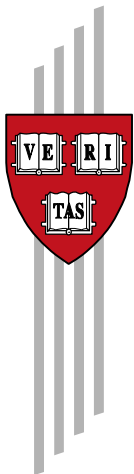# Linking International Agricultural Research Knowledge with Action for Sustainable Poverty Alleviation: What Works?

Patti Kristjanson, Robin Reid, Nancy Dickson, William Clark, Prasad Vishnubhotla, Dannie Romney, Peter Bezkorowajnyj, Mohammed Said, Dickson Kaelo, Ogeli Makui, David Nkedianye, Julius Nyangaga, Paul Okwi, Ranjitha Puskur, Shirley Tarawali, Susan MacMillan, Delia Grace, Tom Randolph, Hippolyte Affognon

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Abstract

This paper asks 'What kinds of approaches and institutions, under what sorts of conditions, are most effective for harnessing scientific knowledge in support of strategies for environmentally sustainable development and poverty alleviation?' In applying an innovative conceptual framework to a diverse set of sustainable poverty-focused projects undertaken in numerous African and Asian countries, we found that strategies key to closing gaps between knowledge and action include: combining different kinds of knowledge, learning and bridging approaches, strong and diverse partnerships that level the playing field, and building capacity to innovate and communicate.

Keywords: sustainability, knowledge, action, poverty, innovation, development

JEL subject codes: 013, 016, 017, 031

Citation, Context, and Program Acknowledgements

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This paper is a work in progress, intended for learning purposes, to share ideas and to stimulate feedback and improvements. It may be revised and submitted for publication elsewhere, so please contact the author with comments or if you would like to cite this.

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1. Introduction

1.1 The problem

The central role of science and technology (S&T) in advancing development has been established for at least half a century, since the seminal writings of Solow (1957), and is currently receiving increased attention around the world (World Bank, 1999; UNDP, 2001; UN Millennium Project, 2005).   The growing recognition in recent years that *sustainable* development strategies need to encompass a globally integrated understanding of environmental as well as economic and social dynamics has placed even greater demands on the production and utilization of relevant knowledge (Sachs, 2000; InterAcademy Panel, 2000; InterAcademy Council, 2004; Schellnhuber, Crutzen et al., 2004).

Equally clear, however, is that the *potential* contribution of S&T to sustainable development has rarely been realized in practice (ICSU et al., 2002). Decision makers from the level of extension agents to that of international negotiators complain that they cannot get the knowledge they want. Researchers and innovators bemoan the failure of society to utilize what is known. Social investment in the R&D that would almost certainly enhance development remains far below what most experts would consider optimal (Ruttan, 2001).   The gap between what knowledge *could* contribute and what it *does* contribute is especially acute in two areas of central importance to the challenge of environmentally sustainable development: when the benefits of knowledge mobilization have a significant public good component, especially a global one (e.g., carbon sequestration or biodiversity conservation); and when the source of the needed knowledge includes both global and local expertise (e.g., green revolution agriculture; mitigating the impact of malaria) (ICSU, 2002; UN Millennium Project, 2005; van Kerkhoff and Lebel, 2006).

Why does the supply of scientific and technical knowledge that could support sustainable development so often remain unmatched with demand? Generic issues relating to macroeconomic incentives, public good provision, and capacity shortfalls are surely part of the answer (InterAcademy Council, 2004). Moreover, there is no question that some successes have emerged (e.g., the development of oral rehydration therapy, no-till agriculture, and some climate forecast applications). But the fact remains that even programs expressly designed to bridge the gap often fail to deliver the goods. And despite much talk and many opinions, there simply is no consensus on what works, what doesn't, and why. As a result, the rapidly growing number of efforts to harness science and technology in support of sustainable poverty reduction–efforts ranging from the Millennium Ecosystem Assessment to the Clean Carbon Initiative to the Global Fund for Health–lack guidance on which institutional arrangements and procedures are most likely to support their goals effectively. Using multi-disciplinary, multi-institute agricultural project experience gained at the International Livestock Research Institute (ILRI), this paper contributes to the understanding on which such guidance should be based.

1.2 Institutions for harnessing S&T for sustainable development

The research reported explores whether a diverse set of projects represented by the 12-year, numerous country history of the international agricultural research system's International Livestock Research Institute can be used to answer the question: *What kinds of approaches and*

institutions, under what sorts of conditions, are most effective for harnessing scientific knowledge in support of strategies for environmentally sustainable development and poverty alleviation? [1] The comparative research described below describes a range of possible approaches and lessons in this regard.

This effort begins with findings and propositions based on work that Bill Clark, Nancy Dickson, and a number of colleagues are conducting through a series of seminars and workshops held at Harvard University and the US National Academy of Sciences' Roundtable on Science and Technology for Sustainability.[2] The aim in their efforts has been to identify candidates for the greatest challenges to harnessing science and technology in support of goals for environment and development. Historical experience in grappling with those challenges was surveyed to identify tentative guidelines for environmental policy. A wide range of practitioner perspectives and academic disciplines was engaged in surveying experience across multiple sectors and national experiences (including health, energy, environment, and agriculture among others). Three dominant challenges and six specific propositions as to what strategies, institutions and approaches appear to increase the probability that S&T will contribute to sustainable development are identified and summarized below.

Linking knowledge with action: The transcendent challenge addressed is that of bringing about a closer match between R&D agendas and decision maker needs. The risks of giving undue weight to either partner in this dialogue are reasonably well recognized by most stakeholders in sustainable development: decision makers generally do not understand either the limits or the extent of what S&T has to offer and, therefore, cannot be counted on to "order" the right R&D; researchers do not understand the integrated, action-focused needs of decision makers and, therefore, cannot be counted on to give useful advice even when decision makers are ready to listen (McNie, 2007). Repeatedly the Harvard team found that the kinds of institutions and processes governing the linkage of knowledge and action that are most likely to mitigate these difficulties and yield useful knowledge engage co-production and boundary organizations. "Co-production" of useful knowledge entails the sustained and substantive interaction between researchers and decision makers, with due attention to securing the meaningful participation in the dialogue of all affected stakeholders. It results in changes to both what decision makers want and what researchers study (Peters, 2000; Kasemir et al., 2002; Jasanoff, 2004). Co-production of usable knowledge is likely to be more successful when facilitated by "boundary" or "bridging" organizations. Such boundary organizations are most effective when they are subservient to neither the science nor policy communities, but rather jointly accountable to both and to the goal of successfully linking knowledge and action for sustainability (Jasanoff, 1990; Gieryn, 1995; Guston, 2001; Hellstrom and Jacob, 2003, Cash et al., 2003).

Integrating multiple epistemologies: A second challenge confronted by most successful efforts to harness S&T for sustainability is the integration of multiple epistemologies. In practice, this means finding ways to combine a) knowledge from different scientific disciplines (e.g., ecology and economics); b) knowledge centered on one scale of analysis with knowledge centered on

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[1] Where institutions are broadly defined as the 'structures and mechanisms of social order and cooperation governing the behavior of two or more individuals' (www.wikipedia.org).
[2] The work at the NAS is described at
http://www7.nationalacademies.org/sustainabilityroundtable/Linking_Knowledge_Main.html; the Harvard seminar and workshops are described at http://www.ksg.harvard.edu/kssd/events.htm.

other scales (e.g., global climate models and local vulnerability studies); and c) generalizable knowledge derived from the application of formal scientific method with locally contextualized tacit knowledge derived from practice (e.g., new fertilizer responsive rice varietals produced at international labs with place-specific planting knowledge of individual farmers). Knowledge systems that arise from combining understanding from multiple sources, including tacit and research-based tend to be more effective. These lead to more discoveries which can be adapted to diverse local contexts and capacities without ignoring impacts across dimensions or people (Berkes, 1999; Murray, 2005).

Facilitating adaptive learning: A third challenge addressed by most successful efforts to harness S&T for sustainability is the facilitation of adaptive learning. Given our uncertainty and downright ignorance regarding the complex interactions between human and environmental systems, paths of environmentally sustainable development cannot be computed in advance. Rather, they must be navigated, using S&T to shape interventions that are experimental, to observe the consequences of the intervention, and to adapt accordingly (e.g., the second generation green revolution system of agricultural research; the ENSO forecast applications efforts of NOAA). Such adaptive learning strategies face serious challenges from typical organizational structures that reward conformity and punish error detection. The Harvard-led research found that institutions and procedures that facilitate adaptive learning strategies create safe spaces and incorporate external review. Efforts that provide institutional 'safe spaces' encourage experimentation, protect experimenters from the consequences of failure, and reward people for learning fast rather than for being right (Johnson, 1999; NAS, 2004). Efforts that effectively institutionalize periodic external review of their activities will be more effective to the extent that they are independent, involve a full range of stakeholders as participants, are authoritative, and are focused on evaluating achievement of particular goals (Social Learning Group, 2001; Mitchell, Clark et al, 2006).

The aims and objectives of the Harvard team match closely with recent initiatives at ILRI aimed at understanding more about how research contributes to real change and positive social and economic outcomes. Five case studies based on diverse ILRI teams/projects were selected for this purpose.[3] Each represents a major challenge of harnessing science and technology to advance sustainable development. These case studies are described briefly below (and in more detail in the workshop report, available at: www.ilri.org/InnovationWorks) and include:
- Better policy and management options for pastoral lands (Kenya, Tanzania);
- Fodder and natural resource innovations for smallholders (India and Nigeria);
- Poverty and ecosystem services mapping (Kenya, Uganda, Tanzania);
- Improving productivity and market success of smallholders (Ethiopia);
- Improving the management of trypanocide resistance in West Africa (Burkina Faso, Mali, and Guinea)

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[3] The criteria used to select these projects, in an attempt to capture a wide range of experiences, included geographic focus, type of partners, and research outputs. The length of time since commencement of the project was also a consideration.

2. Conceptual framework and propositions

Six main propositions were generated from the Harvard team's cross-sectoral research on knowledge systems, giving us a structured way to compare experiences across diverse projects (with the same goal, i.e., sustainable poverty reduction). The extent to which these propositions are supported by the experiences of these four diverse and complex ILRI projects is explored in this paper. We look at how helpful these propositions are in terms of generating insights that can be shared within and outside ILRI to help improve project design and impact (successful strategies, biggest constraints to success, etc). The goal is to generate lessons that are broadly applicable, particularly for research aimed at sustainable poverty reduction, regarding approaches that help increase the probability of success in linking knowledge with action.

The propositions that were examined in relation to each project's experience are:

2.1   Problem definition proposition:
Successful research linking knowledge with action requires dialogue and cooperation between the scientists who produce knowledge and the decision makers who use it. Especially important is that the problem to be solved be defined in a collaborative but ultimately user-driven manner.

2.2   Research management proposition:
Successful efforts to develop research linking knowledge with action generally adopt a "project" orientation and organization, with dynamic leaders accountable for achieving use-driven goals and targets. They avoid the pitfall of letting "study of the problem" displace "creation of solutions" as the research goal.

2.3   Program organization proposition:
Successful research linking knowledge with action includes "boundary organizations" or 'boundary-spanning actions' committed to building bridges between the research community on the one hand, and the user community on the other. These boundary organizations often construct informal "safe spaces" in which project managers can foster user-producer dialogues, joint product definition, and end-to-end system building free from distorting dominance by groups committed to the status quo. In order to maintain balance, most effective boundary organizations make themselves jointly accountable to both the science and user communities.

2.4   The decision-support system proposition:
Successful programs linking knowledge with action create end-to-end, integrated systems that connect basic scientific predictions or observations to decision-relevant impacts and options. They avoid the pitfall of assuming that a single piece of the chain (e.g., a climate prediction) can be useful on its own, or will be taken care of by "someone else".

2.5   Learning orientation proposition:
Successful research efforts linking knowledge with action are designed as systems for learning rather than systems for knowing. Recognizing the difficulty of their task, such programs are frankly experimental, expecting and embracing failure in order to learn from it as quickly as possible. Success requires appropriate reward and incentive systems for risk-taking managers, funding mechanisms that enable such risk-taking, and periodic external evaluation.

**2.6	Continuity and flexibility proposition:**
Successful research linking knowledge with action must develop strategies to maintain project continuity and flexibility in the face of budgetary and human resource challenges, such as: the dual public/private character of knowledge-action systems; budgetary pressure to highlight short-term, measurable results; uncertainty regarding future budgetary priorities in a dynamic political environment; shortages of people who can work effectively across disciplines, issue areas, and the knowledge-action interface; and evaluation criteria that do not measure the less tangible tasks of maintaining these links (e.g., attending meetings, responding to requests for information).

3. The case studies

**3.1	Better policy and management options for pastoral lands: Assessing the trade-offs between poverty alleviation and wildlife conservation (Pastoral project)**
This project was designed to create the knowledge and relationships to enable poor Maasai agro-pastoral communities to influence local and national land use, livelihood and wildlife policies affecting their livelihoods (access to pasture, water) and the sustainability of biodiversity (wildlife) in the areas where they live. Researchers worked closely with communities in four principal large landscapes in Kenya and Tanzania to generate new knowledge that contributes to: a) understanding the impact of livestock-wildlife systems on biodiversity and the implications of changing land-use practices for pastoralist livelihoods and the environment; and b) processes and actions that empower local communities to better manage their livestock and landscapes and to contribute to policy changes that help alleviate poverty and conserve natural resources.

The research was carried out by an integrated community – facilitator – researcher team, representing a wide array of collaborating institutions. The information from the project has been exchanged with communities and policy makers through various means: feedback workshops, target group presentations, conferences and workshops, community meetings, posters, policy briefs, and through radio, and exchange visits of local community, field visits of pastoralists from other parts of the world.

Tangible benefits of this project at the local level have included provision by the collaborative team of information and advice on appropriate improved livestock breeds, livestock marketing and rangeland conditions; community members are now accessing and using improved sheep and cattle breeds, increasing productivity and reducing the disease burden. Participatory mapping of land use and wildlife have catalysed inclusion of community members (for the first time) in new local and national policy debates and actions that affect pastoral livelihoods, the use of their lands and how they benefit from wildlife conservation (Nkedianye 2003, Reid et al. 2007). Work on household economics clearly shows the need for greater benefits and the role of a successful ecosystem service payment programme in reducing poverty (Kristjanson et al. 2002). Local women's groups have also been assisted through linking them to viable markets for their traditional Maasai artefacts and intricate beadwork. And exchange visits with pastoral communities from other wildlife-rich sites in East Africa have exposed these communities to alternative attitudes and livelihood options that successfully combine extensive livestock rearing and wildlife conservation.

3.2 Poverty and ecosystem services mapping in East Africa (Poverty and Ecosystems Services Mapping Project)

Three consecutive poverty and ecosystem services mapping projects have aimed to generate and link improved knowledge about poverty and ecosystem services with action through better targeted, more transparent and sustainable pro-poor policies implemented across East Africa. In the first 3-year project, ILRI partnered with the bureaus of statistics in Kenya, Uganda and Tanzania, Rockefeller Foundation and the World Bank to build capacity and generate new high resolution poverty maps for each of their countries. Follow-up projects in Uganda and Kenya focus on adding an ecosystem services lens and improving linkages between key decision makers in agriculture, livestock, environmental and health sectors in the region. They aim to enhance knowledge regarding rural poverty (where and who the rural poor are, how poor are they, reasons for observed differences in poverty incidence) and awareness of the services that ecosystems provide (food, water, wood, etc.) and the use of this information to mainstream critical sectoral and sustainability issues into national poverty strategies.

Accomplishments to date include improved human capacity across these sectors within governments in all three countries to undertake poverty and ecosystem services analyses, which has been institutionalized in Kenya (with a new poverty analysis unit in the Ministry of Planning, now linking with natural resource ministries). The Kenya government also established a constituency poverty fund which allocates more resources to the poorest areas using the new poverty maps. A collaborative effort involving 30 institutions and 72 researchers led to the publication of a national atlas of ecosystems services and well-being that integrates spatial data on poverty and the environment in Kenya, providing a new approach to examining the links between ecosystem services (the benefits derived from nature) and the poor. In Uganda, joint poverty-related research outputs have been produced with the newly trained poverty analysts and researchers from multiple government and non-governmental institutions and policymakers, linking the new poverty data and maps to environmental and other sectoral data aimed at generating knowledge that will contribute to sustainable development outcomes.

3.3 Enhancing livelihoods of livestock-dependent poor people through increasing use of fodder in India and Nigeria (Fodder Innovation Project)

The first phase of this project, carried out in India, aimed to increase feed availability to enhance livestock productivity. The original premise of the project was that the most effective way to address fodder scarcity was to identify and disseminate new, improved varieties of fodder or dual-purpose crops. A whole-farm approach was used to select technical options to overcome local feed constraints. This built upon existing work and baseline data, developing site-specific 'baskets of options' and offering advice to farmers regarding fodder options that best suited their particular environments. It was envisaged that the Project would have full participation of farmers, local communities and change agents and would involve community meetings, stakeholder workshops and extensive group discussions to identify priorities related to feed constraints and degradation of natural assets. Scaling-up and out would take place through farmer-to-farmer exchanges and the dissemination activities of development organisations partnering with the Project.

However, as the constraints limiting such scaling-up became clearer, it was realised that there was a greater need to consider the roles that a broader range of actors play. The focus of the Project thus shifted to strengthening partnerships, community involvement and a learning environment, specifically through empowering a multi-stakeholder network to increase the levels of adoption of fodder plants, including dual-purpose food-feed crops, by small-scale farmers.

The second phase of this project, now being implemented in India and Nigeria has thus shifted to supporting and building capacity to innovate. The focus of this approach is an investigation into the nature of groupings or networks of individuals and organizations, and the factors that affect their ability to work in a systemic, coherent way to bring fodder-related knowledge and services into productive use in the specific context of poor livestock keepers.

The facilitative learning approach now being taken has resulted in farmers pursuing new ways of doing things in India. For example, the provision of Napier grass to farmers with access to irrigation initially excluded landless farmers without irrigation access. However, farmers themselves started to develop new institutional arrangements whereby wealthier landowners lease poorer farmers small plots for fodder cultivation. Landowners provided planting material, protection of plots and access to water while the livestock owners provided fertiliser and were responsible for harvesting and general plot maintenance. Market failures and lack of private sector incentives were overcome with institutional innovation in another example, this time in Nigeria, where the project team initiated meetings that brought private seed suppliers and extension workers together to discuss ways in which seed supply constraints could be overcome. The project ended up underwriting half of any losses the seed companies incurred as a result of poor sales of improved seed, thus lowering their risk and providing the incentive required for the seed company to provide the solution to a major constraint limiting farmers' productivity.

3.4 Improving Productivity and Market Success of Ethiopian farmers (Markets project)

This project was designed to make knowledge, generated by various scientific and development outfits in Ethiopia, more accessible to, and used by, farmers and other market agents and decision makers. Implemented by ILRI on behalf of the Ethiopian Ministry of Agriculture, the project aims to enhance the market orientation of agriculture in selected areas in Ethiopia, in support of the government's agricultural strategy. Various pilot approaches are being applied and methods aimed at learning from these experiences in order to scale them out are being tested. The project focuses on specific marketable commodities (crops and livestock) that the government has prioritized and is targeting in its operational areas.

Knowledge management, capacity building, deployment of relevant technologies and new institutional arrangements for service delivery to support market-orientation are some critical elements of the project. It engages in diagnostic and action research to support the learning process. While the aim is to bring about changes in the livelihoods of smallholder farmers in the areas in which the project operates, the other major objective is to convince the service delivery organizations (including research and extension agencies) and private sector actors, through influencing policy makers, to adopt new ways of working which are responsive to the needs and demands of the poor smallholder farming community. Various pilot approaches are being applied to embed farmers in a network of supportive partnerships so they can draw knowledge

from others, and combine with their own and generate innovations in farm practice to enhance market orientation. Methods aimed at learning from these experiences in order to scale them out are being tested.

Accomplishments to date include creation of new institutional arrangements and capacity built in partnership processes to support development of farmer-centered innovation processes. The project has created a series of connected stakeholder platforms at key institutional levels, consisting of key decision makers that represent various actors/actor groups. These bodies provide 'safe spaces' for project members to experiment with new approaches. They are also designed to break down both horizontal and vertical information sharing and thus to speed up the process of identification, development and uptake of innovation. The project has been experimenting with, and learning about, successful strategies for achieving jointly defined outcomes. However, a major challenge lies in supporting national actors to adopt responsive ways of working and engage in dialogues with the users to jointly develop agendas and ensure a continuous flow of knowledge generated for application to solve priority problems and demands. Creation of such a learning and enabling environment in Ethiopia will require substantial organizational transformation with new incentive and reward systems that encourage innovation and an outcome orientation.

3.5 Improving the management of trypanocide resistance in West Africa (Managing Drug Resistance Project)

Ngana or trypanosomosis, transmitted by tse-tse flies, is the main killer of cattle in Africa and an important threat to human health. Historically it excluded cattle from an area of Africa larger than the United States, the so-called 'tsetse belts', extending from the Sahara to the Kalahari. However, the needs of rapidly growing populations have led to agricultural expansion, while cheap, effective drugs allow keeping of draft cattle in the tsetse areas. But the biologically predictable result of the frequent treatments needed to keep cattle alive under continuous challenge has been the emergence of resistance to the drugs used.

In the late 90s a diagnostic and basic science research project (carried out by ILRI, national research institutes and a European university) in Burkina Faso produced the first geographical mapping of drug resistance and developed laboratory and field tools for its detection. This success led to a more ambitious project with the objective of assessing the resistance situation in neighboring Mali and Guinea and testing 'best-bet' strategies for resistance management. Capacity-building and policy analysis were other components.

The project team mapped disease levels and drug resistance across a broad swathe of the cotton belt, identified the drivers of resistance, and economically assessed the associated losses and impact. They rigorously tested a range of options for managing resistance and found that improving the way that drugs were used was the best way to manage the problem. Several Rational Drug Use tools were developed and tested for a range of stakeholders. Policy analysis showed a huge gap between regulation and reality which was encouraging misuse of drugs, while stakeholder approaches started untangling the web of different interests and incentives that maintained this disconnect between policy and practice.

Over a 5-year period, the project generated over 100 publications, reports, extension tools, training materials and tested strategies, and its success attracted funding for a third phase aimed at further scaling out these successful strategies. Its complexity, diverse partnerships and achievements make it an interesting case for testing the six propositions.

4. Lessons regarding successful research linking knowledge with action

The six propositions described above provide a useful comparative framework for addressing the ingredients for success (or failure) in linking the knowledge generated through research with actions that help people. We explore how well these propositions hold, how important they turned out to be for our case studies and what major constraints were faced. Since these propositions arose largely from observations based on non-agricultural/natural resource management research, we propose some revisions and additions to these propositions given the lessons from these case studies that should make them even more relevant to researchers, policymakers and practitioners in this area.

4.1   Problem definition proposition

Our case study experience suggests that the degree to which potential users of the information (communities, policymakers, and donors) are involved in problem definition from the outset of a project varies, and this engagement tends to expand over time as trust is developed.

Most of the case study research teams did not use a rigorous stakeholder engagement process to bring together diverse partners and agree on outputs, desired outcomes and impacts, and exactly who was going to do what in order to achieve them. The exception to this was the pastoral project that used a process called 'outcome mapping', developed at IDRC, that articulates, for each key project partner, what each wants to achieve (i.e., starting with the needs of the users) rather than from what scientists want to produce.[4] One of the strengths of this approach is that specific metrics are chosen with each partner, allowing an assessment of the project's degree of success regarding outcomes and impacts. The poverty mapping project found outcome mapping a useful approach to track actual outcomes achieved, rather than as a planning tool. Both the fodder innovation and market projects will be utilizing outcome mapping and other stakeholder engagement tools in the second phase of their projects and both aim to use an innovation systems framework which recognizes the importance of networks of actors. The lesson here is that rigorous processes aimed at bringing diverse partners into alignment over agreed-upon goals, outputs and outcomes are vital to success in linking knowledge with action, and are often an 'afterthought' in otherwise well-conceived and inclusive projects. On the other hand, use of these tools can be time consuming, so rigorous assessment of their impacts on project goals needs to be assessed.

Other lessons that arise in efforts towards involving potential users, such as community members or policy makers, right from the outset of projects include:
1. Bringing diverse partners together and agreeing on goals, outputs, outcomes and how impacts will be measured is not easy and most people need a lot of help with it; rigorous

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[4] For more information on outcome mapping, see http://www.outcomemapping.ca.

stakeholder engagement processes and highly skilled facilitators can help limit the amount of time and money spent on this and increase the probability of success;

2. Users and producers of information often have very different ideas of what is required, and the sooner this is resolved, the more likely that the research products will be useful and used;

3. The projects that did not identify, prioritize and engage with critical partners in the first phase to define the problems to be addressed (i.e., took a more 'researcher-driven' approach) ended up shifting their focus in their second phases towards a systems approach that did so. For example, the fodder innovation project made such a shift in approach after failing to see any uptake of their new fodder technologies in Phase 1 of their project;

4. The research agenda should be flexible enough to adjust to users' evolving needs; events (e.g., droughts, government changes, etc) can quite quickly change the demands for knowledge and being able to respond to these demands can be critical for success. Furthermore, as the experience in the pastoral project shows, meeting the immediate needs of the users often requires creating new linkages to other knowledge providers since these needs can be outside the expertise of the original project team.

5. From a research perspective, meeting quickly evolving user needs is not a trivial task; one useful strategy is to identify some quick products (summary of existing information, preliminary data and maps) for the team to produce while pursuing longer term products. Another strategy is to integrate community members in all stages of the research process so they understand and 'own' the time it takes to produce different types of information (Nkedianye et al., in prep).

6. Getting policymakers to prioritize their information needs is challenging; they often come up with 'shopping lists' of issues where they want more information, or are simply ignorant of the kinds of knowledge that can be generated to help inform their decisions. An approach taken by the poverty and ecosystems services mapping project was to develop and present 'example' research products to key individual decision-makers in order to stimulate their imagination as to the realm of possible research outputs that could assist them. Now in its third phase, involving bringing together environmental and human well-being information, we have not yet fully succeeded in making this work truly 'user-led' for all of the wide range of users.

An important lesson from these case studies is that scientists need to be a little more modest about their role in generating knowledge. To talk only about 'scientists producing knowledge' ignores the important role of indigenous knowledge in solving problems. The pastoral, markets and fodder innovation project experiences highlight the benefits of indigenous (as well as 'scientist-produced') knowledge sharing arising from the co-development of products based on both practical and scientific knowledge and simple facilitation of community-to-community visits. Indigenous knowledge was key, for example, in the development of a farmer-designed system (i.e., new institutional arrangements regarding leasing of irrigated plots from wealthier farmers) in India, enabling poorer farmers to adopt a higher yielding fodder variety for the first time.

Not all of our projects involved users in problem definition, and in some cases this may be appropriate and needed, especially for long-run sustainability issues and other 'invisible'

problems. For example, in the Managing Drug resistance project, problem definition was entirely external. Drug resistance is insidious and invisible, undetectable by the farmers affected, or the effects attributed to other causes. Further, there was little debate over the urgency of the problem or the imperative for prolonging the usefulness of existing drugs. Complexity, controversy and need for collaborative agreement entered, not with the identification of problems as posited by this proposition, but with the creation of solutions.

In the case of the pastoral project, part of the project focused on bringing together information collected on household economics across sites in a common analytical framework, a task never attempted before, and this work was only weakly driven by users. The final product, however, will have a great deal of influence on policy makers because it covers such a broad set of sites, but only if clear efforts are made to provide this information to policy makers in a useful form and a repeated manner.

Thus if we were to restate the proposition given the lessons from the case studies, we would do so in the following way, to: "Successful research linking knowledge with action requires the use *of processes and tools that enhance* efficient dialogue and cooperation between those *who have or produce knowledge* and the decision makers who use it*, and help ensure the research is user and problem-driven."*

4.2   Research management proposition

International agricultural research centers such as ILRI are in a unique position to engage in collaborative, use-driven (as opposed to curiosity driven) fundamental research in which engagement of the users (livestock keepers, investors, policy makers, etc.) is key to the research agenda. ILRI researchers are often regarded by potential knowledge users as impartial and unbiased due to the fact that they are not local research institutions subject to local government political pressures. Reframing an issue to solve a particular problem for a particular user or group of users is important. This makes scientists accountable to the users and allows scientists to build capacity to answer other questions in the future.

Our case studies show that there are different approaches and strategies that can be pursued with respect to research management with the goal of linking the knowledge generated by the research/project with action. The pastoral, poverty mapping, fodder innovation and markets projects all used a logical framework approach to specify outputs, outcomes and impacts sought. The markets project soon moved on to a results-based management framework with a robust M&E system with specific outcome indicators.[5] Similarly, the pastoral project added an outcome mapping approach, developing specific outcome indicators and targets for each boundary partner. A lesson here was that the logical framework was more useful for monitoring the progress of producing outputs, and the outcome mapping was more useful in making sure the research is strongly user-driven, focusing the team on creating outcomes or changes in behavior on the part of the boundary partners. The strategy pursued by the poverty mapping project was

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[5] The logframe is a planning tool/matrix that lays out project or program activities and outputs plus the corresponding indicators and milestones (under direct managerial control); shows the intended impact of the research project as specified through the purpose, intermediate goal, and goal plus the respective indicators; and lists conditions (assumptions) which are neither part of the project strategy nor under the direct influence of project management, but of importance to the implementation (See http://www.fao.org/Wairdocs/TAC/X5747E/x5747e04.htm).

to tie output targets to payments, which created strong incentives for the research partners to produce their outputs in a timely manner; however, this approach clearly is easier to apply in the case of specific outputs (e.g., analyses, papers, workshops completed) than for many of the outcomes we are seeking (e.g., specific policy changes based on research evidence).

One of the problems encountered in the fodder innovation project was a lack of clarity in the higher levels of the logframe (purpose and goal), which define the outcomes and impact that the project is trying to achieve. A greater understanding that behavioural change was a key element of moving from outputs to outcomes and impact was needed, and a logframe approach typically does not capture such aspects. Their project team learned they needed to find approaches/tools for: 1) identifying critical partners; 2) defining the behavioral and institutional changes needed to achieve the outcomes they were seeking; and 3) developing strategies to increase the likelihood that those outcomes are achieved.

Our case study lessons did not lead to a reformulation of this particular proposition, i.e., that 'Successful efforts to develop research linking knowledge with action generally adopt a "project" orientation and organization, with dynamic leaders accountable for achieving use-driven goals and targets. They avoid the pitfall of letting "study of the problem" displace "creation of solutions" as the research goal'.

4.3   Program organization proposition

Conducting solution-oriented research with people in the user community doesn't happen by accident. It takes time and effort to get access to the user community and to gain their trust. This work requires a brokering function that spans the boundaries between partners. Boundary spanners are neither captured by the decision makers nor are they science-advocates for the community they work in. Boundary spanners are part of institutions that build accountability systems that credit this work. Boundary spanning work and institutions and processes that support it can structure reward and incentive systems differently and build skills in how to do it better (an aim of ILRI).

Boundary work operates between two or more groups that work to different standards and objectives (e.g., basic scientists evaluated by peers versus action people who are validated by a political process). Boundary objects are joint creations at the interface of communities (e.g., models, maps, assessments, contracts, posters).

The case studies show that there are a range of approaches that can be taken, by a variety of organizations and by individuals, to effectively span boundaries between researchers and knowledge users. It is such an important role/function that researchers should be more explicitly talking about it and looking at different approaches and processes that help them do this more efficiently and effectively. ILRI itself acted as a facilitative, boundary-spanning organization that helped provide the 'glue' and bring diverse organizations and individuals together in all of the case studies.

A huge lesson for ILRI is that simply putting such a precise language to this function ('boundary spanning') is tremendously useful for gleaning insights as to what seems to work or not work

when researchers more explicitly identify this as a critical role they must play if they are to more successfully generate knowledge that is useful and used to solve complex problems.

The fodder innovation project organized and facilitated multi-stakeholder meetings, providing a learning platform that brought together public and private sector stakeholders. The poverty mapping project linked poverty analysts from three countries together, giving them the tools to undertake a similar analysis via an approach aimed explicitly at having a policy impact (by involving policymakers as integral team members from the outset of the project).

The pastoral project took an innovative approach that used individuals and communication strategies as its means of spanning boundaries, hiring community facilitators as research team members who worked full-time at spanning the boundaries between communities, scientists and policymakers. This project team also committed to co-learning and co-creating a hybrid of traditional/local and scientific knowledge.

The drug resistance project used participatory methods to span the boundaries between community members and researchers and they were very successful at generating understanding, enthusiasm and ownership. As a result the strategies to deal with drug resistance which emerged were based on field realities–contributing to their success, as proven by rigorous testing. But when it came to giving information on drug use to farmers (knowledge private veterinarians strongly opposed getting into lay hands), science proved more successful at breaking down barriers; it took using best-practice research design (double-blind, randomized, controlled clinical trials with the results published in a peer-reviewed journal) to overcome vested interests that opposed the finding that giving drug use strategies directly to farmers was indeed both safe and beneficial (Grace et al., 2007).

Other lessons regarding boundary-spanning functions and objects include:
- Creating boundary objects that are useful to scientists, policymakers and communities is harder than producing outputs targeted to one audience, but it is a very effective way to span boundaries and gain trust.
- It takes time to create a flow of information between researchers, community members and policymakers, but once it starts it creates an increased demand and opens up new channels of information flow, and, in some cases, this flow can last well after the end of the formal 'project'.
- As trust develops between diverse partners, more open dialogue and action tend to follow quite quickly, but developing the trust takes time.
- It takes rather unique individuals that are good listeners, facilitators and communicators to successfully span boundaries and where the boundary organization has a research mandate, individuals need to be careful: 1) not get so close to the action that the degree of bias of the research becomes questioned; or 2) let the science continue to be researcher-led, losing credibility in the eyes of the users.
- For the most part, these projects made limited use of tools and processes that help span boundaries more efficiently and effectively via collaborative user-driven dialogues. Some examples include outcome mapping (www.outcomemapping.ca); joint fact-finding (www.beyondintractability.org/essay/joint_fact-finding); challenge dialogue process (www.innovationexpedition.com); adaptive management

(www.adaptivemanagement.net); policy-focused assessment process (Scheraga and Furlow, 2001); policy evaluation framework (Cohen et al., 1994) value of information approach (Yokota and Thompson, 2004); institutional histories (ww.ciat.cgiar.org/riiweb/Innovation_histories.htm); appreciative inquiry (www.cgiar-ilac.org); and negotiation support (van Noordwijk et al., 2001). However, the pastoral project's approach (the community facilitator-researcher) is a good example of innovation in project management that resulted in successful linking of knowledge with action and it may be a very good model for future projects (Nkedianye et al., forthcoming).

- The markets project is facing major challenges in ensuring that the lessons they are learning about user-driven research are absorbed and institutionalized within the national research system in Ethiopia.
- The boundary spanning organization or individual does not act as an intermediary but facilitates processes that allow the different players (actors, stakeholders) to interact with each other and become more effective.

Our case study lessons suggest that even more important than 'boundary-spanning organizations' are boundary-spanning individuals and efforts. Having said that, individuals work within institutional frameworks, and these need to be supportive of such work (or at the very least, not block it). We need to further explore and understand what kinds of institutional change can encourage and accelerate boundary work. We also hypothesize that a lot of boundary-spanning activities, behavior and approaches can be learned, so there is also a need to develop courses and training materials aimed at capacity building in this area.

Based on our case study lessons, we would suggest the following wording for this proposition: 'Successful research linking knowledge with action includes "boundary *work or actions*" committed to building bridges between the research community on the one hand and the user community on the other and creating networks that allow interactions between the different users and producers. This boundary *work* often involves constructing informal *new arenas*, in which project managers can foster user-producer dialogues, joint product definition, and *a systems approach* free from distorting dominance by groups committed to the status quo. *Defining joint 'rules of engagement' in the new arena that encourage mutual respect, co-creation and innovation that addresses complex problems, while recognizing that in order to implement changes, each partner is answerable, and has to return to, their institutional homes and the cultural norms, rules, constraints, etc. that go along with them, is key.*

4.4 Decision-support system proposition

Many efforts to link knowledge with action collapse because they locate their activities only in one part of the knowledge to action or research to development continuum. They neglect links in the hope that someone else will provide those links. Earlier vaccine development research at ILRI focused on the very tough 'hard science' issues and neglected learning anything about the potential demand for, and constraints to, production, use, adoption and impact of the vaccine if and when produced (Clark et al. 2005).

Research with an explicit poverty reduction focus, as is the case for ILRI and the wider international agricultural research system, must be able to demonstrate an impact on the poor, yet scientists at ILRI also face a mandate to produce 'international public goods' (i.e., local impact isn't good enough). There is a fundamental contradiction between these two assertions. Success in addressing this contradiction lies in successful engagement with local partners in strategically selected multiple sites (so the knowledge generated can be extrapolated more broadly) whereby there are both local actions leading to poverty reduction and research generating knowledge that is useful in a broader context.

Does innovative user-driven sustainable poverty reduction research always require an end-to-end integrated systems approach (e.g., involvement of public and private sector actors, NGO's, community members, scientists, policymakers)? The evolution of all of our case studies (and in fact, much of ILRI's research over the last 10 years) towards such an 'innovation systems' approach suggests the answer is yes, if the speed and magnitude of impact are important. For example, one rule of thumb in the 1980's was that research takes a full generation to affect policy decisions. The case studies here and elsewhere suggest that development of an end-to-end system is critical to shortening this time lag.

This does not imply, however, that there is not a role for more traditional, 'researcher-driven' research, but it does mean, in the context of sustainable poverty alleviation, that it needs to be placed in a larger framework and recognized for its unique role. Many scientists fear that this implies they will not be working to their comparative advantage (i.e., the science) and end up spending all their time on process (i.e., partnership building). There is indeed a risk that this can arise. Our case studies all point towards the need for bringing in 'tried and tested' rigorous processes, tools and expertise in the areas of stakeholder engagement, facilitation, teambuilding, and the establishment of metrics for measuring and communicating outcomes and impacts.

The drug resistance project started by attempting to join all the dots, with objectives covering detection of drug resistance, practical management, building capacity, and changing policy. In practice, the project team soon learned there were some things they could deliver, some they could influence, and some which were essentially outside their control. Imperfect initial knowledge, constant evolution in the systems studied, uncovering new facts and findings along the way all meant the connection from research results to impact (less drug resistance) was shifting and non-linear, looking more like a tangle of yarn than a chain. The eventual preferred path from knowledge to action (Rational Drug Use) was one not considered at the beginning of the project. So while the concept of drawing out the links from knowledge to action is certainly helpful, a premature commitment to a particular chain, as envisioned ex-ante, should be avoided to allow learning and joint exploration of various paths.

The Ethiopian market project has taken a value chain approach (a type of 'end-to-end' system) and created multi-actor platforms that included policymakers. They face huge challenges in linking smallholders to the market (the essence of the project), convincing their government partners that thinking about new institutional arrangements may be beneficial, and in involving the nascent private sector in a country that is still so dominated by the public sector. They have found, as with the other case studies that a systems approach requires emphasis on cross-site comparisons and synthesis of lessons and good practices.

The pastoral project created an explicit mechanism to ensure that the science was driven by the potential users with their community facilitator-researcher model. Priority research questions were developed with the community; potential outputs/products were then assessed; these outputs were co-created with the involvement of the users, and communication of the results was targeted to broader audiences using multiple media.

A lesson from taking this approach was that policymakers, although not necessarily involved from the outset, became drawn in as community members (their electorate) were empowered with knowledge that essentially leveled the playing field and allowed them to engage directly with policymakers on priority issues, often for the first time.

The project teams involved in the case studies found that the linearity suggested by the terms 'end to end' systems, or 'value chains' is not, in fact, mirrored in practice. Defining the 'system' is in fact a huge challenge for any project team. One of the first steps taken in the second phase of the fodder innovation project was to undertake a landscaping exercise aimed at better understanding the system and key players that should be involved in the project. They now are developing diagnostic tools to facilitate and explore institutional change processes. So once again, the key to success in seeing policy, technological, and/or institutional changes that contribute to sustainable poverty reduction may lie in investing in appropriate partnership processes and tools at the outset of any project.

Given the confusion surrounding terms like 'end-to-end' and 'innovation systems', we would suggest to sticking to a 'systems approach'. Thus a possible reformulation of the fourth proposition is: 'Successful programs linking knowledge with action *take a systems approach that recognizes scientific research is just one 'piece of the puzzle', and aims to identify and engage with key partners that can help turn co-created knowledge generated by the project/program into action (new strategies, policies, interventions, technologies) leading to better and more sustainable livelihoods'*.

4.5   Learning orientation proposition

Providing safe places to experiment is difficult for management. Those who do something different are often seen to be trying to change the power balance, which can be unpopular. Research has shown that organizational creativity in groups that experiment and push the limits is highest where such activities are hidden from management, or where a 'safe space' or nurturing ground for taking risk is created/supported.

How can managers encourage risk taking? It is difficult to institutionalize a learning approach because donors inevitably value success rather than failure, which is also typically reflected in organizational reward systems. Encouraging innovation and learning implies a substantial number of projects should fail or irritate management. High tech R&D firms use a 70% failure rate to demonstrate that they are taking enough risks. Management needs support from independent review groups to advise what the appropriate rate of failure should be. Daring to make mistakes and learning from them rather than burying them is something that requires learning.

All our case studies have experimented with different approaches and strategies and attempted to learn from them. To what degree they have established environments and 'safe spaces' where scientists and partners were encouraged to be innovative and take risks is a good question.

For example, in the markets project, advisory and learning committees were created to serve as learning platforms, define actions to address government priorities at various levels and help negotiate safe spaces for these activities. However, the functions of these committees were not sufficiently defined and they ended up playing 'policing' and resource allocation roles which essentially defeated their original purpose. They are also finding that learning seems to still be a fairly abstract concept for most project staff as well as partners, and they are facing a lack of appropriate skills, tools and experience in Ethiopia (e.g., facilitation, communication) required for full implementation of this approach. A cultural and institutional environment that discourages risk taking and finds failures generally unacceptable adds considerably to the challenge of taking a learning-based approach.

The poverty mapping project took a pretty standard approach to learning, involving policy makers as project advisors and presenting the approach and preliminary results in order to educate and elicit feedback periodically during the project. Extra time and effort was put into developing high quality co-produced communication products aimed at broad (i.e., not just scientific) audiences, and that paid off in terms of increased policymaker attention and use, but not necessarily learning.

Discarding and innovating were certainly features of the drug resistance project. The point of departure was a recommendation of an expert panel saying the best way to manage drug resistance was an integrated approach of tsetse control, treatments and resistant species. It quickly became obvious that "the best was the enemy of the good" and this Rolls Royce version was so expensive and unsustainable that whether it worked or not was almost irrelevant. They ended up taking an approach that was less effective and more controversial, but made more sense given the incentives intrinsic to the animal health delivery system (e.g., farmers' desire to save money, drug sellers' desire to win clients) and that could continue in the absence of external support.

A lesson from the pastoral project with respect to a learning orientation is that convening the right team and committing to co-learning and co-producing 'hybrid' knowledge (e.g., a combination of indigenous and scientific knowledge) for action at the beginning of the project is absolutely critical to success. Their team found that taking a learning approach can be unsettling as there is no set recipe for what will or will not work. Relatively frequent team meetings to discuss progress and problems are needed. Confidence is built as lessons are learned and successful outcomes are achieved. Experimentation with new avenues of communication such as radio programmes and community briefs were quite successful.

The pastoral project is also a very good example of how institutional 'protection' is needed to truly encourage innovative and risk-taking behavior; ILRI management and large external financial support effectively provided a safe space for the team in the face of external criticism concerning a livestock institute working with wildlife. The community researcher-facilitators were highly supported and encouraged to take a learning approach by their research managers at

ILRI. However, this occurred largely in spite of, rather than because of, internal incentives and rewards for the research managers to take such risks. An observation here is that often these rewards tend to come instead from external sources–for example, recent system-wide (CGIAR) partnership and communication awards have recognized the accomplishments of such initiatives.

The lessons from our case studies with respect to learning seem to support this proposition very well as currently formulated– 'Successful research efforts linking knowledge with action are designed as systems for learning rather than systems for knowing. Recognizing the difficulty of their task, such programs are frankly experimental, expecting and embracing failure in order to learn from it as quickly as possible. Success requires appropriate reward and incentive systems for risk-taking managers, funding mechanisms that enable such risk-taking, and periodic external evaluation.'

4.6   Continuity and flexibility/adaptive management proposition

Our case studies highlight constraints that limit achieving continuity and flexibility, including: entrenched top-down systems of governance; poor human capacity and skills in local institutions; project-trained individuals and champions moving on to other jobs; the slow pace of institutional change; and projects too short to have the kinds of impacts needed to convince governments and other partners to change their behaviors and adopt new approaches.

In dealing with these constraints, all our case study research teams have thought hard about, and struggled with, finding appropriate strategies aimed at maintaining project continuity and flexibility. Two to three-year funding cycles, institutionalization of systems approaches and scaling out of project results arguably remain our greatest challenges in more successfully linking knowledge with action resulting in sustainable poverty reduction.

The main strategy pursued by all teams involved training and capacity building of partners and/or community members. In looking at the evolution of these projects and their training activities, a clear lesson is that project managers need to be thinking about training in more of the so-called 'soft skills'–e.g., facilitation, synthesis, stakeholder engagement, monitoring and evaluation, impact assessment–and in the use of tools and processes that will lead to faster and broader outcomes and impacts ('action'). For example, the pastoral project built capacity in their team to use outcome mapping, which examines desired project outcomes in terms of behavioral, institutional, policy and other changes for each key partner involved in the project. The fodder and markets projects will also be building such capacities. While arguably a 'baby step' towards institutionalizing the sought-after changes, it can result in the recognition and articulation of institutional changes that are needed for sustainable development to occur, and the design of strategies to achieve those desired outcomes.

Other strategies aimed at achieving project continuity and institutionalization (i.e., with the project team 'handing over' the lead to local partners) seen in our case studies include: empowerment of community members and support to collective action efforts, strong support for continuous engagement between local users and producers, joint producer-user proposal development, and creating demand for institutionalization of research activities by raising the visibility of project partners through high profile, high quality research/communication co-

produced products, or 'boundary objects'. These are co-created objects that span two different worlds, e.g., science and policy, and meet the needs of individuals within each (Guston, 2001, Cash et al., 2002), and they were important elements of success for several of our case studies. In the poverty and ecosystems services mapping and pastoral projects, these boundary objects included maps, policy briefs and reports. It was through these boundary objects that herders, state and local officials, poverty analysts, environmental modelers, conservationists, etc. began to work together towards solving complex problems.

We propose the following re-wording of this proposition:
> *'Successful research linking knowledge with action must develop strategies that focus on strengthening linkages and effective patterns of interaction between organisations and individuals operating locally where impact is sought. A key role of boundary spanning work/organizations is the facilitation of processes that create strong networks and build innovation/response capacity of the system. Co-created communication strategies and boundary objects/products are key to the longevity and sustainability of project outcomes and impacts.'*

4.7 Asymmetry of Power proposition

The case study teams added this seventh proposition based on an important lesson learned across all of the case study projects:

> 'Linking research with knowledge requires strategies to deal with the often large (and largely hidden) asymmetries of power felt by stakeholders.'

Various strategies were pursued that implicitly, if not explicitly, aimed at leveling the playing field for partners in less powerful positions. In the poverty mapping project, capacity-building efforts led to co-created products (maps, presentations, posters, books) which were 'owned' by the local government partners rather than the international researcher team who catalyzed and led the initiative. There was not an insignificant amount of prestige and status gained through ownership of these products that soon were in high demand from policy makers throughout the country.

The pastoral project explicitly recognized the perceived huge power imbalances across their multi-partner project team, particularly the often unrecognized power of scientific experts, particularly in a community context. The team then pursued multiple strategies (e.g., hiring local community members as members of the core project research team, co-creation of knowledge by a hybrid community-scientist team) aimed at developing trust and demonstrating respect for the knowledge of all partners. These efforts ultimately led to a Maasai voice in local land policy decisions for the first time in Kenyan history.

An example from our case studies that highlights the importance of the asymmetry of power can be seen in the markets project, where national researchers have viewed the project as competition, limiting their involvement and falling far short of the desired problem-oriented co-creation of knowledge.

5. Conclusions

The framework and propositions arising from the Harvard team's examination of the kinds of approaches and actions that can increase the probability that project/program knowledge will lead to action for sustainable development were extremely useful to our case study teams. They provided some helpful language to make more explicit the strategies and actions that had been pursued (or were being pursued) implicitly. We found none of these propositions irrelevant and suggested some relatively minor changes that may make them more broadly relevant to international agricultural/NRM research for development efforts.

Our case studies show that problem definition/prioritization with users is critical but not easy to do in practice, nor is defining the system boundaries and key partners. The second phase of the fodder project is using an innovation systems approach to better define their target systems and key partners, and is now aimed at identifying ways in which to enhance the adaptive capacity of the system to address fodder-related constraints.

Based on our experience, we would argue that 'backwards' project planning is extremely useful, where the starting point is defining what achievements/outcomes (e.g., a new and inclusive land policy in place) are being sought by each partner as well as collectively. Then the group jointly decides what outputs (papers, maps, analyses, etc) they should produce to best support the desired outcome. It is for this reason that the outcome mapping approach has been found to be so useful across very diverse projects.

We propose that an explicit recognition of the need for new arenas, where partners come together to solve problems and create joint outputs, after having reached agreement as to new rules of engagement that encourage and support creativity and innovation, could greatly improve the probability of success of future projects. At the same time, strategies that account for poor incentives, limited capacity and other existing constraints need to be developed for achieving desired outcomes.

We learned that boundary-spanning individuals and efforts are critical, and since individuals work within institutional frameworks, these need to be supportive of such work, thus we need to further explore and understand what kinds of institutional change are needed to encourage and accelerate boundary work. We also hypothesize that a lot of boundary-spanning activities, behavior and approaches can be learned, so there is also a need to develop courses and training materials aimed at capacity building in this area.

Shifting towards systems designed for learning rather than systems for knowing continues to be a challenge for international research centers, and it is an even greater challenge for our national and local partners. Management support for a learning approach and improved incentives are needed to achieve this transformation, as we have learned at ILRI, where researchers are now evaluated on performance criteria that include collaborative partnerships and communication outputs beyond scientific journal articles.

This in turn allows us to offer a degree of institutional protection to our project partners that encourages innovative and risk-taking behavior, as the 'community facilitator-researcher' model

from the pastoral project demonstrates. But institutions such as these are still very far from supporting and rewarding a 25% failure rate, much less one 3 times higher. New initiatives are needed that will fund these collaborative teams to experiment with different approaches to boundary spanning in order to make significant progress in linking knowledge with action.

These case studies (and many others as well) demonstrate that two to three-year funding cycles, institutionalization of systems approaches and scaling out of project results remain big challenges in more successfully linking knowledge with action resulting in sustainable poverty reduction. Capacity building efforts with our partners remain key here, particularly in skills, process and tools for more efficient and effective stakeholder engagement, project management, and definition, achievement, and communication of outcomes and impacts. Capacity building in the broader sense, targeting the way in which different groups work together and aiming to change interactions so together they become more effective at addressing problems is also key. In reflecting on the lessons from these case studies, we also see the importance of putting communication up front and center in project planning, as communication strategies are one of the keys to success in institutionalizing project outcomes.

We added a seventh proposition to the original six regarding the importance of taking into account perceived asymmetries of power, and the need for strategies aimed at leveling the playing field among project partners and the related importance of building trust. Our case studies suggest that successful efforts to link knowledge with action come up with empowerment strategies aimed at 'leveling the playing field' in order to generate hybrid, co-created knowledge.

In sum, we found these propositions give insight into success but need to be interpreted within a project context. For example, the proposition on user-driven problem definition was extremely relevant for some projects, but much less so for others. There are tensions between some of the propositions. For example strong leadership versus collaborative direction-setting, clear goals and targets versus high flexibility, end-to-end systems versus frank experimentation. Clearly the propositions are adjuncts too, but not substitutes for, good judgment and good management.

This learning exercise has already been tremendously useful to the project team members that have been involved, and many of the lessons will be applied in future project development and implementation. We are beginning to think about more strategically setting up experiments that test some of these hypotheses about what helps link knowledge with action, rather than merely compiling lessons from past research on a rather 'ad hoc' basis. Nonetheless, we feel that by putting our case study lessons into this very useful framework, they will also be helpful to a wide range of individuals and organizations who are working towards sustainable poverty alleviation.

In the interests of further developing these useful ideas we conclude with some questions:
- Whom would these propositions help and how would they be used? (e.g., in evaluation, in planning, in implementation).
- To what extent are the propositions interpretable only in the light of subsequent success or failure? For example, what in one project is labeled innovation and flexibility may in a failed project be seen as lack of direction and planning.
- Are these propositions necessary (i.e., required) and/or sufficient (i.e., nothing else needed) for project success?

- Are the propositions discriminating and predictive? Can they help us pre-identify which projects are likely to succeed and which won't?

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Appendix 1: Case study summaries

The case summaries are included as an appendix because they: provide valuable information about the programs represented at the workshop and how they contribute to sustainability; offer specific examples of and lessons from program managers' efforts to link knowledge with action; and include resources for additional information, such as program URLs and program managers' contact information. These cases may provide the reader with a more thorough and nuanced understanding of some of the key points made at the workshop.

Note: Participants' case summary responses are included in the appendix as submitted for the workshop without substantive editing. They represent the perspectives of the individual authors, and not necessarily those of the authors of this working paper or the organizations that employ them.

This Appendix is divided into 3 parts: Part 1 is the workshop invitation; Part 2 contains the questions and materials the workshop participants were asked to address and compile before the workshop, and part 3 shows those case study summary materials.

1.   Invitation to workshop, 15-17 Nov 2006, ILRI-Nairobi

Dear Colleague,

On behalf of a Steering Group of ILRI and Harvard University researchers, we write to invite you to join a small group of colleagues (see below) for a two day workshop on *Bridging the gap: Translating livestock research knowledge into action for sustainable development outcomes.* The workshop will bring together ILRI researchers to focus on the question of how scientific and practical knowledge can better be linked with action in pursuit of the goals of sustainability: meeting fundamental human needs while preserving life support systems. The workshop has three goals: i) an introductory part that allows the group to get familiar with the teams and projects that participants have experience working in; ii) a reflexive part where participants talk about what makes some teams/projects work better than others in linking knowledge with action; and iii) a methods part to explore some characteristics of successful programs/projects. We hope that participants will find ways to build on the workshop discussions in advancing their own many and varied activities related to linking knowledge with action for sustainable development.

The workshop is being sponsored by the ILRI's People, Environment and Livestock Theme (US linkage funds) and the Harvard University Sustainability Science Program. It will take place at ILRI in Room 720. The workshop will begin with dinner at 7pm on Wednesday, November 15 and run through to 4:00pm, Friday, November 17. If you are traveling from outside Nairobi, your costs (travel, accommodation and perdiem) will be covered – please liaise with Joyce Wanderi for details.

The Steering Group includes researchers from ILRI and Harvard University. Bill Clark and Nancy Dickson are from Harvard's Kennedy School of Government. Bill and Nancy are not familiar with livestock research, but have looked at other complex systems to understand what sorts of institutions and procedures can help link knowledge with action in that area of

environment and development, and want to explore effective work underway at ILRI. They will be there to learn and to share something of what they have learned elsewhere. The aims and objectives of the Harvard team match very closely to recent initiatives at ILRI to understand more about how research contributes to real change and positive social and economic outcomes. Recent studies include an activity using outcome mapping principles, applied retrospectively as an assessment tool to learn lessons about partnerships and strategies in a set of 5 cases (including the reto-o-reto and poverty mapping projects). In the fodder innovation project an innovation systems framework was used to reflect on processes in Phase 1 of the project with a view to learning lessons for implementation of Phase 2. Such exercises – seeking to learn lessons about how research is implemented in order for outputs to lead to outcomes will be a central part of activities in the new Innovation and Learning Unit.

The workshop will focus on the role of ILRI projects/staff in linking knowledge with action to promote sustainable development. It will draw on selected cases as well as the wealth of participant experience with other relevant efforts, to begin a process of: a) identifying examples of particularly successful or instructive projects from which useful general lessons might be extracted; b) highlighting the most significant obstacles or barriers to successful projects and effective means of overcoming them; and c) determining the sustainability challenges for which projects are most (and least) likely to prove helpful. If we determine, based on the discussions at the workshop, that some topics could usefully receive further and more systematic exploration as a means of linking knowledge with action for sustainability, possible follow up activities will also be discussed. This might include preparing a synthesis paper summarizing the experiences presented at the workshop and the lessons that will be drawn from that experience. We will also explore ideas for developing funding proposals.

Overview of the agenda
At our session on Thursday, November 17, we will begin with a presentation on findings from an international comparative research project that Nancy and Bill lead on *Knowledge Systems for Sustainable Development* that draws on case studies from around the world examining knowledge systems for water management, climate forecasts, fisheries, agriculture, and health. "Knowledge systems" are viewed as consisting of a network of linked actors, organizations, and objects that perform a number of knowledge-related functions that link knowledge and know-how with action. Included are the incentives, financial resources, institutions, and human capital that give such systems capacity to do their work.

Next 4 cases from ILRI teams/projects will be presented, each of which represents a major challenge of harnessing science and technology to advance sustainable development. The selected cases are:
- Reto-o-Reto project: Better policy and management options for pastoral lands (Robin Reid**,** Mohammed Said, Dickson/Makui);
- Fodder innovations for small holders in India (Prasad Vishnubhotla, Dannie Romney);
- Poverty mapping (Patti Kristjanson**,** Julius Nyangaga, Paul Okwi); and
- Preventing and containing trypanocide resistance in the cotton zone of West Africa (Delia Grace**,** Hippolyte Affognon, Tom Randolph).

Each case will have up to 30 minutes to make a presentation, followed by 15 minutes of clarification questions**.** The Steering Group will work to identify the most productive themes that emerged from the discussion of the cases, and table these themes for further discussion by the participants on Friday, November 17.

Pre-meeting preparation
For each ILRI case listed above we ask you to prepare the following materials that will then be distributed to all participants via the briefing book (and is thus needed by **November 1**):

      1) A "**Case memo**" of 2-4 pages, prepared by each of you. We suggest that each case memo include a short paragraph on as many of the elements listed in Appendix 1 as possible, though you are the ultimate judges of what will be most useful in your particular case.
      2) 2-4 **additional readings**, selected by you, from the published or grey literature that will help the participants to get the most out of your case or the issues it raises within the broad challenge area it represents. The readings can be whatever you find most likely to help other participants who want to immerse themselves a bit more deeply in your subject. These could be review papers of experience in efforts to link knowledge with action in the larger field from which your case is taken, or more extended characterizations of the "problem" addressed in the case, or anything else you think participants might find useful. For each document please give us 2-3 sentences explaining how these documents are relevant to the case and/or the information they provide. An annotated bibliography will be produced of the documents for the meeting.
      3) A paragraph length **biography** describing your position, background, and brief descriptions of the objectives of projects that you are involved with would be very helpful.

Material to be included in the briefing books will be sent to all participants in the workshop by November 8th. If you have some of the material earlier, please send it immediately in order to mitigate the deadline crush. You can always add readings or revise your memo after the 1st – we will send electronic updates to participants and make physical copies available at the meeting. But the more we can get into the briefing book the better.

All materials – memos and readings -- should be sent (ideally as pdf files) to Shirley Tarawali at s.tarawali@cgiar.org, and copied to Joyce Wanderi at j.wanderi@cgiar.org

Thanks so much for your help in putting this together. It promises to be an interesting workshop.

Sincerely,

The Workshop Steering Group: Shirley Tarawali, Robin Reid, Dannie Romney, Patti Kristjanson, Bill Clark, and Nancy Dickson

Participant list:
Hippolyte Affognon, University of Hannover, Germany
William Clark, Kennedy School of Government, Harvard University
Nancy Dickson, Kennedy School of Government, Harvard University
Delia Grace, People Livestock and Environment/Market Opportunities Themes, ILRI
Patti Kristjanson, Innovation and Learning Unit, ILRI
Ogeli Makui/Dickson Kaelo, People Livestock and Environment Theme, ILRI
Julius Nyangaga, Outcome mapping team, ILRI
Paul Okwi, Poverty mapping team, ILRI
Vishnubhotla Prasad, Fodder Innovations project, ILRI
Ranjitha Puskar, IPMS project, ILRI
Tom Randolph, People, Livestock and the Environment Theme, ILRI
Robin Reid, People, Livestock and the Environment Theme, ILRI
Dannie Romney, Innovation and Learning Unit, ILRI
Mohamed Said, People, Livestock and the Environment Theme, ILRI
Shirley Tarawali, People, Livestock and the Environment Theme, ILRI

Admin and logistics:
Joyce Wanderi
(Martin Njorge)

2.   **Case Memo Questions**

In an effort to begin understanding the diversity of cases that we will be exploring during the workshop, we have requested that participants briefly answer the following questions about their cases. Previous work suggests that successful programs linking knowledge with action are agents of change and innovation. As such, established interests and organizations generally seek to oppose or co-opt such programs. In fact, it's a wonder than any succeed at all. We list below some candidate characteristics of successful programs, together with questions about these characteristics that we ask participants in this workshop to reflect upon in the context of their own program experience.

The cases and examples are in general complex systems involving the production and utilization of scientific or technical knowledge. For convenience we simplify that complexity by referring to *producers and users of knowledge. Producers* are meant to encompass the scientists, engineers, and practitioners who through their experiments, observations, and trial-and-error probing create knowledge about how the world works. *Users* are those who may use knowledge in shaping actions that change how the world is working. This category includes *decision makers*, such as policy makers, managers, extension agents, farmers, executives, householders, and citizens. Of course, the experience of such users also is a source of knowledge and in good collaborative arrangements the distinction between producers and users of technical knowledge may become (intentionally) blurred. *End-to-end systems* link research inputs with impacts to create end-to-end integrated systems that connect basic scientific products such as observations and predictions with decision-relevant impacts and options.

Short, descriptive title of team/project:

Question: What is a short, descriptive title for the team/project you are presenting? Is your research attempting to link knowledge with action, and, if so, what knowledge and action does it now link?

1. Problem definition:

Tentative finding: Successful research linking knowledge with action requires dialogue and cooperation between the scientists who produce knowledge and the decision makers who use it. Especially important is that the problem to be solved be defined in a collaborative but ultimately user-driven manner.

Question: What is the problem to be solved by your research? How -- if at all -- did the development of the research provide for a user-driven dialogue between scientists and decision makers to shape problem definition? How -- if at all -- did the ultimate problem definition differ from initial formulation by scientists and decision makers, respectively?

2. Research management:

Tentative finding: Successful efforts to develop research linking knowledge with action generally adopt a "project" orientation and organization, with dynamic leaders accountable for

achieving use-driven goals and targets. They avoid the pitfall of letting "study of the problem" displace "creation of solutions" as the research goal.

Question: Was your research developed in such a "project" mode? Did it have specific, measurable goals and targets? If so, what? To what extent and in what ways was goal and target definition driven by scientists or decision makers, or both? To what extent and in what ways were research leaders held accountable for achieving those goals and targets?

3. Program organization:

Tentative finding: Successful research linking knowledge with action include "boundary organizations" committed to building bridges between the research community on the one hand, and the user community on the other. These boundary organizations often construct informal and sometimes even partially "safe spaces" in which project managers can foster user-producer dialogues, joint product definition, and end-to-end system building free from distorting dominance by groups committed to the status quo. In order to maintain balance, most effective boundary organizations make themselves jointly accountable to both the science and user communities.

Question: Did your research involve a boundary spanning function or organization? If not, how did you organize the dialogue between producers and users of research knowledge? If so, where and how was the boundary organization or function created? What did it do? To what extent was it accountable to both users and producers for achieving its goals?

4. The decision-support *system*:

Tentative finding: Successful programs linking knowledge with action create end-to-end, integrated systems that connect basic scientific predictions or observations to decision-relevant impacts and options. They avoid the pitfall of assuming that a single piece of the chain (e.g., a climate prediction) can be useful on its own, or will be taken care of by "someone else".

Question: To what extent is the decision support system developed by your program an end-to-end system? What are its discrete elements (e.g., i. a weather forecast; ii. an impact model converting climate forecasts into yield forecasts required by decision makers; ii a discussion roundtable' or 'feedback workshops')? Which were the hardest elements to put in place? Why? What changes in research, decision-making, or both have occurred as a result of the system?

5. Learning orientation:

Tentative finding: Successful research linking knowledge with action are designed as systems for learning rather than systems for knowing. Recognizing the difficulty of their task, such programs are frankly experimental, expecting and embracing failure in order to learn from it as quickly as possible. Success requires appropriate reward and incentive systems for risk-taking managers, funding mechanisms that enable such risk-taking, and periodic external evaluation.

Question: Did your research have an expressly experimental orientation? How did it identify

which risks to take? How did it identify success and failure? How did it engage outside evaluators to help it reflect on its own experience? What are the most important lessons you have learned regarding pitfalls to be avoided, or approaches to be followed in the future?

6. Continuity and flexibility:

Tentative finding: Successful research linking knowledge with action must develop strategies to maintain project continuity and flexibility in the face of budgetary and human resource challenges, such as: the dual public/private character of knowledge-action systems (needs more explanation, not sure what this is); budgetary pressure to highlight short-term, measurable results; uncertainty regarding future budgetary priorities in a dynamic political environment; shortages of people who can work effectively across disciplines, issue areas, and the knowledge-action interface; and evaluation criteria that do not measure the less tangible tasks of maintaining these links (e.g., attending meetings, responding to requests for information).

Question: How do budgetary requirements and/or human resource pressures influence your program? What, if any, collaborative funding mechanisms have you developed to ensure continuity and relevance to users' needs? If applicable, how do you maintain public funding, or incorporate private funding for the provision of a partially private good. What, if any, innovative approaches have you developed for enhancing human capacity in your program area (e.g. providing incentives to reward interdisciplinary activities or training in team building / facilitation)? How does this translate into the characters you look for in people who you recruit to join your team?

7. Other insights?

Question: What other insights or conclusions emerge from your experience about the factors responsible for success and failure in activities designed to link knowledge with action?

8. Other issues?

Question: Are there any other issues that you would like to discuss during the workshop?

9. Contact information:

Question: Could you please list for the case presented the key contact person (presumably but not necessarily yourself), with title and contact information?

10. Representative publications / products:

Question: Could you please list a couple of key publications or products that would help us to understand the program you have described, including web sites? (If possible, please append electronic copies

3.   Case Studies

Case Study 1: Reto-O-Reto Project: Better policy and management options for pastoral lands: Assessing the trade-offs between poverty alleviation and wildlife conservation

Dickson ole Kaelo, Ogeli ole Makui, Mohammed Said and Robin Reid, Patti Kristjanson
November 2006

Short description of the project

This project was designed to create the knowledge and relationships to enable poor agro-pastoral communities to influence local and national land use policies affecting their livelihoods (access to pasture, water) and the sustainability of biodiversity (wildlife) in the areas where they live. Researchers aimed to work with these communities to generate new knowledge that contributes to: a) understanding the impact of livestock-wildlife systems on biodiversity and the implications of changing land-use practices for pastoralist livelihoods and the environment; and b) processes and actions that empower local communities to better manage their livestock and landscapes and to contribute to policy changes that help alleviate poverty and conserve natural resources. The project focused on four principal large landscapes and the communities within them: 1) Kitengela / Nairobi National Park, Kenya; 2) Amboseli / Longido, Kenya and Tanzania; 3) Mara / Trans-mara, Kenya; and 4) Tarangire / Simanjiro, Tanzania.

The research is carried out by an integrated community – facilitator – researcher team. The information from the project is being exchanged with communities and policy makers through various means: feedback workshops, target group presentations, conferences and workshops, community meeting, posters, policy briefs, and through radio, and exchange visits of local community, field visits of pastoralist from other parts of the world.

1. Problem definition:

In many of the pastoral areas in East Africa there has been a need for better and more usable information that allows a wide range of stakeholders to work together to manage land and water more sustainably, equitably and productively. Although there is significant research on this issue, this research is rarely linked to the problems or information needs of pastoralists in local communities. From another perspective, the policy makers make changes in policy without seeking the participation of both the community and researchers. And communities are not taking advantage of the existing knowledge and information to better manage their land.

Across the region, pastoral groups, government land managers, and policy makers alike expressed the need for objective evaluation of the short and long-term economic and ecological returns to various policy and land management options. To address these issues the team had a series of meetings with a number of stakeholders during the proposal formulation process and prior to the start of the project to set the research agenda. Once the project was funded and started, this research agenda was fined tuned by a new team of community facilitators who worked closely with communities and policy makers at local and regional level and also the ILRI research team.

2. Research management

The research project was designed to put communication and community / policy maker needs at the centre and up front, rather than at the periphery or last. In a pictorial sense, the communities and policy makers were in the middle of the circle and the researchers were in the ring around the edge of the circle. In boundary organisation language, each member of the team was charged to take some of the function of a boundary individual: to be responsible not only to their home institution, but also discuss and represent the needs of a set of other stakeholders at different levels of scale.

The project started with a logical framework to guide planning and monitoring, and then quickly also adapted the IDRC Outcome Mapping approach to refine its vision, strategy and identify boundary partners. Put simply, this method plans backwards from identification of desired changes in partner behaviours to research products, rather than the other way around. The boundary partners consisted of community groups, policy makers, government institutions, and local authorities and NGOs. For each boundary partner specific outcome challenges, progress markers, specific outcomes or measurable goals and evidence were developed. The targets for the community were to improve pastoral livelihoods and livestock production, strengthen community institutions and empower community members, and improve access to common property and environmental sustainability. The target for our policy boundary partner was to ensure that environmental sustainability and land use planning were developed at the local and national level. And finally the target for the donor and development agencies was to improve financial and political sustainability of the project through increased donor support. The logical framework has been more useful for monitoring the progress of producing outputs, and the outcome mapping has been more useful in making sure the research is strongly user-driven and focusing the team on creating 'outcomes' or changes in behaviour on the part of boundary partners.

The researchers were accountable for producing information, with the participation of community members, and making sure all results were available in useable form for the various boundary partners. The role of the facilitators was to support their communities in making positive changes through information and knowledge generated from the project. The team has made considerable progress facilitating policy change – but this process also depended other factors which are beyond the control of the team. Refer to Outcome Mapping articles for more detail information.

3. Program organization

The project team which comprised researchers, policy impact and community facilitators worked closely towards achieving project targets. In a group or individually, the team members picked boundary partners to work with from community, local authorities or policy makers or a combination of the three. The strategy was to produce information that could be used by the various partners to the address the problems stated in section 2 above.

The centerpiece of this project was communication and linking communities with scientists with policy makers. To accomplish this, the team created four new positions, called community

facilitators, who worked full time at spanning the boundaries between these three groups. While the facilitators worked either for ILRI or African Wildlife Foundation (in Tanzania), their job assignment was to work closely with a variety of organizations to understand fully their information needs and to help those organizations find the needed information, either inside or outside ILRI. Each facilitator was evaluated with informal and formal evaluations and judged on how well they were 'responsible' to their boundary partners (as above) and facilitated their needs. They also were assessed on how well they worked with the 'researcher team'. We often remarked on how the boundaries between the facilitators and researchers were very blurry, and that we were all both, facilitating our chosen boundary partners, and carrying out research, with a different location and level of scale for each remember of the facilitator – researcher team. One of the most important aspects of this communication process was the selection of the facilitators themselves to ensure they would be as effective as possible when working with local communities and policy makers. A joint pastoral and researcher team carefully defined the criteria for the facilitators that would make them most effective from a Maasai cultural and researcher cultural perspective. These characters included: 1) good listening skills, 2) respectful of elders, 3) rising leaders in good standing with the community, 4) eloquent speakers, 5) advanced education (at least a BSc.), 6) ability to work independently, and 7) a member of the communities they serviced.

At first the flow of information between researchers, community and policy makers was not strong. As information started flowing between researchers and communities, communities and policy makers, and then researchers and policy makers, different specific information channels started to evolve. In a number of instances, the community started to work directly with policy makers to discuss policy issues; researchers also worked directly with the communities and policy makers. Policy makers started calling scientists to contribute to some policy review work. Over time, trust and open dialogue developed among the researchers, communities and policy makers at local and national levels. This happened more strongly for the Kitengela and Mara sites, and not as strongly for the Amboseli and Simanjiro / Longido sites in Tanzania.

4. The decision-support system

In a sense, the end-to-end 'decision support system' adopted by this project was entirely based on the community facilitator – researcher – community team. The process seemed to work like this: 1) the team identified priority research questions with input from the communities (either directly or through the facilitator, based on the outcome mapping) and also based on scientific interest / importance, 2) the team then identified the outputs or products that could be produced in the short term and meet requested needs right away, and over the long-term, 3) the team then produced the information together (with community members participating, often with significant training investment), and then 4) the team decided what forms the information should take to be most effective to communicate with communities more broadly (meetings, radio programme, posters, feedback workshops, briefs) and with scientists (reports, papers, book chapters, international conference presentations, international assessments). Interestingly, one of the lowest priority communication avenues was a website (communities often do not have access) and, correspondingly, this website is still under construction.

With this approach, big changes happened. Research is usually a very slow process, and we had to figure out how to produce initial information much faster and get it out to people. The researchers on the team felt their research was useful and helpful to people on the ground for the first time and this added to their feelings of responsibility in producing accessible information. The communities started paying attention to researchers and started to request their input and support regularly. Confidence among community members rose as they used the information to build their case with policy makers. Policy makers engaged more often and more directly with communities partly because of the stronger confidence and the reliable information at hand. Policy makers also requested direct help form the researchers in reviewing new policy instruments.

For example, in the Kitengela, the four research areas of communication, land use, biodiversity and livelihoods were treated separately. Over time, the team integrated so that it could support the complicated issues raised by communities, policy makers or researchers. For example, by combining information on land use, livestock, household economics, wildlife trends and agriculture, the team derived trade-offs of various land use options. Much of this information is now being used by the communities and local authorities to develop the first-ever master land–use plan for Kitengela. In addition, as the project started producing and sharing information many partners started to share data and work with project team. The database developed by the teams is being used by other projects and organizations addressing the issue of ecosystem services and poverty.

5. Learning orientation
These are the main points:

- The team adopted a learning approach from the beginning, which was unsettling at first, because we had no set recipe for what would and would not work

- As we learned, we gained confidence and built on the successes and learned what did not work

- We then experimented with new avenues of communication like radio programmes and policy briefs. It is not clear yet whether the latter is really useful yet, but the initial indications are good.

- What really worked included:

  o The community facilitators as boundary individuals and their work, the spark and drive they added to the team, and the critical role they played in every step of this project

  o Bi-monthly 2-day meetings to discuss progress, new community needs, new research outputs

  o Feedback workshops

o High profile presentations at a wide range of meetings

• What was less successful included:

  o The ratio of facilitation time to research time was inappropriate. Because reliable research information is so hard to create, the researchers rarely kept the facilitators busy communicating reto-o-reto research information. This did allow the facilitators to work with other ILRI researchers and communicate a much broader and more useful set of information.

  o It was clear that the amount of information flow entirely depended on the quality of the facilitator, which created some unevenness

  o The researchers had little time to spend in the field, partly because the demands to create information were so large and daunting

6. Continuity and flexibility:

This is an issue for this team because the original project was funded by a large outside grant. During the course of the project, the team wrote many grants to continue funding on different aspects of the project past the end of the original grant. Community members also engaged strongly in the research and took responsibility for contacting the core team at ILRI about their needs. Extensive training helped build the capacity of community members to collect information and to judge the reliability of other information.

7. Other insights:

• The project was too short - there is now demand for the project to continue, and the stakeholders require the previous, highly funded level of engagement

• There is a need to scale up the lessons from this work to other places and broader scales of resolution

• The integrated team (different backgrounds) made a difference but also has its difficulties

• It takes a long time for government agencies to change their approaches to tackling issues, thus long-term engagement is necessary for outputs to become outcomes and then impact

• There is still a great deal more to be learnt from the field

• Mutual trust, , open minds, a common vision, good leadership and a desire to make a difference were the core values that united the team and made it especially effective.

8. Other issues:

• How do we document our work and experiences and develop principals that can assist other people to replicate or improve on this approach?

9. Contact information:

• Mohammed Said: m.said@cgiar.org

• Dickson ole Kaelo: olekaelo@yahoo.com

• Ogeli ole Makui: ogelimakui@yahoo.com

• Shem Kifugo: s,Kifugo@cgiar.org

• Robin Reid: r.reid@cgiar.org

10. Representative publications / products:

• ONeWORLD Radio Programme (contact M. Said)

• Policy briefs (contact M. Said)

• www.maasaimaracount.org

• Project posters (contact M. Said)

• Kitengela land use map (contact S. Kifugo)

• Reid, R.S. Savannas of our birth: People, wildlife and change in East Africa. University of California Press.

• Reid, R.S., Tomich, T.P., Xu, J., Geist, H., Mather, A., DeFries, R. Liu, J., Alves, D., Agbola, B., Lambin, E., Chabbra, A., Veldkamp, T., Kok, K., Noordwijk, M., Thomas, D., Palm, C., and Verburg, P.H. 2006. Linking Land-Change Science and Policy: Current Lessons and Future Integration. In: Lambin, E., Geist, H. (eds). Land Use Change, LUCC, IGBP. Springer Verlag. Pp. 157-171.

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• Cochrane, K., D. Nkedianye, E. Partoip, S. Sumare, S. Kiruswa, D. Kaelo, L. Onetu, M. Nessele, M. Said, K. Homewood, P. Trench, R. S. Reid, and M. Herrero. 2005. Family

fortunes: Analysis of changing livelihoods in Maasailand. Final report, Project ZC0275, Dfid Livestock Production Programme. International Livestock Research Institute, Nairobi, Kenya.

• Reid, R.S., Serneels, S., Nyabenge, M. and Hanson, J. 2005. The changing face of pastoral systems in grass-dominated ecosystems of East Africa. In: Grasslands of the World, FAO, Rome, Italy.

• Ogutu J.O., Bhola, N. and Reid, R.S. 2005. The effects of pastoralism and protection on the density and distribution of carnivores and their prey in the Mara ecosystem of Kenya. *Journal of Zoology* **265**: 281-293.

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• Lamprey, R. and Reid, R.S. 2004. Expansion of human settlement in Kenya's Maasai Mara: What future for pastoralism and wildlife? *Journal of Biogeography* **31**: 997-1032.

• Reid, R.S., Ogutu, J., Rainy, M., Kruska, R.L., Nyabenge, M., McCartney, M., Worden, J., Wilson, C.J., Kshatriya, M., Kimani, K., and N'gan'ga, L. 2003. *Mara Count 2002: People Wildlife and Livestock in the Mara Ecosystem.* Report, Mara Count 2002, International Livestock Research Institute, Nairobi, Kenya.

Website: http://www.reto-o-reto.org/

Case Study 2: Poverty and Ecosystems Services Mapping

Project Title: Demonstrating how poverty maps can be used more effectively to design and target pro-poor interventions across different sectors in Eastern Africa.
This research attempts to link knowledge about poverty to action through improved, better targeted and more transparent pro-poor policies implemented across East Africa. . It aims to improve linkages between key decision makers in agriculture, livestock and health sectors in the region, and enhance their knowledge regarding rural poverty (where and who the rural poor are, how poor are they, reasons for observed differences in poverty incidence) in order to mainstream critical sectoral issues into national poverty strategies.

Problem definition
The problem to be solved by this research is non-existent or ineffective policies at national and sub-national levels for reaching the poor and improving their welfare. The research approach involved both scientists (the research team) and policymakers (the advisory team) from the outset in order to ensure that the information and knowledge generated by the scientists was useful and used. The scientists initially formulated the problem as a technical one (i.e. refining techniques to get the best possible poverty maps, i.e. poverty estimates with small errors

associated with them), whereas the decision makers were more interested in the most recent and relevant poverty information for their particular (fairly narrow) constituencies.

Research management This research was developed in a project mode, with a strong overall project manager as well as clear use-driven goals, targets and incentives for the policy and research teams in each country, who were held accountable for achieving those goals.

Program organization This research involved both research and decision-maker boundary partners from the outset, with ILRI essentially playing the role of a 'boundary spanning organization', ensuring that the researchers, in particular, were accountable to both users and producers for achieving its goals.

The decision-support system The analysis led to poverty incidence, depth and distribution estimates for small geographic areas (e.g. one or two small rural villages). Connecting this to decision-relevant impacts and policy options is challenging because these will occur at different levels of government and across many different sectors (e.g. agriculture, health, education). Our approach has been to develop the poverty analyses units (made up of part of the research team) and encourage linkages with the other sectors and decision-makers at different levels through capacity-building exercises and development of timely decision-relevant research outputs (e.g. poultry and poverty distribution maps in Uganda for the Ministry of Agriculture who is preparing for a possible avian flu outbreak).
A key challenge has been prioritization of research outputs with policymakers; they tend to come up with 'shopping lists' of issues where they want more information. One approach we have used is to develop 'example' outputs to demonstrate some of the possibilities and hold small meetings with key individual decision-makers in the different sectors to stimulate their imagination and help us prioritize research activities.

Learning orientation In terms of learning orientation, this research has evolved as the partnerships have expanded. Analytical results have been presented at various workshops, some policy-oriented, where communication of results to a broad audience was stressed and feedback sought at relatively early stages. Much effort has been put into developing and sharing communication products and holding high profile media events (e.g. a poverty map powerpoint presentation developed with the permanent secretary and 'use of poverty information' presentation developed with local government minister in Kenya). There has been a continual experimentation with approaches to more effectively engage decision-makers and disseminate results.

Continuity and flexibility Project continuity and flexibility have been achieved largely through the support of one key partner, Rockefeller, who has been keen to build on the research accomplishments and make sure that the link to 'action' is indeed achieved. However, other collaborators (World Bank), DFID, and local governments (largely through World Bank and other donor funds, e.g. to their statistical units) have also been key. For example, by raising the profile of the statistical units through high profile, high quality research/communication products (e.g. the poverty books), we created demand for the institutionalization of such knowledge generation within these government units, and enhanced their visibility and status.

Human resource constraints have been addressed through the capacity building components, although we have been lucky not to lose a few key people that we have trained and relied on for outputs during the process. Our strategy for incorporating government support has been to create a demand for ongoing high quality poverty analyses and products (e.g. for the poverty books by the MPs). We have not yet tried to incorporate private funding, but need to think about this.

Other insights What Learning Can Be Drawn from this Initiative?

1. Researchers can effectively build capacity by applying a range of strategies aimed at influencing partners' awareness, working environments, skills and behaviours.

2. Strategies aimed at influencing awareness, incentives and rewards were helpful in supporting change in target partners' actions and relationships. Taking the researchers in the Government Statistical Research Units as the primary focus, the approach was to initially enhance their knowledge and relationships as well as to make their working environments more supportive of and receptive to their research. The early involvement of government policy analysts and policy makers was effective in creating support and receptivity for the researchers' work among the users of the researchers' outputs. The project team and the local research teams also enhanced receptivity to poverty mapping in their working environment by giving presentations to donors and development agencies throughout the process, informing them of the poverty information and of ways in which the data and tools could be used. This, along with high profile book launches featuring senior policymakers, donors and development partners gave credibility to the local partners. Helping the high-level decision-makers with the presentations of the products (maps, books) at these events increased local knowledge and ownership.

3. Strategies that result in immediate and 'hard-to-reverse' outcomes may be necessary to generate high quality outputs for which the producers can immediately take credit. Contractual arrangements were established with the researcher partners and monitored by the project team. Firm milestones and agreed upon standards of quality for work increased the likelihood of timely and acceptable outputs. Assisting partners to achieve prominence in their field and to take credit for good quality outputs builds commitment and enhanced partner influence. The project supported the production of high quality, high profile books, published by the local partners, so they (local working associates) could receive the bulk of the credit and recognition for the work

4. Technical training and assistance reinforced by hands-on work and support by colleagues over the long term yields success. Training is an essential part of the research process. In all three countries poverty analysis skills were built through training and technical assistance reinforced by poverty mapping work. Partners undertook and met their commitments as the work progressed. Experienced researchers from other parts of the world were also included in the start-up workshop, where they were able to present their personal experiences in similar undertakings, the benefits they realized, as well as the institutional and policy changes poverty maps have led to in their countries. Continued access to these colleagues was a useful supportive asset, offering continued mentor-type structures.

5. Involving the users of research outputs early in the project enhances the relevance and acceptance of the research. The research team helped establish policy support teams consisting of poverty policy analysts and high level policymakers in developing the methodology so they fully understood the outputs and were able to directly feed them into the country poverty policy processes.

Other issues There are major transactions costs involved in building and nurturing partnerships with individuals located in institutions that are poorly managed. Yet these are often the ones we most need to work with, and influence (particularly when bad policies limit impact of our research on the poor). Most of our partners face poor incentives and rewards for interdisciplinary, multi-institute approaches (and we continue to struggle to improve these within our own institute as well!). Are there 'tried and true' approaches that help limit these transactions costs so researchers spend more of their time on actual research?

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Representative publications / products
The following two books present the results of the poverty analyses in Kenya and Uganda in both map and table formats, and are written in a non-technical style. They explain how the analysis was done, how to interpret the results and suggest possible uses of the information for targeting pro-poor policies and interventions. The data, maps (and GIS layers behind the maps) and reports can all be downloaded from the web.
Uganda Bureau of Statistics. 2004. Where are the Poor? Mapping Patterns of Well-Being in Uganda 1992 and 1999. Uganda Bureau of Statistics (UBOS), Entebbe, Uganda, and International Livestock Research Institute (ILRI), Nairobi, Kenya. 86 pp. Available at:
http://www.ilri.org/research/Content.asp?SID=145&CCID=41
Maps :
http://www.ilri.org/ILRIPubAware/ShowDetail.asp?CategoryID=TS&ProductReferenceNo=TS%5F051101%5F002

GIS files:
http://www.ilri.org/gis/search.asp?opCountry=LIKE&tbCountry=Uganda&opTheme=LIKE&tbtheme=Poverty&opBoolean=AND&display=Brief&submit1=Submit
Central Bureau of Statistics. 2003. Geographic Dimensions of Well-Being in Kenya. Vol. 1: Where are the Poor? From Districts to Locations. Government of Kenya, Ministry of Planning and National Development, Central Bureau of Statistics (CBS) in collaboration with International Livestock Research Institute (ILRI). CBS and ILRI, Nairobi, Kenya. 164 pp. Available at:
http://www.ilri.cgiar.org/Infoserv/webpub/fulldocs/GeogDim/Kenya_Poverty_Atlas.pdf
or http://www.worldbank.org/research/povertymaps/kenya/volume_index.htm
GIS files:
http://www.ilri.org/gis/search.asp?opCountry=LIKE&tbCountry=Kenya&opTheme=LIKE&tbtheme=Poverty&opBoolean=AND&display=Brief&submit1=Submit
Maps: http://www.ilri.org/research/Content.asp?CCID=12&SID=149
The following (attached below) is a case study excerpt, undertaken as an 'ex post' outcome mapping exercise for the poverty mapping project.
Kristjanson P, Okwi P, Ndeng'e G, Emwanu T, Henninger N. Poverty Mapping Initiative: Case Study 3, in: Nyangaga J, Romney D, Smutylo T. 2006. Research beyond borders: Five cases of ILRI research outputs' contribution to outcomes. ILRI Working Paper, ILRI, Nairobi, Kenya. The poverty mapping project in Kenya evolved into a poverty and ecosystems services mapping project, with the following output:
This book is downloadable at:
http://www.ilri.org/ILRIPubAware/ShowDetail.asp?CategoryID=TS&ProductReferenceNo=TS%5F070531%5F001

The following are publications relating to the analytical component of the project, and use of poverty maps globally. When the project began in 2000, high resolution poverty maps existed for only a few developing countries and only one in Africa; researchers trained through this collaborative effort have now resulted in this poverty-related knowledge being generated for 6 SSA countries.
Henninger, N. and Snel, S. 2002. Where are the poor? Experiences with the development and use of poverty maps. World Resources Institute: Washington, D.C (http://population.wri.org)
Hoogeveen, J.G., Ewanu, T and Okwi, P.O. Updating Small Area Welfare Indicators in the Absence of a New Census. *World Development Report,* forthcoming
Okwi, P.O., Emwanu, T. and Hoogeveen, J.G. 2003. Poverty and Inequality in Uganda: Evidence from Small Area Estimation Techniques. World Bank and UBOS Working Paper, UBOS, Kampala, Uganda.

Case Study 3: Confirming veterinary drug resistance in West Africa,
　　　　　　designing appropriate response strategies, and promoting their uptake

1. Problem definition
Farming systems across the sub-humid zone of West Africa often depend on cattle keeping, both as a production activity and to provide animal traction for cultivating expanded crop areas, especially for cash crops such as cotton. This zone is infested by the tsetse fly which transmits

the potentially debilitating and fatal cattle disease: trypanosomosis. Farmers employ a combination of strategies to manage this disease challenge, the most popular of which is regularly treating their cattle with trypanocides, veterinary drugs specific to the disease that can be used prophylactically or curatively; as the local saying goes, '*here, you farm with a syringe in the hand*'. Each head of cattle is treated on average at least once a year. When drugs are used extensively in this manner, drug resistance can be expected to emerge, and the drugs will become less effective. Both farmers and veterinary professionals find it difficult to detect drug resistance due to a combination of lack of awareness as well as other possible explanations for drug failures, including inappropriate administration of drugs, which is often done by the farmers themselves. However, if drug resistance is allowed to become established and spread, the viability of cattle keeping and animal traction will be threatened.

In the mid-90s, scientists from ILRI teamed with collaborators in Germany and West Africa to develop a technique for detecting resistance, testing it in a zone of suspected resistance in southwestern Burkina Faso. Having confirmed the presence of drug-resistant pathogens (trypanosomes), a new project was initiated in 2002 to apply the detection technique to other suspected hotspots of resistance in Mali and Guinea, and test appropriate strategies for farmers, veterinary professionals, and policy makers that would minimize the risk of creating new resistance. That project, which is just ending now, confirmed that pockets of resistance exist across the zone studied, and provided evidence that promoting information and training on rational drug use and integrated disease control could reduce the risk of resistance. A protocol for more rapid detection of resistance and a range of prototypes for informational and training materials and decision-aid tools were developed. A new phase of the project is just starting, and in addition to understanding better how established resistance might be reversed and assessing the impacts of these research efforts, a major objective is to scale up and out across the region the prototypes developed during the preceding phase.

This evolving collaborative effort involves several research challenges.

- It concerns an invisible problem that required international and regional researcher action to identify and to bring to the attention of local researchers and authorities, and so is at its origins unabashedly supply-driven. Awareness was subsequently raised and cooperation cultivated through a sequence of consultations and increasing direct collaboration with local actors.

- Evaluating the appropriateness of response strategies has, however, required partnership with local actors right from the start, and a participatory approach was adopted.

- As the overall effort has evolved over the years and new information and understanding was generated, research objectives were periodically revised through consultation with both local users and international research actors.

- It was appreciated early that the problem and proposed solutions required a systems perspective since determinants of resistance range from the microbial to the international policy level.

• The current challenge is devise a strategy for efficiently and effectively scaling up and out such a variety of products, feeding them into the appropriate development and policy channels across the varying country contexts in the region.

2. Research management
While the funding for the initial phase of 'discovery' was oriented to scientific outputs, the funding source (BMZ Targeted funding for the CGIAR) for the two subsequent phases have stressed development objectives. This has contributed to more careful planning of the objectives and research activities to ensure their relevance, appropriateness and likelihood of impact. Progress markers and measures of success were set by the researchers primarily in terms of completing planned tasks rather than impact measures. Progress and achievements are reviewed annually in donor reports. ILRI scientists were held accountable for the overall objective of the project in the form of Medium Term Plan outputs, but it no longer appears under the current format. Specific project deliverables may, however, be explicit in individual scientist's annual work plans and performance evaluations. It is not clear to what extent collaborating scientists and partners are held accountable.

3. Program organization
In the recent phase, the project operated with boundary partners at four levels:

i. National research: to ensure understanding, ownership, capacity, and advocacy of the issue, the direct participation of the relevant national veterinary research institutions and trypanosomosis control agencies was solicited in each country

ii. Local farmer and service providers: Within the study sites, cattle keepers and service providers (animal health technicians, veterinarians, drug sellers) were recruited as individuals and their representing organizations, to participate in the project activities, which often involved not only providing information, but also receiving training.

iii. Local and national policy makers: Local and national stakeholder workshops provided forums to present the issues and involve key actors and policy makers in understanding the problem and analyzing the feasibility of proposed solutions.

iv. Regional and international actors: Contact was maintained through a project newsletter and periodic interaction with relevant international agencies (esp. FAO PAAT, AU-IBAR ISCTRC) and the pharmaceutical industry to keep them informed and solicit feedback on the findings being generated by the project.

4. The decision-support system
An end-to-end, integrated system sounds in part like a code word for what we have termed a systems approach: the problem of resistance cannot be effectively addressed by focusing only on the epidemiological dynamics without addressing farmer incentives to undertake control actions, or policy makers' incentives to provide the appropriate enabling policy or institutional environment. Along our continuum of systems, the status report for the project partners may look something like this:

• Epidemiology of resistance: While we have a crude but robust understanding of the main drivers that lead to resistance, providing the basis for formulating prevention strategies, our knowledge of how to contain and reverse established resistance is still poor.

• Farmer and service provider incentives: Through socio-economic analyses and intervention trials, the project has identified a set of key informational messages and techniques for influencing the practices of those most directly involved in the delivery and use of trypanosomosis control technologies, esp. drugs. While different channels (state services, private sector, NGOs, media) have been proposed through which these products could be disseminated, a clear strategy for accessing these channels has yet to be devised.

• Policy support: Stakeholder analyses have made clear the complexity of perceived interests, and how promoting rational drug use is seen by certain parties as a threat to the professionalism of veterinary services. The strategy adopted is to work with national partners to generate evidence of resistance in a country, use this evidence to raise awareness among stakeholders, and then work with stakeholders to evaluate potential responses.

To tie these together and improve the likelihood of sustained follow-through to the end users, the project promotes ownership and buy-in by empowering different actors: state research and veterinary services to monitor the problem and inform the other stakeholders, certain stakeholder organizations pursuing their interests as lobby groups, pharmaceutical suppliers protecting their markets, and policy makers appreciating the threat to livelihoods and how vested interests may be managed.

5. Learning orientation
The project operates in a learning mode; initial design of project activities is often rather sketchy, and is refined as the project evolves. Annual project meetings are structured around a review of findings from the previous year and discussion of their implications for the activities planned for the coming year. Findings are not always predicted; the advantages of rational drug use, for example, emerged as it was tested and compared to other strategies during the preceding phase. Some risk-taking is encouraged, such as the potentially controversial testing and promotion of rational drug use messages.

6. Continuity and flexibility
A variety of strategies have been incorporated into the project to promote continuity without depending on external support, including:

- Ensuring that managers and technical staff in state agencies (which tend not to change quickly!) are directly involved, and having them present results to national stakeholders to establish their role

- Developing a fairly low-cost and easy-to-apply methodology for monitoring drug resistance accessible to resource-constrained national agencies

- Assigning one such group from one country to backstop the introduction of the methodology in other countries, thereby enhancing regional expertise and ownership

- Preparing and disseminating training materials, including training modules to be incorporated into conventional technical training for professionals and technicians

- Raising awareness among key stakeholder groups so that they may continue to act as lobby groups to maintain pressure for policy action

- Working with the pharmaceutical industry to identify actions and messages that may be in their own interest to promote as part of their marketing efforts

- Exploring with NGOs and other development actors what messages and tools might help to support their own development objectives, as an indicator of their willingness to replicate and promote the messages without additional support.

7. Other insights
A systems perspective is critical to ensure that the project's research findings translate into changed mindsets and practices. Focusing only on working with and disseminating biological/epidemiological knowledge within the regional research community is not likely to lead to impact. Clearly, the problem and potential solutions require understanding and exploiting incentives at all levels, from farmers and local service providers, to professional organizations, public sector technicians and policy makers, and the private sector.

8. Other issues
We are struggling just now with designing components of the new phase of the project related to rolling out the various products from the preceding phase of the project across the region, and undertaking impact assessment to value the returns to the donor research investments made to this research over the years. Although initially conceived as independent activities, we are proposing to integrate the two activities by considering the regional roll-out within an innovation systems framework, i.e. using tools to identify the actors who might be involved in promoting the products and analyzing their strengths, weaknesses, and incentives in doing so, and based on this devise a roll-out strategy. The challenge would be to figure out if we can evaluate how effective this approach is. This would then be integrated into the impact assessment, which will be projecting future uptake of the research results. The idea would be to evaluate how eventual

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impact of the research results—both in terms of its timing and its extent—is influenced by applying an innovation systems-inspired strategy for dissemination and uptake. We would like to have the opportunity to pick everyone's brains on this at some point during the meeting.

Hippolyte Affognon (Benin) is a research associate and PhD candidate in the Institute of Development and Agricultural Economics at the University of Hannover (Germany), with research interests in animal health economics, agricultural project impact assessment and policy studies. Hippolyte is currently finishing his PhD research under the project on trypanocide resistance in the cotton zone of West Africa that is one of the case studies under discussion at this meeting, and may be involved as a post-doctoral researcher on the new phase. His PhD research used a damage control framework for the economic analysis of trypanocide use under risk of drug resistance.

Delia Grace (Ireland) is a post-doctoral veterinary epidemiologist on joint appointment with ILRI and Cornell University, currently involved in a project on the application of risk analysis approaches to zoonotic disease problems in developing countries. Project activities include learning lessons from food safety projects in African and India, elaborating a conceptual framework and methodologies, and developing project proposals. Delia has interest and experience in quantitative and participatory epidemiology, animal health policy and delivery systems, and tropical livestock disease including trypanosomosis. Her PhD research at the Free University of Berlin (Germany) was also a part of the trypanocide resistance project in West Africa under discussion.

Tom Randolph (USA) is an agricultural economist and has been responsible for developing ILRI's research on livestock keeping and human health. His research interests have included agriculture and human nutrition in southern Africa, rice policy and impact assessment in West Africa, and animal health economics generally.

Case Study 4: Enhancing livelihoods of livestock dependant poor people through increasing use of fodder: India

<u>Background</u>
The Project 'Enhancing livelihoods of livestock-dependant poor people through increasing use of fodder was initially designed to run for six years in two three-year phases, starting in October 2002. The Project was justified on the basis that the demand for meat and milk in developing countries is predicted to double in the next 20 years as a result of growth in urbanization and incomes. Such increases in demand potentially present significant opportunities for poor livestock producers to increase incomes and build assets to improve their livelihoods. In India, of the large sections of the population living below the poverty line 150 million are livestock keepers .The lack of sufficient year-round feed is a major constraint to livestock productivity.

The Project was originally based on the premise that the most effective way to address fodder scarcity was to identify and disseminate new, improved varieties of fodder or dual-purpose crops. A whole-farm approach was considered in the selection of technical options to overcome local feed constraints. This would build upon existing work and baseline data to develop site-specific 'baskets of options' and to offer advice to farmers to enable them to select options that

best suit their particular environments. It was envisaged that the Project would have full participation of farmers, local communities and change agents and would involve community meetings, stakeholder workshops and extensive group discussions to identify priorities related to feed constraints and degradation of natural assets. Scaling-up and out would take place through farmer-to-farmer exchanges and the dissemination activities of development organisations partnering with the Project. However, the constraints for scaling-up became clearer and it was realised that there was a greater need to consider the roles that a broader range of actors play within the local cluster.

The focus of the Project accordingly shifted to strengthening partnerships, community involvement and a learning environment, specifically through empowering a multi-stakeholder network to increase the levels of adoption of fodder plants, including dual-purpose food-feed crops, by small-scale farmers.

Project staff investigated a diverse array of partnerships and institutional relationships in terms of their potential to stimulate the adaptation and adoption of fodder innovations in order to scale up and out best-bet technologies. Project staff started to ask the kinds of questions that would facilitate this: What groups of actors need to be involved in raising levels of fodder adaptation and adoption? What patterns of interplay occur between stakeholder interactions/relations, institutional settings and policy goals such as poverty reduction? This re-orientation of project thinking started to yield generic lessons on ways of learning, which in turn was helping to enhance the Project's ability to influence approaches, processes and practices of partners.

Partners were given training in monitoring and evaluation and encouraged to develop their own work plans for activities. They were also encouraged to depart from the traditional seed distribution and demonstration plot activities, and initiate new or innovative ways to scale up the technologies. This allowed for partners to think and work in new ways that challenged the habits and practices that they had become used to.

Findings from key Project activities showed that the issue of addressing fodder scarcity was much more complex than simply providing technologies such as improved germplasm. Analysis of the uptake of an improved groundnut variety indicated the importance of considering the circumstances along with the interactions and other institutional factors of all players in the system. The need for institutional innovations like fodder market were shown to be responsible for the scale-up of fodder technology in irrigated systems.

In March 2005 external consultants at the instance of DFID to review progress and make recommendations on the way forward carried out an output-to-purpose review. The reviewers concluded that considerable progress had been made by the Project but recommended that a clearer conceptual framework would be helpful to assist with operationalisation in future and suggested the use of an innovation systems approach. Accordingly Phase II of the project dealing with the capacity to innovate is being started from January 2007. At the core of this approach is an investigation into the nature of the groupings or networks of individuals and organisations and the factors that affect their ability to work in a systemic, coherent way to bring fodder related knowledge and services into productive use in the specific context of poor livestock keepers.

Application of the Knowledge to Action Criteria

<u>Problem Definition</u>
The problem to be solved was the shortage of fodder for cattle in both dry land agriculture and irrigated areas, which was constraining the poor livestock keepers from enhancing their livelihoods. Initially informal discussions between farmers, researchers, extension specialists and other service providers along with formal surveys were organised. This reinforced the hypothesis that shortage of fodder from dual-purpose crops in dry land areas and planted forages in irrigated tracts was the problem to be addressed. Accordingly a high yielding groundnut cultivar and an improved variety of a perennial fodder were accepted as candidate intervention strategies. However, with the continued interaction of actors and on the basis of results after a couple of seasons it was realized that technology per se, while it was important, was not the problem. It was reconciled that – institutions and actors responsible for the institutions and the knowledge generation and application by them - were the underlying issues to be addressed. Fodder shortage was only a symptom of the complex problem.

Research Management
The Research, "Enhancing livelihoods of poor livestock keepers through improved fodder use", was developed in a Project mode to start with. It had clearly stated outputs, targets etc. During the first year it remained an implementer of research with pre-determined activities aimed at generating technology based solutions to the Project-identified fodder problems. However, from second year onwards the focus changed towards *'Empowerment of a multi-stakeholder network or system'*. That far the Project changed from implementation to a facilitation mode by providing a platform for learning through partnership. The partners who are mostly from civil sector organisations were encouraged to learn from actions and incorporate learnings into subsequent planning. Farmers' field days where partners interacted with farmers; quarterly interactive meetings where different partners interacted among themselves and with the Project and - multiple stakeholder platforms where all concerned actors across public, private and civil sectors – have decided the action plans, goals and targets for the Project.

Program Organization
The civil society partner organisations like Dairy unions, NGOs and para-statal organisation like NDDB (National Dairy development Board) served as boundary organisations. As facilitator, the Project also took upon itself the boundary spanning function by organising learning fora at local, Project and National level where research scientists, other public, private and civil sector personnel participated. The initiative organised and facilitated multi stakeholder platforms as safe spaces for learning across actors of unequal influence and power. It is planned to enhance the use of such platforms in phase II (although not necessarily with the same partners from Phase I) of the Project to understand and address issues at local level and to generate influence at policy level.

Decision-support system
The project with its emphasis on capturing multiple actor perspectives or empowering a multi-actor coalition can be seen as a prelude to developing an end-to-end integrated system. The initiative is learning to account for the non-linearity of the innovation process. In one of the case studies where different groups of a community innovated an institutional arrangement in the form of 'leasing' small areas of land for fodder production, the Project studied and characterised the experiential capacity build-up process that entailed the innovation. The lessons from the case might be useful for targeting other areas and in designing a decision support system.

Learning Orientation
Yes the Project has experimental orientation. The approach of the Project after its first year changed from knowing to learning and to this end it analysed both success and failure. The successes and failures were identified on more than technological criteria such as yield. For example a technology like hybrid napier grass which requires intensive irrigation management was considered a useful intervention in the context of small farmers because it provided for a "win-win" partnership between the better off and the 'constrained' small farmers. Based on these findings and subsequent review by the donor agency, the project changed from a project centric focus to a learning-by-doing focus. In 2005, an external review of the Project acknowledged the positive shift to the new approach, and agreed with the Project that consultation with the multiple actors should also include facilitation activities to help arrive at a shared

understanding/perspective by way of designing solutions through not only technology, but also institutional arrangements.

<u>Continuity and Flexibility</u>
Project experiences have taught us that skills capacity could be a constraint for learning oriented Projects. The types of skills (particularly soft-skills) are required to help facilitate and re-orient new ways of doing things. A critical mass of persons with these skills are required for the learning process.

Implications and Conclusions

The criteria presented above were helpful in assessing the project interventions and evolution of learning with respect to addressing the problem of fodder scarcity. Four of the six criteria - Problem definition, Research management, Learning Orientation and program organization were found to be most relevant in evaluating the knowledge to action transition in the project. While fodder is known to be a major constraint of poor livestock keepers, many of the poverty alleviation programs in India have limited their focus to single intervention such as provision of low-cost credit to help farmers for purchase of animals ignoring the other inputs necessary to maintain productive livestock management systems. In addition, the State Departments of Animal Husbandry were mandated to deliver animal health and artificial insemination services while ignoring the importance of fodder related services. Considering these points, and that fodder research programs in India have historically addressed the fodder shortage issue with improved germplasm, the importance of the institutional issues have not been highlighted. As such, reference to the criteria used for evaluating Knowledge to Action will help redefine fodder research for addressing the issue of fodder scarcity - the main focus of the Fodder Innovation Project (Phase II).

The concept of offering "safe space" is a very useful principle and has already been adopted by the project. Any interventions dealing with 'institutional change' must have a mechanism where (in spite of unequal influence or conflicting mandates) actors are able to freely air their views and contribute to an unrestricted process of problem solving. A clear and direct focus on the importance of the actors and their orientation within a network is an important lesson from the project that can be included into the knowledge to action paradigm. The ability for exchange of both codified and tacit knowledge between the range of actors allows for understanding of one another's priorities/mandates, and develops links that help facilitate the generation and application of knowledge.

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