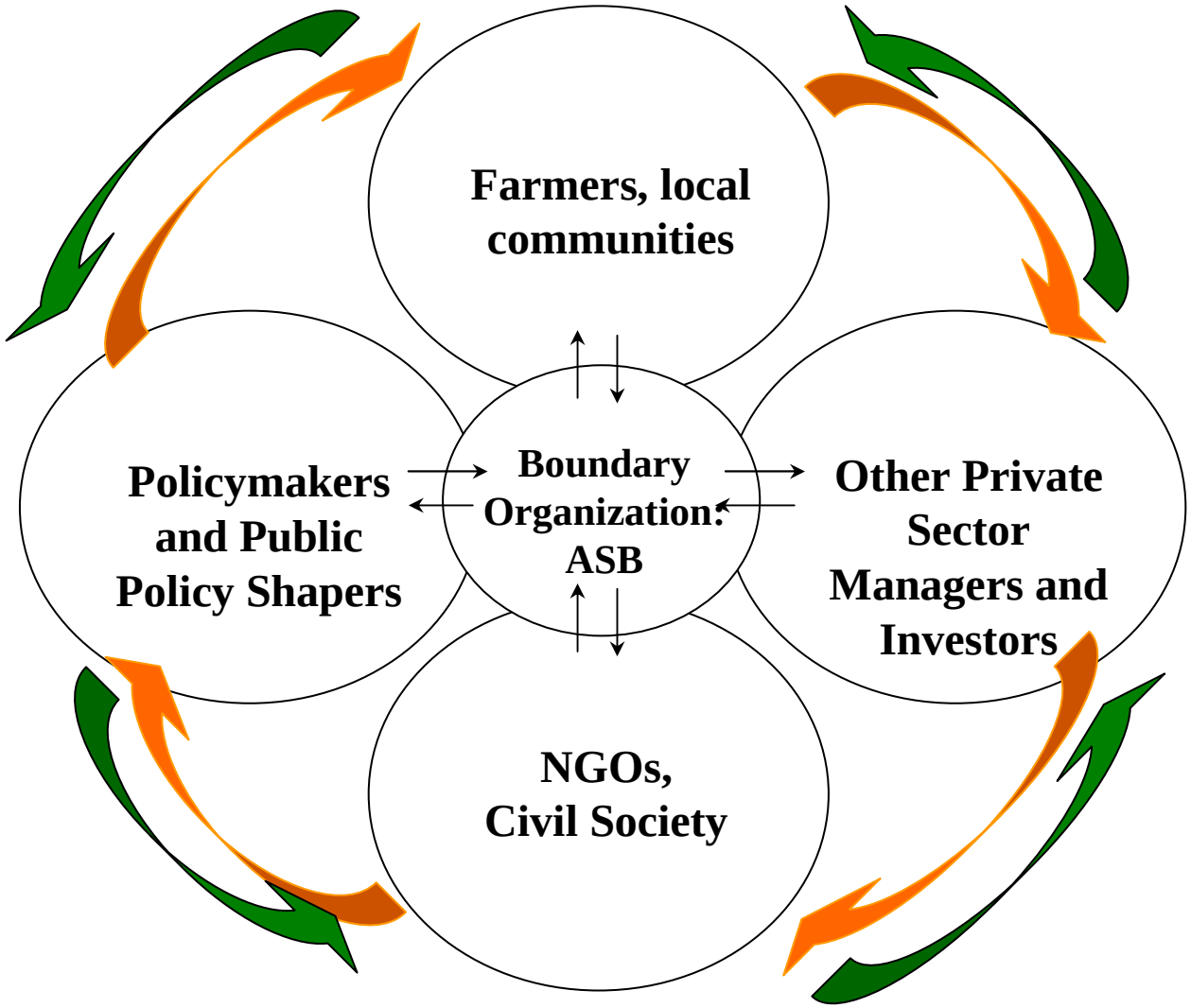
Effective and equitable science? The central role of “boundary work”

- Systems for linking knowledge with action for sustainability involve multiple “cultures” – scientific and experiential knowledge, researchers and decision makers, local and global organizations.
- Communication and cooperation across such cultures can be difficult and prone to misunderstanding… especially when each has different endowments of knowledge, power
- Successful systems almost always include individuals or organizations devoted to the task of “boundary spanning” across such cultures. These crucial elements of the knowledge system facilitate communication, translation, and negotiation across a variety of “cultural” boundaries.
  - eg. *ICRAF’s RUPES projects; ILRI’s Reto-o-Reto “facilitators”; ASB*

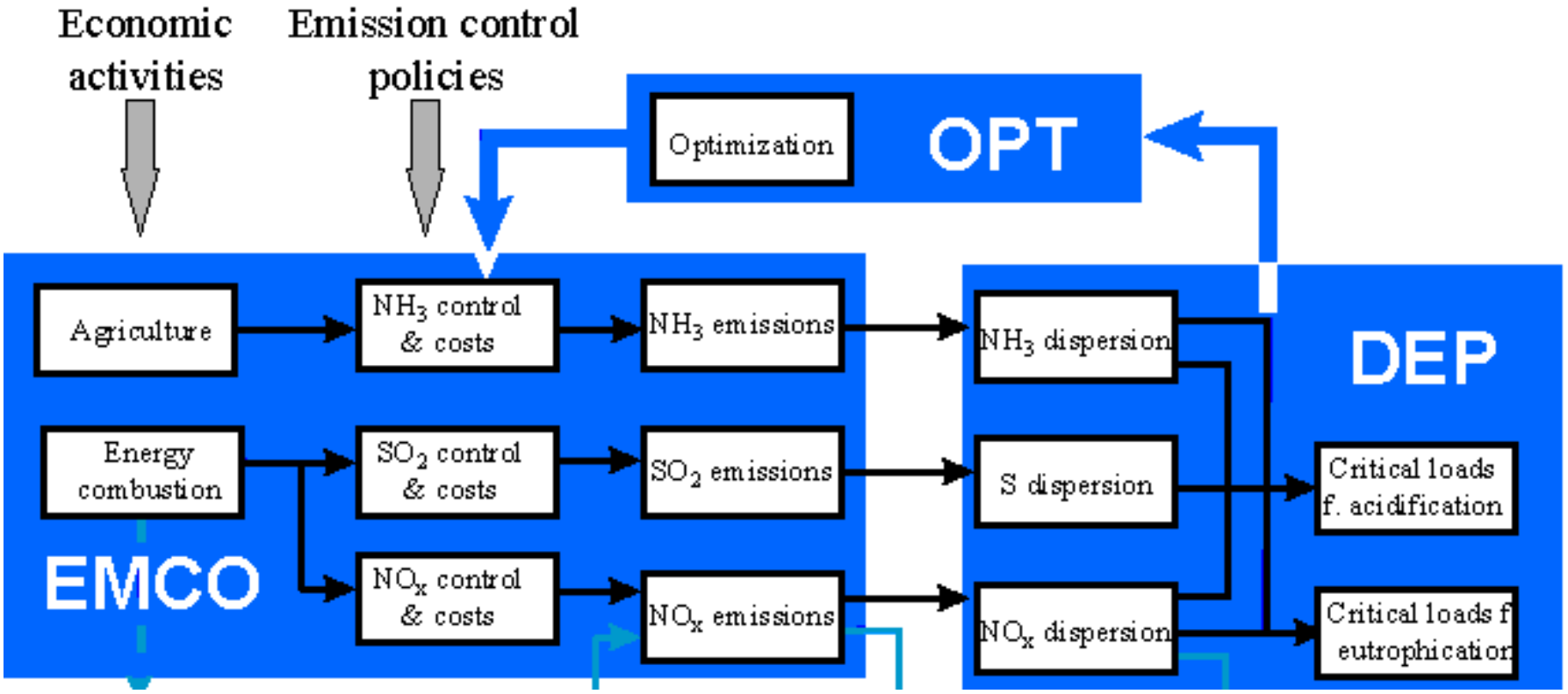
Effective and equitable science? The central role of boundary work

- Successful systems almost always include individuals or organizations devoted to the task of “boundary spanning” across such cultures. These crucial elements of the system facilitate communication, translation, and negotiation across a variety of “cultural” boundaries.
- They create collaborative knowledge products, jointly “owned” and trusted by multiple stakeholders….

CGIAR's ASB as a "boundary organization"

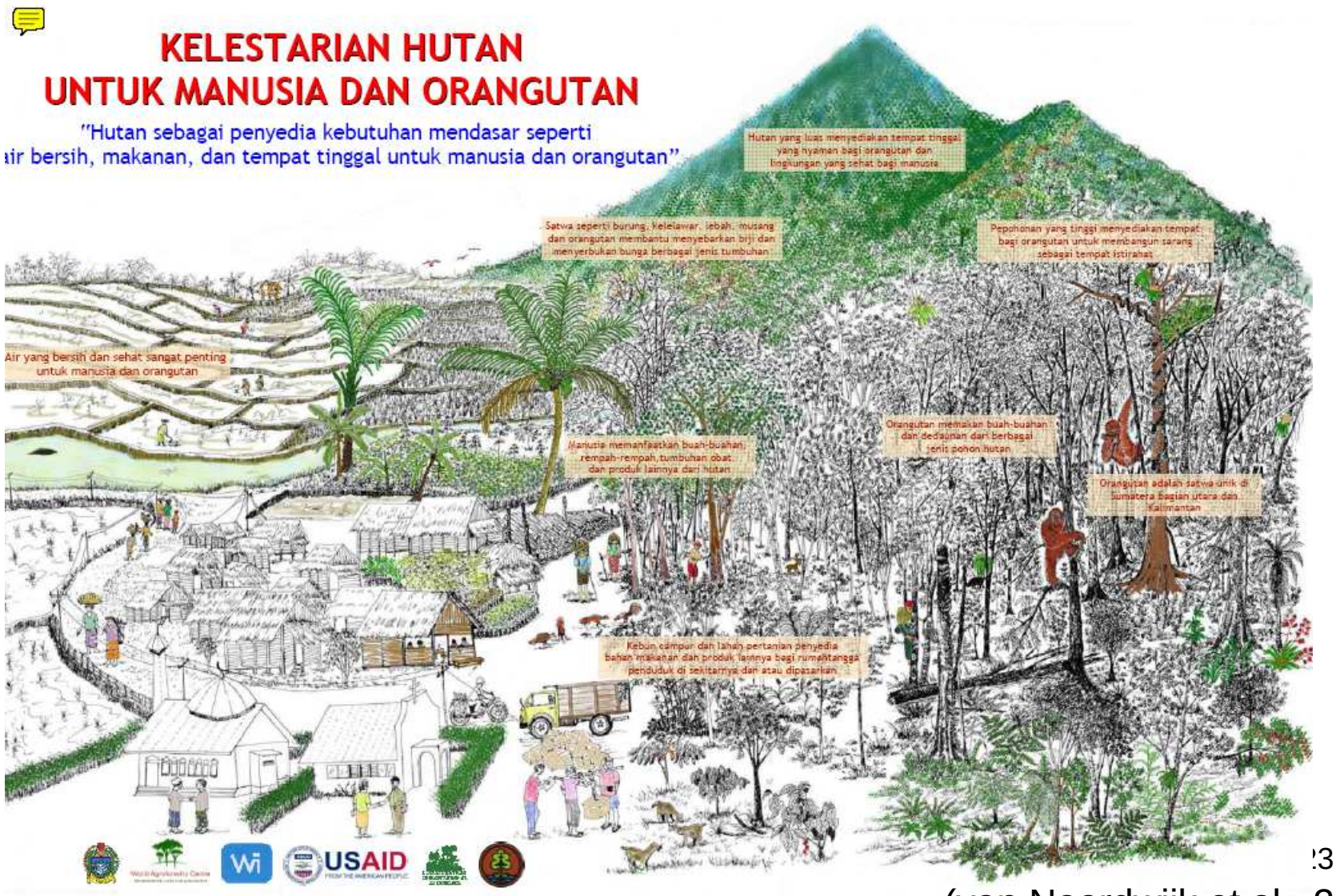


Another boundary object: The RAINS Model of Acidification



Tunistra, Hordijk et al., 2008)

A Boundary-spanning Object…



(van Noordwijk et al., 2008)

Effective and equitable science? The central role of “boundary work”

- Successful systems almost always include individuals or organizations devoted to the task of “boundary spanning” across such cultures. These crucial elements of the system facilitate communication, translation, and negotiation across a variety of “cultural” boundaries.
- They create collaborative knowledge products, jointly “owned” and trusted by multiple stakeholders….
- The central challenge for research organizations is to support and nurture such boundary work – and the people who do it -- as central components of their strategies to produce effective and equitable science for development.

What next? A collaborative agenda for forging better linkages

- Research needs
  - detailed study of particular linkage efforts to identify key institutions, processes that increase changes of success
  - comparative efforts across programs (eg. for conservation and poverty alleviation)
- Capacity building
  - fellows programs for training scholars and practitioners in knowledge systems (eg. Wageningen “New University;” TWAS Fellows; Harvard’s “Sustainability Science Fellows”)
- Pushing and pulling the international system…
  - donor community pulling toward greater engagement in development action while science community pulls for less….?
  - Education about the central role of boundary work that supports close engagement between researchers and users

Further Information

- Keep up to date through the virtual *Forum on Science and Innovation for Sustainability*
  - www.sustainabilityscience.org
- Publish research results in the new Sustainability Science section of the *Proceedings of the National Academy of Sciences* of the US (articles immediately available free on line in >100 developing countries)
  - www.pnas.org/site/misc/sustainability.shtml
- Apply to spend a year with the *Sustainability Science Fellows Program* at Harvard
  - www.cid.harvard.edu/sustsci/index.html
- Let me and my colleagues know of your reactions, ideas
  - William_Clark@harvard.edu

Selected Publications

- Cash, David, William C. Clark, Frank Alcock, Nancy Dickson, Noelle Eckley, David Guston, Jill Jäger, and Ronald Mitchell. 2003. Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences* 100(14): 8086-8091.
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