QUESTIONS AND ANSWERS:

AGRICULTURAL INNOVATION SYSTEMS

AND

RESEARCH AND EXTENSION

March 2016

QUESTIONS AND ANSWERS: AGRICULTURAL INNOVATION SYSTEMS AND RESEARCH AND EXTENSION

Report prepared by:

Dr. Vickie Sigman
Senior Agricultural Extension Advisor, Modernizing Extension and Advisory Services Project

MEAS, Modernizing Extension and Advisory Services
www.meas-extension.org

Leader with Associates Cooperative Agreement No. AID-OAA-L-10-00003.

The report was made possible by the generous support of the American people through USAID. The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States government.

TABLE OF CONTENTS

CONTENTS **PAGE**

ACRONYMS

AIS	Agricultural Innovation System
AKIS	Agricultural Knowledge and Information Systems
AR4D	Agriculture Research for Development
CAHW	Community Animal Health Worker
Compete	Agricultural Research Competitive Grants Program
CIMMYT	International Maize and Wheat Improvement Center
CIP	Crop Intensification Programme
CRG	Competitive Research Grants
DFID	United Kingdom Department for International Development
DIV	Development Innovation Ventures
DNEA	National Directorate of Agrarian Extension
DNSV	National Directorate of Veterinary Services
FHH	Female-Headed Household
FOS	Focus on Scaling
FSR	Farming Systems Research
FSR/E	Farming Systems Research and Extension
CGIAR	Consultative Group for International Agricultural Research
IIAM	Instituto de Investigação Agrária de Moçambique
imGoats	Small Ruminant Value Chains to Reduce Poverty and Increase Food Security in India and Mozambique
ILRI	International Livestock Research Institute
IP	Innovation Platform
MAGA	Ministry of Agriculture, Livestock, and Food
NGO	Non-governmental Organization
RDO	Rural Development Organization
RIU	Research into Use
SDAE	District Services for Economic Activities
SMS	Subject Matter Specialists
SPER	Provincial Services of Rural Extension
SPP	Provincial Livestock Services
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

To develop informed recommendations in support of strengthening extension performance and impact in Mozambique within an AIS framework, this paper investigates four key questions. Can the Agricultural Innovation Systems (AIS) framework be used to improve coordination between research and extension? Can it be used to strengthen research and extension performance for greater impact? How has the framework been applied in low-income countries? What roles might extension play in AIS? Background discussion of the AIS framework and current thinking about innovation processes contextualizes answers to these questions.

BACKGROUND

The AIS framework provides an analytical structure for examining innovation processes. While there are no blueprints for developing innovation systems, there are options for stimulating innovation within the framework including removing constraints and creating incentives for the adoption of technologies and practices, developing the capacity to innovate, and investing in research and extension to support innovation. Innovation funds, using competitive and matching grants, are a mechanism to finance options for stimulating innovation.

Forward thinking about innovation asserts that something is not an innovation until it is actually used, that is put into practice in the real world. Based on this thinking, research results—even though promising—are not an innovation until they are actually used. The idea of putting research into use has catalyzed much of the thinking about AIS and innovation. The AIS framework, however, is particularly weak in guiding efforts to expedite scaling and use or adoption of innovations. This area is the historical realm of extension but less work has been collaboratively carried-out between research and extension to address these weaknesses than is needed. The historical disconnect between research and extension continues to negatively impact efforts to get improved technologies and practices into the hands of and used by stakeholders who need them: farmers, processors, traders, and others along the value chain. Examination of innovation processes has shown that agronomic research is often not the key driver of innovation as innovation is not only technology (e.g., improved seeds, drip irrigation), but also has organizational (e.g., new ways of organizing groups or new ways of organizing production) and institutional (e.g., new or revised institutional set-ups or policies) dimensions. A hallmark of AIS is that a re-ordering of relationships and interactions between stakeholders is typically needed for innovation or change to occur. This suggests a re-ordering of the relationship between research and extension is pivotal to accelerating innovation and facilitating the use of innovations.

The dominant practical application of AIS is via Innovation Platforms (IPs). IPs operationalize a key premise of AIS: that increased interaction and more effective relationships among stakeholders around an idea, theme, or topic will result in better flow of information and ideas and better ways to solve related problems. IPs are now widely-applied to a range of topics from commodity and horticultural crops, livestock, to conservation agriculture. Many are initiated (and largely managed) by research organizations, although individuals or other public, private, or civil society organizations can initiate a platform.

Innovation brokers perform particularly important roles in IPs. They facilitate the identification of demand, help build networks, provide technical backstopping and capacity building, and carry-out overall management of IP innovation processes. Extension agents have traditionally carried-out various roles within the context of innovation brokering and it can be argued that innovation brokering is thus a natural precedented, albeit expanded, role for public, private, and civil society sector extensionists. However, with some exceptions, brokers mentioned in the literature are typically non-extensionists from research organizations or NGOs.

The development of IPs, while tending to follow a replicable pattern, is a dynamic and often iterative process which is influenced by the political (institutional) environment in which IPs operate. Power dynamics among stakeholders, the need to address new issues—through adaptive research or otherwise--that arise as the IP evolves, and the need to develop capacity of IP stakeholders are a few of the challenges IPs face. As well, IPs encounter challenges similar to those of projects having different implementation structures such as misdiagnosis of key critical constraints and opportunities, weak communications with stakeholders, failure of experiments undertaken or strategies applied to solve problems, weak reporting and M&E systems, and limited evidence of impact.

KEY QUESTIONS

To answer the key questions noted above, the paper reviews five IPs, four implemented in Africa (Nigeria, Malawi, Rwanda, and Mozambique) and one currently being implemented in Guatemala. All cases are public-sector research/project activities. All five were, or are, being led by researchers. Extension service providers are NGOs or the public-sector. NGOs were, or are, the major players in extension activity in three of the five cases. Private-sector providers were not involved in any of the cases. Conclusions and recommendations are drawn based on analysis of the five cases.

Can the Agricultural Innovation Systems (AIS) framework be used to improve coordination between research and extension? A point to be considered is whether coordination is between research and NGO extension or research and public-sector extension. For the cases examined there is no clear pattern of the effect of using an AIS framework, operationalized through IPs, on research and extension coordination. And there is insufficient information to determine reasons for this. Coordination between research and public-sector extension appears to have improved in one case, is unlikely to have improved in another, and did not improve in another. Public-sector extension was inexplicably minimally involved in one other case and it is too early in the life of the project to assess any improvements in another case. Coordination between research and NGO extension did improve in one case but did not in another. The AIS framework provides a window of opportunity to strengthen research and extension coordination, particularly via joint participation in IPs. However, improved coordination needs to be an objective of the IP and must be backed by appropriate incentives for both research and extension.

Can the AIS framework be used to strengthen research and extension performance for greater impact? The IPs examined neither targeted nor specifically reported on strengthening research and extension performance for impact. Based on cases reviewed, there is a mixed picture of the effect of using an AIS framework, operationalized as an IP, on research and extension performance. In one case,

such use appears to have strengthened performance, in another it apparently did not. In another case applying the framework likely had little effect and in another it likely strengthened research and extension performance. And, in one case it is too early determine any effects. Further focused study is needed to clarify the conditions under which the AIS framework, more specifically IPs, could be used to strengthen research and extension performance for impact.

How has the framework been applied in low-income countries? There are a few examples of using innovation support facilities designed as delivery mechanisms to coordinate action for innovation. By far the most frequent operationalization of the AIS framework in practice is via IPs and the framework has been dominantly applied in low-income countries as operationalized through IPs.

What roles might extension play in AIS? Extension has been playing a number of roles important within the AIS framework and should continue to do so. However, a shift in extension thinking to encompass the wider-arena of AIS is needed. The role of innovation broker represents a challenging and newer role for extension. To realize the role will require capacity development for extension brokers of innovation and substantial organizational and institutional changes in extension and research organizations to support such a role. Extension as an institution has a very challenging conceptual role to play in collaborating with research to address the scaling gap in the AIS framework by creating a vision within the framework of how to get to scale. A related and new role for extensionists, that of scaling subject-matter specialist, would bring extension focus to designing and operationalizing scaling activities and would require significant support to achieve.

AN EMERGING MODEL

An output of analysis by other authors of various IP cases, including several reviewed in this paper, resulted in a proposed model of agricultural innovation for impact at scale (Gildemacher & Mur, 2012). The model is not focused on IPs but on the larger process of agricultural innovation with the explicit intention of including scaling.

Referred to in this paper as the Focus on Scaling (FOS) model, FOS identifies three actions leading to three types of results (Gildemacher & Wongtschowski, 2015). Identifying opportunities and needs leads to identification of entry points (e.g., ideas, problems to be solved) for innovation. Experimentation under real-life realistic conditions to test and adjust entry points (e.g., technologies, new market relations, new ways of collaboration) leads to tested and tried promising new technologies and practices. Bringing into routine use (or adoption) involves further adaptation leading to impact at scale. Further adaptation to reach scale could include localized adaptation of the technologies or practices themselves; training or organization of producers, traders, and service providers; policy changes; and other organizational and institutional changes.

The model accentuates the experimental and adaptive nature of the innovation process. This has practical application for program planning. Projects charged with taking innovations to scale must plan for experimentation and adaptation of technologies and practices. Even though technologies and practices have been proven in one context, their application in different contexts may result in identification of contextual issues to be resolved through further adaptation.

RECOMMENDATIONS

Informed by the above, the paper puts forward the following recommendations:

Recommendation One: Focus on scaling and on public-sector extension.

Develop the Capacity to Innovate. For sustainability, to leverage extension experience, and to build government capacity to innovate, prioritize capacity development for public-sector extension.

Supporting recommendations are:

- Design and deliver an AIS capacity development program for selected extension staff at national, provincial, and district levels. The program should focus on preparing a cadre of innovation-savvy extensionists ready to promote innovation. Participants should be able and equipped to exploit ICT to support their AIS work. The program should strengthen the extension system's capacity to manage internal organizational change and to coordinate a pluralistic extension system.
- Provide specialized training in innovation brokering for selected extension staff to prepare them for leading existing and/or future IPs.
- Investigate the feasibility of and requirements for integrating earlier discussed extension scaling subject-matter specialists, within the extension system (DNEA or SPER level).
- Convene an extension-led AIS community of practice to include other AIS actors.
- Establish a virtual learning platform to advance learning about AIS and to encourage exchange of related experiences.
- Embed an innovation expert in DNEA to support DNEA in moving the AIS agenda forward.

Design, Test, and Document a Scaling Activity. The model to take innovations to scale, earlier discussed and referred to as Focus on Scaling (FOS) in this paper, is a prototype. In order for public-sector extension to develop expertise in scaling within the AIS framework, practical resourced experience in doing so is needed. Within the priority areas of USAID agricultural activity, there are technologies and practices that need to be identified, adapted, and/or taken to scale. There are likely already technologies and practices that have been identified but yet need to be further adapted to local conditions and transitioned to scale. To address these needs requires the input and expertise of both extension and research. Supporting an activity based on the FOS contributes to meeting these needs and has the potential to demonstrate improved research and extension coordination and improved performance for impact. Supporting recommendations include:

- Engage both research and public-sector extension, clearly tasking extension with activity leadership and overall responsibility while promoting joint cooperation between extension and research.
- Finance a mechanism to support extension leadership and joint research and extension cooperation.
- Use pilot-tests to transition promising technologies and practices to scale.
- Charge the activity with including women in all processes.

- Integrate IPs into the design, taking into account lessons learned and previous research and extension experience in promoting innovation processes.
- Ensure opportunities for extension to demonstrate the utility of using extension innovation brokers in innovation processes.
- Document and widely-disseminate to AIS stakeholders lessons learned through designing and testing the activity.
- Include activity documentation and learning in the extension AIS capacity development program.

Recommendation Two: Invest in the AIS system.

An AIS assessment is recommended to inform actions to build the capacity of the system as a whole. A first step is to identify the key actors and elements in the system and the strengths and weaknesses in their capacities to innovate.. The assessment will help to inform and pinpoint next steps in building system capacity which steps could include some of the following.

- Strengthening farmer groups, associations, and cooperatives.
- Improving access to agricultural credit and financial skills training to processors, traders, and input suppliers.
- Linking larger agricultural projects with smaller efforts to experiment with problematic elements of the larger project (e.g., marketing, input supply development, aggregation of products, new processing practices).
- Reviewing ongoing agricultural projects against guiding principles for innovation processes, earlier discussed, to assess interventions suitable for promoting innovation.
- Supporting the engagement of the Mozambican Forum for Agricultural Extension Services, a forum designed to share information and increase professional interaction among extensionists, in AIS activities.
- Establishing an IP to address the complex problems and challenges of research and extension coordination.

Recommendation Three: Experiment with various funding mechanisms.

- Create an office-wide Innovation Support Project to test-out and adapt innovative solutions to extension, AIS, and other economic development challenges.
- Use competitive and matching grants to target innovative ideas for strengthening extension performance.
- Co-fund collaborative extension and research activities to facilitate coordination, help balance power relationships between the two, and combine the relative strengths of each to address target issues and problems.

1. AGRICULTURAL INNOVATION SYSTEM (AIS)

1.1 KEY QUESTIONS

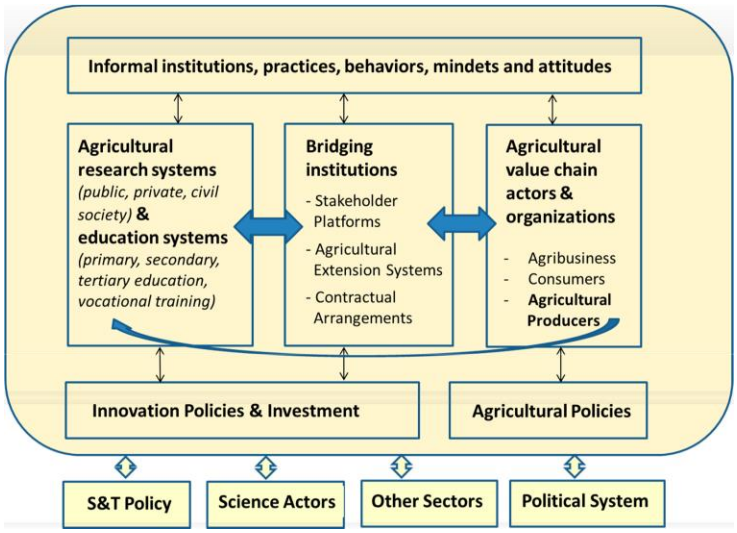
To develop informed recommendations in support of strengthening extension performance and impact in Mozambique within an AIS framework, his paper examines four key questions. Can the AIS framework be used to improve coordination between research and extension? Can it be used to strengthen research and extension performance for greater impact? How has the framework been applied in low-income countries? What roles might extension play in AIS?

1.2 KEY CONCEPTS

1.2.1 AIS

An AIS consists of "a network of actors or organisations, and individuals together with supporting institutions and policies in the agricultural and related sectors that bring existing or new products, processes, and forms of organisation into social and economic use" (Tropical Agriculture Platform [TAP], n.d., p. 1). Formal and informal policies and institutions shape the way actors jointly learn, interact, generate, share, and use knowledge (TAP, n.d., p. 1). An important distinction between this definition and some earlier definitions is that the former includes both *existing and new* products, processes, and forms whereas others (Rajalahti, Janssen, & Pehu, 2008) consider only *new* products, processes, and forms.

Figure 1.
A Conceptual Diagram of an Agricultural Innovation System



Source: Aerni, Nichterlein, Rudgard, and Sonnino (2015) adapted from Spielman and Birner (2008).

Figure 1 shows the various elements in an AIS. Central to AIS is the idea that the system involves much more than 'doing research'. It is the linkages, interactions, relationships, capacities, influences, and learnings among the elements that contribute to determining system operation, outcomes, and impact. An expected outcome of AIS, broadly speaking, is innovation (Klerkx, van Mierlo, & Leeuwis, 2012). Spielman, Ekboir, Davis and Ochieng (as cited in Klerkx et al., 2012, p. 468) characterize a well-functioning AIS as:

- Learning within and among firms and organizations in order to innovate
- Strengthening capacities (individual and collective) to innovate
- Both demand and supply-driven science and technology

- Innovation agents managing complex interactions
- Network-based knowledge dissemination (both tacit and codified knowledge)
- Decentralized management of innovation processes

The Global Donor Platform for Rural Development (2013) recently noted that some donors are moving towards incorporating AR4D (Agriculture Research for Development) into the broader concept of AIS (p. 10). The Donor Platform recognizes the diversity of actors and roles in the agricultural innovation process including AR4D, rural advisory services (public, civil society, and private advisory support), and agricultural education and training. This is noteworthy. AR4D, as a research-driven approach, tends at best to place the role of extension and advisory services (and thus the widespread dissemination or scaling function) in subsidiary positions to research whereas AIS in theory stresses the importance and inclusion of all actors and functions in the system. Indeed, one of the core features of AIS thinking is the understanding that innovation or change typically involves a re-ordering of relationships and interactions between stakeholders (Leeuwis & Aarts, as cited in Gildemacher & Mur, 2012, p. 11).

The language of AIS is in itself interesting. While not always the case, there are tendencies to rename or rebrand previously used development literature language. In particular, the dissemination function of extension is often referred to as scaling up or scaling out and adoption is often referred to as use, application, or uptake of something. From an extension perspective, although extension is included in AIS diagrams, there is a sense in the literature that research is most interested in reaching farmers or other stakeholders directly. Because there are insufficient numbers of researchers to reach farmers and others directly (a problem well-known to extension), extensionists end-up working directly with farmers and to an extent, linking them with researchers, a process often criticized within AIS thinking as being too linear.

There are a number of reasons innovation systems fail to perform: Different incentive systems for public, private, and civil society sector actors; differences between indigenous knowledge and formal science-based knowledge; and social and cultural differences that exclude certain actors. In short, in real life, actors in the system do not necessarily understand each other. They belong to different worlds which have their own languages, cultures, and incentive systems. Research and extension are prime examples of this.

1.2.2 Innovation

Innovation is discussed in terms of process and product. Agricultural innovation is the process of creating and putting into use agricultural practices, new to a particular environment (Gildemacher & Wongtschowski, 2015, p. 3). In the Diffusion of Innovations, Rogers (2003) defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (p. 12). Of considerable practical importance are the definitions and descriptions of innovation that clearly assert that something can only be considered an innovation if it is actually applied, that is, put into use (Leeuwis & Van den Ban, 2004). Thus, a research result showing the potential of a practice is not an innovation per se (Gildemacher & Wongtschowski, 2015, p.3). Agronomic research is often not the key driver of innovation as innovation is not only technology, but also has organizational and institutional

dimensions. Examples of these include: technology (seeds, planters, backpack sprayers, drip irrigation); organizational (new ways of organizing groups, production and/or consumption); and institutional (new or revised institutional set-ups, partnerships, or policies) (Nederlof, Wongtschowski, & van der Lee, 2011, pp.13-14). In this context, widely-held differentiations between institutions and organizations suggest institutions are the 'rules of the game' (both the formal legal rules and the informal social norms governing individual behavior, ways of working, and structuring social interactions) while organizations are groups of people and the governance arrangements they create.

Inclusive innovation is a concept emerging within AIS thinking. Some conceptualizations emphasize the inclusion of the poor in defining problems to be addressed and in contributing to developing solutions and suggest that for innovations to be inclusive, the poor must be able to adopt and benefit from them (Foster & Heeks, 2013). Others emphasize a pro-poor approach that equally values and incorporates the contributions of all stakeholders, including marginalized groups, and specifically identifies the need for collaboration between civil society, governments, and private sector actors (Oxfam, n.d.).

Guiding principles for innovation processes have been identified in the innovation literature (Woodhill & Wennink, 2014, p. 35). These are widely-discussed in the literature, excluding perhaps the principle of gender equity and inclusion which receives less attention. They are:

- Innovation is an on-going process that evolves over time and space. It can occur at different levels (e.g., local, national, regional, or international).
- As a multi-stakeholder process, innovation involves a broad array of actors including farmers, researchers, extensionists (from public, civil society, and private sector), processors, traders, input suppliers, local authorities, and other value chain actors and supporters.
- Learning is central to innovation processes and learning processes for innovation can be designed and facilitated. Failing is part of the learning process.
- Different stakeholders bring diverse types of knowledge to the process.
- The context (e.g., policies, institutional frameworks, development programs, infrastructure for stakeholder interaction) in which innovation is occurring is critical and can enable or constrain innovation processes.
- The balance of power between stakeholders needs to be actively managed as there are imbalances due to gender, age, caste, health, economic status, etc. which can inhibit innovation processes.
- Gender equity and inclusion needs increased attention throughout the whole AIS.

1.3 EVOLUTION

The concept of innovation systems is not new. Rather, it can be traced back to ideas articulated in the 1800's by various economists investigating the influence of technological change on productivity and the social and economic effects of technological change (Spielman, 2005). Since the 1960's, various frameworks including Technology Transfer, Farming Systems Research (FSR), and Agricultural Knowledge and Information Systems (AKIS) have developed and have to some extent contributed to the latest framework iteration of AIS. These three earlier frameworks are highlighted below.

- **Technology Transfer**, well-known as the linear system whereby researchers develop technologies which are given to extensionists who disseminate them to farmers, began around the 1960's and continues today. This technology supply push system, although not without its successes, is weak in developing technologies that fit the contexts in which different categories of farmers operate. Thus, within the framework of Technology Transfer, extensionists were sometimes in the unenviable position of promoting technologies that were not appropriate for the farmers with whom they were working. Technology Transfer was not attuned to the role of markets, focusing more on the technology push side. The Training and Visit Extension System (Benor & Baxter, 1984) is often put forward as typifying a Technology Transfer approach.
- **FSR** gained significant traction in the late 1970's-1980's, and focused on fielding multidisciplinary teams to diagnose farmers' constraints and needs in order to better target research efforts and develop technologies to overcome constraints identified. Part of the participatory research movement, FSR increased farmer participation in the research process and strengthened research/farmer linkages. FSR ultimately was termed FSR and extension (FSR/E). Even so and arguably, extension played a limited role in FSR/E as reflected in the title of a seminal work on the subject *Farming Systems Research and Development: Guidelines for Developing Countries* (Shaner, Philipp, & Schmehl, 1982) and confirmed by Byrnes (1989). The approach succeeded less-well than expected in producing new technologies that were widely adopted, left research and extension linkages underdeveloped, encountered numerous implementation and institutional problems, and its sustainability in light of dwindling donor financing was questioned resulting in its diminished standing on the international development agenda (Byrnes, 1989; Norman, 2002; Heinemann & Biggs, 1985).
- **AKIS**. Weak linkages between research and extension have long been a systemic problem and have had a negative impact on agricultural development. Part of the AKIS approach asserts that research and extension should not be seen as separate institutions which must somehow be linked but rather should be seen as participants in a single AKIS (Röling, 1990). Röling (1990) defines an AKIS as follows:

  > An AKIS is a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in such processes as the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of knowledge and information, with the purpose of working synergically to support decision making, problem solving and innovation in a given country's agriculture or a domain thereof (p. 1).

  As the precursor to AIS, AKIS focused attention on strengthening interactions between actors in the knowledge system, recognizing farmers as important actors in the system, and emphasizing the wide-range of actors in the system – not just research and extension. In these respects, AKIS is not so different from AIS. Rivera and colleagues (Rivera, Alex, Hanson, Birner; 2006) suggest AIS did not take advantage of the experiences and lessons learned through development and implementation of AKIS and maintains that the two approaches developed to some extent in parallel, with AKIS influenced by an extension perspective and AIS by a research perspective. A critique of AKIS asserts that the approach was still fixated on methods of passing information to farmers (Hall, 2007, p.7).

2. OPTIONS FOR STIMULATING INNOVATION

2.1 INVESTMENTS AND INTERVENTIONS

While there are no blueprints for developing innovation systems (World Bank, 2006), there are various options for investments and interventions to stimulate innovation within the framework of AIS. Understanding the context in which investments and interventions are to be implemented is critical and guides selection of best fit options. This is a first step investment: an analysis of the AIS, its strengths and weaknesses, and identification of priority areas to be targeted for improvement. Some additional key areas likely to warrant investment are[1]:

- **Removing constraints and creating incentives for the adoption of technologies and practices.** General constraints include lack of understanding of land rights; inadequate markets, transport, and input supply infrastructure; and limited access to credit and other financial services. These are organizational and institutional constraints to innovation. Lack of technologies and practices developed and adapted for local conditions and use are also likely to be a constraint. Removing constraints to adoption of specific push technologies and practices (e.g., orange fleshed sweet potato) requires specific studies to first understand the context as well as studies to identify constraints from user perspectives (not only farmer perspectives but others involved in the value chain) coupled with interaction among AIS stakeholders to problem-solve innovative ways to address constraints identified. Natural resource management and climate change technologies and practices that are costly for farmers to adopt need to be incentivized. Strengthening local organizations such as farmer groups, associations, cooperatives, and other community-based organizations can help to overcome barriers to adoption. Strong local organizations can facilitate farmers' access to markets, providing incentives to innovate.
- **Developing the capacity to innovate.** Capacity development at individual, organizational, and enabling environment levels is needed. Individual capacity development relates to all individuals in organizations and communities; organizational to all public, private, and civil society organizations; and the enabling environment to the broad system in which organizations and individuals operate including the institutional and policy framework (FAO, 2010, 2014). Among others, problem-solving, learning about how to learn and ways of sharing that learning, understanding of AIS concepts, how to deal with complexity and change, and ways of engaging in multi-stakeholder processes are capacities that need to be developed and/or strengthened.
- **Investing in research and extension to support innovation.** As part of capacity development, these organizations, and the individuals in them, also need a reorientation toward AIS including the concept that the plethora of actors in AIS—farmers, extensionists, researchers, processors, traders, local authorities, educators, the private sector, etc.—are all important players with roles

[1] This section draws largely from FAO, (2014), *The state of food and agriculture: Innovation in family farming*. Rome: FAO.

to perform in AIS. Investing in research capacity to adapt research carried-out by other countries to domestic circumstances may have high pay-off as may funding farmer-led and managed experimentation with technologies and practices. Investing in public-sector and other extension organizations capacity to manage internal organizational changes needed to facilitate innovation is a priority. Developing public-sector extension capacity and investing in public-sector extension finances to coordinate a pluralistic extension system and ensure that advisory services provided by the private and civil society sectors are of high quality contributes to innovation processes. Later discussed herein, capitalizing on extension as innovation brokers represents a key investment in the overall process of stimulating innovation.

Further to the above, the World Bank (2010) suggests investing in additional types of intervention to promote innovation. These are listed in Table 1 along with examples of investments.

Table 1. Investments and interventions that warrant strengthening in many agricultural knowledge systems.

FOCUS INVESTMENT/ACTIVITY	EXAMPLES
Focus on **Joint Action** – organization of stakeholders at diverse levels	• National innovation committees/council • Industry–agribusiness–(sub-)sector level associations, coordination committees, or boards • Producer organizations
Enhancing interaction, learning, and **knowledge flow** within organizations and across organizations and sectors.	• Information venues such as annual consultation/knowledge-sharing workshops, stakeholder platforms (consultative, planning, integrative) • Virtual platforms, web interface • Sector or industry networks • Knowledge brokers with appropriate skills and tools
Focus on **outcomes**—putting ideas to use	• Technology transfer units, technology fairs • Pilots of new technologies and practices in partnership • Training for professional skills, market understanding, entrepreneurship, intellectual property rights (IPRs) • Innovation funds and technology incubators • Technology foundations for transfer and commercialization
Private sector's role as a significant player and innovator—requires capacity and incentives for all actors	• Innovation funds, incubators, matchmaking services to bring partners together • Lower transaction costs—organization of actors • Training, internships programs, university-industry curricula • Units for special services and communication

Source: R. Rajalahti (World Bank, 2010).

2.2 INNOVATION FUNDS: AN INVESTMENT MECHANISM

National governments, donors, and the private sector including farmers all invest in agricultural development and innovation. Innovation funds are a particular mechanism for channeling funds to target innovation. Competitive grants and matching grants are two main instruments used. The former often fund research, although they could as well fund extension and/or collaborative research and extension activities.

The United States Agency for International Development's (USAID) Development Innovation Ventures (DIV) uses competitive grants (combined with cost-sharing) to pilot and test innovative ideas and scale those that are cost-effective and have high probability for widespread success. A distinctive feature of DIV is the rigorous testing that occurs to inform decision-making regarding scaling. To address

significant agricultural constraints faced by farmers in northern Ghana, a project is being implemented using a randomized control trial "to measure the impact of varying combinations of three innovative agricultural interventions, namely: (1) assured access to commercial drought index insurance at varying prices; (2) assured access to good-quality input technology packages; and (3) a community-based mobile extension service" (USAID/DIV, 2015). This exemplifies DIV investments in innovation.

Although not considered at the time as innovation funding per se, Mozambique has experience using Competitive Research Grants (CRG) to fund research. The goal of the USAID-funded Mozambique Agricultural Research Competitive Grants Program (Compete) was to strengthen the capacity of Mozambique's agricultural research system to cost effectively promote the adoption of improved agricultural technologies (ARD, 2010). The project was designed to develop the capacity of IIAM (Instituto de Investigação Agrária de Moçambique), Mozambique's national research institution. The majority of program funds were provided to directly fund agricultural research grants, although part of the funding for each grant was earmarked for the development of extension materials. While commendable, the development of extension materials created some unresolved issues relative to the role and activities of research and extension. It seems some researchers felt they were spending too much time on extension materials rather than doing research. Accomplishments of Compete included, among others, linking research to the broader agricultural community and the use of participatory research models (ARD, 2010). However, the extent to which technologies and practices developed and/or adapted through the project were adopted, that is used, by targeted clients is an unknown.

The World Bank (2010) uses innovation funding to support innovators and their links with public, private, and civil society sector actors and institutions. Funds are granted based on the eligibility, relevance, and quality of proposals submitted. The following, based on World Bank (2010), highlights aspects of their innovation fund investments.

- CRGs focus on research capacity and efficiency and are designed to stimulate scientific creativity. They may be linked to an agricultural research fund open to various potential contributors. While they are called CRGs, documentation indicates they can be used for technology transfer activities (p. 5). This is usually within the context of a research program. World Bank funded CRGs have been shown to strengthen public research systems and universities and research and industry collaboration (Independent Evaluation Group, 2014).
- Matching grants are typically used to fund the promotion of near-market technology generation, extension and adoption of technology, and overall adoption, often in grants including multiple stakeholders. In Ghana, CRGs were used to develop farmer-based organizations including rehabilitation of facilities and strengthening group capacity through training.

An innovation platform *is a space for learning and change. It is composed of a range of actors (e.g., farmers, processors, traders, local authorities and leaders, researchers, and extensionists) who come to together to identify problems and opportunities around areas of mutual interest and find ways to address problems and build on opportunities identified.*
(Source: Adapted from Tui et al., 2001 & Ekboir, 2012).

3. APPLYING THE AIS FRAMEWORK: INNOVATION PLATFORMS

3.1 Overview

The AIS framework provides an analytical structure for examining innovation processes and has led to various diagnostic studies. It is short on application in the real world. Currently, Innovation Platforms (IPs)[2] are the primary practical application for putting AIS into action (Nederlof et al., 2011). There is an extensive literature on IPs and numerous key documents are referenced herein.[3]

IPs address a key premise of AIS: that increased interaction and more effective relationships among the array of stakeholders will result in better flow of information and ideas and better ways to solve problems, all needed for innovation to take place. Platforms focus on a range of areas from commodity and horticultural crops, livestock, to conservation agriculture. Many are initiated (and largely managed) by research organizations, although individuals or other public, private, or civil society organizations can initiate a platform.

It is increasingly recognized that individual or teams of innovation (or knowledge) brokers are critical to moving platforms forward. Innovation brokers are more than facilitators of meetings. They facilitate demand articulation, build networks, and manage innovation processes (Leeuwis & Van den Ban, 2004). They perform important functions for innovation platforms ranging from facilitating quality interactions between actors, linking and strategic networking, technical backstopping, mediation, advocacy, capacity building, financial management and reporting, and documenting learning (Heemskerk, Klerkx, & Sitima, 2011). Innovation brokers need specialized professional skills, and typically related training, to perform these functions.

Extensionist have traditionally carried-out many of the responsibilities of innovation brokers such as articulating demand, linking, technical backstopping, mediation, and capacity development. Various responsibilities of innovation brokers are reflected in the definition of agricultural extension: Extension services facilitate the access of agriculture stakeholders (men and women farmers and their families, their organizations, and other innovation system actors) to knowledge, information, and technologies; facilitate their interactions with each other and with partners in relevant organizations (e.g., research,

---

[2] IPs have also been referred to as multi-stakeholder platforms, innovation networks, or innovation clusters. IPs is the term used herein.

[3] For further references see: http://www.meas-extension.org/resources/innovation-platforms,

education, agribusiness, banks); and assist them in developing their own technical, organizational, and management skills and practices related to their agricultural environment (adapted from Davis & Heemskerk, 2012). Thus, it can be argued that innovation brokering is a natural precedented, albeit expanded, role for extensionists from the different sectors and their organizations. Nonetheless, while there are exceptions, most brokers mentioned in the literature are non-extensionists from research organizations or non-governmental organizations (NGOs), with few from the private sector.[4]

Platforms are context specific and as such the silver bullet model for their development, implementation, and evaluation does not exist. There are however principled actions underlying successful IPs that are widely-discussed in the literature (Posthumus & Wongtschowski, 2014). These are:

- Engage an inclusive range of men and women actors
- Focus on a shared problem or opportunity, rather than the agenda of a few members
- Develop a shared vision of purpose, articulation of incentives, and understanding of AIS concept
- Make certain changes resulting from the innovation benefit multiple categories of members
- Keep communication and learning at the center
- Be transparent; remain flexible
- Ensure a skilled innovation broker facilitates the platform[5]
- Work toward initial success to motivate platform member commitment
- Develop ways to monitor and evaluate progress

The development of IPs tends to follow a similar pattern depicted in Figure 2 (Tui et al., 2001). An idea or question or complex problem leads to platform initiation whereby the broad area the platform is to tackle, stakeholders, and broker/facilitator are identified. Platform members come together to discuss and determine a finer-tuned focus and identify problems and opportunities related to the focus. This is a time of gathering related information from various sources and sharing of that information. Options to address problems and opportunities are discussed and plans detailing the way forward are made. Roles and responsibilities are to be defined. Options could include technical issues (seed potato production), organizational issues (arranging for bulk marketing of potatoes) and/or institutional issues (potato seed certification or policy to open neighboring country borders to potato trade). Solutions need to be tested and refined under user conditions and in cases, developed (trade policy). The IPs role here is to coordinate experiments, facilitate roles and responsibilities definition, monitor progress, and troubleshoot bottlenecks with platform members. Developing the capacity of different actors in the platform to successfully implement solutions is critical. The IP helps members to identify capacity

---

[4] Incentives for private sector brokering may be limited, particularly during IP establishment.

[5] It has been suggested that innovation brokers should operate from a position of neutrality. Reasons this would be challenging in practice are: the very large majority of brokers are funded by projects/activities that support the facilitated IP or represent a specific group in the IP (e.g., farmers or their representatives). Concerns for biased brokers could be addressed through training and professional development.

needs, including ways of working together in IPs, and finds means to address needs. Successful innovations are to be taken

to scale. Analyzing and reflecting on what has worked and what has not is key learning that needs to occur and be used to inform platform practice. Again, this is part of the platforms responsibility.

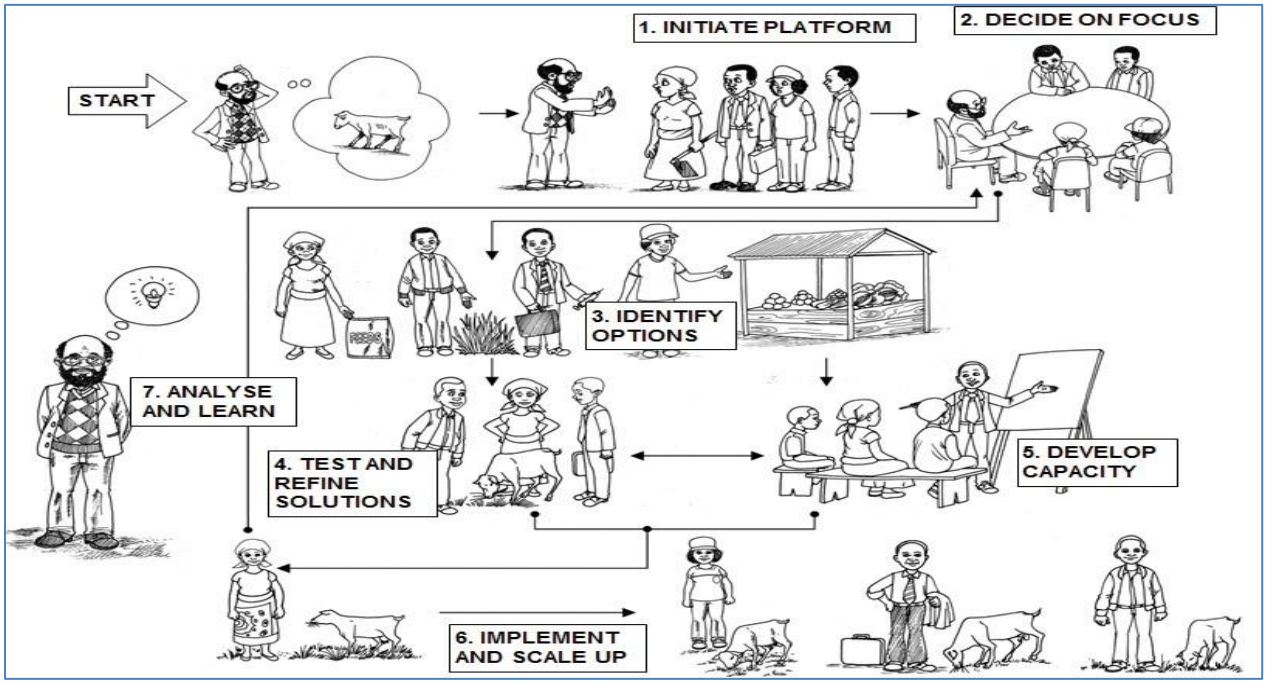


Figure 2. Innovation Platforms Tend to Follow a Seven-Step Cycle.
Source: Tui et al., 2001, p. 3.

The figure gives a delightful, concrete, and very useful depiction of the process. Nevertheless, it is particularly difficult to diagram the dynamics and difficulties of IP development. The process is far more iterative and challenging than may be construed from a static depiction. For example, platform members may not get along, power dynamics among them may create social, technical, and/or institutional problems, and/or members may lose interest if it is not clear what they gain from participation (incentives); testing and refining solutions are likely continue to occur throughout the process as new issues and problems arise; the original focus of the platform may be modified as the process unfolds; and capacity development as well as analysis and learning should occur throughout the process.

Taking innovations to scale, that is getting them used, has been and continues to be a distinct and pervasive challenge. It has been asserted that a vision for how to get to scale is missing in innovation system thinking (Gildemacher & Mur, 2012, p. 169) of which IPs are a part.

3.2 CASE EXAMPLES

To focus more explicitly on the key questions asked at the beginning of this paper and offer insight into the range and types of IPs from an extension perspective, particularly with the view of how public,

private, and civil society extension service providers are, or are not, involved, a review of three mini-cases and two more in-depth cases of IPs is provided. Mini-cases review IPs from Nigeria, Malawi, and Rwanda. These three cases are selected because they were implemented in Africa, focus on a variety of themes applicable to Mozambique, are evidence-based, are structured to capture comparable information across cases, and show a range of results. The more in-depth cases are from Guatemala and Mozambique. The former is selected because the IP approach is itself innovative and the author has direct experience with the platform and the latter to provide a specific case from Mozambique. Elements analyzed across cases include: focus, purpose, scope, implementation, actors, accomplishments, whether IP activity resulted in improved research and extension coordination and/or strengthened research and extension performance and impact, and challenges. The analysis of these case elements is meant to inform IP practice in Mozambique.

3.2.1 Mini-Cases

The three cases are part of the United Kingdom Department for International Development (DFID) funded project Research Into Use (RIU) in operation from 2006 to 2012. The overarching purpose of RIU was to investigate ways to scale up successful innovations in agricultural research, many resulting from the previous 10 years of DIFID-funded research (1995 to 2005), and learn about how to improve the contribution of research to agricultural development. The following draws heavily on information reported in a results-focused study of RIU commissioned by DIFID (Gildemacher & Mur, 2012). Responses to the questions related to research and extension (R/E) coordination, performance, and impact are based on the study but were not necessarily investigated in the study.

Cowpea Value Chain Innovation Platform, Kano State, Nigeria
(Emechebe, Ugbe, Sanni, Jokthan, & Philemon, 2012)

Table 2. Cowpea innovation platform, Nigeria	
Focus	Cowpea, most important food legume crop; supply driven activity as technologies to be scaled, already proven successful, little need for experimentation
Purpose	Increase cowpea production and improve productivity; improve storage and reduce post-harvest losses; improve management and utilization of cowpea fodder
Scope and Level	Target 200 communities; 100,000 cowpea farmers; one state-level platform operated across six (including Kano) of Nigeria's 36 states
Implemented by	RIU Nigeria Country Office collaboratively with federal research agency, Agricultural Research Council of Nigeria
Actors	Public research and extension organizations, local government, private sector (jute bag makers, banks, input suppliers), NGOs (farmer associations, women's marketing association)
Accomplishments	• Increased productivity: control group 53% targeted households 86% • Storage practices (triple bagging) adoption rate: control group 0% targeted households 71% • Fodder compactor • utilization rate: control group 0% targeted households 7%
Improved R/E coordination?	Public extension agents received training of trainers from RIU then held agronomic and storage training for farmers and conducted village-level demonstrations; they engaged with farmers and interfaced between RIU and farmers; role in platform meetings unclear
Strengthened R/E performance?	As reflected in accomplishments and actors involved, yes; extension appears to have played a considerable role in realizing impact as technology already developed; IP effective in achieving technology transfer at scale
Challenges	Fodder management required more experimentation than other interventions, resulting in limited adoption; farmers not active in platform-level decision-making, their role restricted to receivers of specific extension services; stakeholders' capacity to innovate questionable, RIU acted as primary facilitator, little investment in capacity to innovate as technologies already developed; platform functioned to bring technologies and practices to scale not so much as a mechanism to address constraints and opportunities

Overall, through the Cowpea Value Chain IP in Kano, Nigeria, it appears the availability of seeds, inputs and bags, combined with direct interaction (farmer-to-farmer and extension agent demonstrations) has been an effective approach for upscaling research results (Emechebe et al., 2012, p. 37). The IP had a positive impact on cowpea production and storage at the household level.

Nyagatare Maize Innovation Platform, Nyagatare District, Rwanda

(Mur & Audet-Belanger, 2012)

Table 3. Maize innovation platform, Rwanda	
Focus	Maize for food security, focus of government Crop Intensification Programme (CIP), CIP distributes subsidized fertilizer, improved seed, supports land consolidation; early emphasis on productivity (in-line with CIP) then to storage and marketing; experimentation with farmer-run maize trading group and with a warehousing/credit system; overall focus on farmers
Purpose	Introduce value chain and market-oriented thinking; promote farmer entrepreneurship; enhance maize sector actor interaction
Scope and Level	83 platform members representing estimated 1000 households; one district-level platform operated in one district
Implemented by	Largely RIU collaboratively with Rwanda Development Organization (RDO), a national NGO (RDO also formal implementing agency of the CIP program)
Actors	Cooperatives, traders, financial institutions, RDO provided extension and other services, [Rockefeller Foundation, n.d.]) district government agronomists, seed multipliers
Accomplishments	New varieties introduced but adoption poor, farmer and cooperative leaders trained, demonstrations established, increases in productivity per/ha but relative higher increase for control than for platform members; area planted to maize increased for platform members as compared to control (difficult to attribute accomplishments to RIU/platform because RDO and sector agronomists providing services as part of CIP and as part of platform activities)
Improved R/E coordination?	Does not appear to have improved R/E coordination but improved relations between actors in the chain as a whole
Strengthened R/E performance?	CIP accomplishments (e.g., increased productivity) represent improved performance and impact but attribution of this to the project, research and/or extension is unclear; contribution of platform to performance and impact likely limited; some evidence that IP contributed to improved capacity to innovate
Challenges	Capability of platform to develop post-harvest and marketing solutions limited; IP focus on farmers limited interaction with others such as processors, traders; weak communications between platform level cooperative representatives and the members they represent; reporting and monitoring weak; platform was externally driven and funded, unable to facilitate innovation without external inputs; impact of maize investment group and warehousing/credit system limited

The IP contributed to improved interactions between farmers, traders, NGO service providers, and district administration. It identified value chain issues and initiated, coordinated, and implemented experimentation with technological and market options (Mur & Audet-Belanger, 2012, p. 130). However, its development as a facilitator of innovation was weak and would require outside support to move forward. Although production at the household level increased, this could not be attributed to the IP because a major government effort (CIP) to improve the maize sector in Rwanda was occurring at the same time in the same area in which the IP operated.

Malawi Pig Sector Innovation Platform

(Bymolt & Wennink, 2012)

Table 4. Pig sector innovation platform, Malawi	
Focus	Pork, due to increase in number of smallholders raising pigs as a livelihood strategy and growing demand for processed pork; key constraint identified was linkages between supply and demand; interventions focused on building four marketing facilities with abattoirs, farmer cooperatives to manage the facilities
Purpose	Build an IP to facilitate sustainable partnerships and coalitions and identify and develop interventions to improve the pork value chain
Scope and Level	Four districts (districts similar to US county); target of 19,800 pig farmers would use the four market facilities established; one district-level platform operated across four districts
Implemented by	Primarily RIU with farmers; platform chose one facilitator to link platform with farmer associations in each of the four districts
Actors	Ministry of Agriculture & Food Security for policy and representative from Animal Health and Livestock Development; university research; producers (farmers, pig club members, piggery associations later formalized as cooperatives); various private sector (feed, cold storage); NGOs; marketing, credit and insurance organizations (public-sector extension involved though not listed in the documented list of actors)
Accomplishments	RIU grants supported farmer associations in construction of four market facilities built to expected quality standards; limited capacity development delivered by public extensionists on group dynamics, agribusiness management, and meat processing; public extension linked producers to some institutional buyers, particularly NGOs; platform facilitators received facilitation training (two facilitators from extension services)
Improved R/E coordination?	R/E coordination does not appear to have improved; public-sector extension and farmer association links reinforced due to government services interest in professionalizing cooperatives as part of national policies
Strengthened R/E performance?	Very little impact at household level; farmers who benefited lived close to the market, or had good transport, or were close to cooperative leaders; IP did not contribute to capacity to innovate
Challenges	Insufficient funds to support platform member determined plans; farmers lacked production skills, training for pig husbandry not funded as technologies supposedly already available and being used (critical error in original diagnosis of key constraints); target for users of market facilities grossly overestimated; weak cooperatives; clubs making up membership of cooperatives needed to be strengthened; cooperatives lacked skill in market operation and promotion

While the potential for changes in the coordination in pig value chains was created, the potential was not realized and the IP is now dormant. The building of the slaughter and market facilities motivated associations to formalize as cooperatives and for some pig farmers to become more serious and professional about marketing pigs (Bymolt & Wennink, 2012, p. 160).

3.2.2 Guatemala: Buena Milpa

Introduction

Discussions beginning in mid-2015 between the International Maize and Wheat Improvement Center CIMMYT and the Modernizing Extension and Advisory Services (MEAS) project resulted in a collaborative activity to examine the extension landscape in which the four-year USAID/Guatemala Feed the Future Buena Milpa[6] project operates and to assess ways to strengthen extension activities of the Buena Milpa project. CIMMYT, headquartered in Mexico, is one of fifteen research centers in the Consultative Group for International Agricultural Research (CGIAR). As part of its efforts to develop sustainable intensification options for and with smallholder farmers in maize-based farming systems, CIMMYT leads the Buena Milpa project. MEAS, based at the University of Illinois, engages in action-oriented research and outreach efforts to strengthen agricultural extension systems in developing countries to effectively serve the food security and economic development needs of resource-poor men and women farmers. Driving the CIMMYT/MEAS collaboration was the objective of bringing extension expertise from MEAS to link and engage with a traditionally research-focused institution, CIMMYT, via the Buena Milpa project which CIMMYT leads. The rapid review was carried-out over a two-week period in late 2015 in the Western Highlands of Guatemala through literature review and fieldwork interviews with extension and research stakeholders and Buena Milpa staff. In addition to the elements of analysis examined in the mini-cases, the Guatemala case views—through an AIS lens—the identified challenges Buena Milpa faces and provides detail on ways to address challenges identified.

Background

Extension. Extension activity began in Guatemala in the 1950's. Among other factors, Guatemala's long and violent civil war precipitated the closure of all public-sector extension in Guatemala in 1990. The country's Ministry of Agriculture, Livestock, and Food (MAGA), established a new system in 2013. This system provides the framework for a country-wide pluralistic, demand-driven extension system with MAGA's Rural Extension Services central to and anchoring the system. The basic approach of MAGA extension is farmer-to-farmer. Through a cascading training system, MAGA extensionists are trained to develop the capacity of volunteer farmers, called promotors, who work with organized groups of farmers to develop their capacity and to carry-out agricultural activities aimed at improving the overall well-being of men and women farmers and their families. In a short time, MAGA has recruited and posted over 1,000 extensionists across Guatemala's municipalities, an administrative division similar to a US county. Each municipality has three extensionists. Each focus on one of three themes: system management and supervision, family farming, or healthy households including nutrition.

Buena Milpa Project. The Buena Milpa project which commenced in 2015 came about largely as a result of collaboration between New Seed (Semilla Nueva), a U.S. based grass roots NGO working in

---

[6] Buena in Spanish means good. Milpa is a Mesoamerica cropping system traditionally producing maize, beans, and squash. Milpa also refers to a field. As used for the project, the name generally refers to good field, good maize field or crop, or sometimes, good maize/bean field/crop.

sustainable agriculture development in southern Guatemala; CIMMYT; and the Institute of Science and Technical Agriculture (ICTA), Guatemala's national research institution. These entities were interested in innovation systems and research to development projects.

Focus

The Buena Milpa project is meant to be a scaling out activity—which implies a major emphasis on extension activities. Previously studied technologies, practices, processes, and models are to be scaled out. To avoid a technology-driven project, these technologies, practices, processes, and models are to be adapted based on farmer and other stakeholder needs and input. The project focuses on three technical areas: (1) milpa-maize germplasm improvement, (2) natural resource conservation in farming systems, and (3) maize-based farming systems and diversification. It also focuses on two enabling environment process areas: (1) agricultural innovation systems and (2) social inclusion. The latter stresses the inclusion of those previously excluded, women in general and indigenous men and women in particular.

Purpose

The project's original objective was to contribute to the reduction of poverty, food insecurity, and malnutrition, while increasing sustainability and resilience of maize-based farming systems in the Western Highlands of Guatemala. Maize growers in the highland are less involved in maize production for the market than for consumption, thus the objective was shifted from reducing poverty to increasing food security.

Scope

The operational area of the project is the five Feed the Future focus districts in the Western Highlands of Guatemala. Information on the target number of farmers is not available.

Implementation

CIMMYT leads the project with a CIMMYT employee heading the project in Guatemala and CIMMYT Mexico providing technical backstopping. The conceptual framework for the project is the AIS. AIS is described by the project as "AIS is a concept that describes the organization of interacting and evolving groups of stakeholders (farmers, extension agents, researchers, institutions, companies, etc…) that work together around a common agricultural problem to stimulate innovation and change towards solving the problem" (Buena Milpa, n.d., p. 6). Buena Milpa staff do not work directly with farmers. Rather, the project has developed an IP[7] of collaborating organizations which implement, along with farmers, the

[7] Buena Milpa refers to this body as an "innovation network" to distinguish it from the term "innovation platform" used by a larger CIMMYT-led project in Mexico (MasAgro) which functions somewhat differently than the Buena Milpa network but informed the development of Buena Milpa. The Buena Milpa network performs functions largely as an IP and is referred to as such in this document.

research-related and much of the extension work of Buena Milpa. This differentiates the Buena Milpa IP from others that hire their own extension agents or deliver extension through a few selected NGOs.

Buena Milpa IP collaborators (also referred to as members) are not sub-contracted entities per se. The project manages a small grants program to finance collaborator activities. The general idea is to utilize the strengths of different actors in the IP, along with farmers and their groups, to jointly learn, refine, test, and promote the uptake of innovations (technologies, practices, and processes). The primary role of Buena Milpa is that of innovation broker as well as research contributor. The voice of farmers is to be indirectly captured by the NGOs in the IP, a majority of whom work primarily with indigenous populations. In essence, Buena Milpa's extension approach is embodied in its IP with IP members' approach to extension generally following that of the national system: a cascading system whereby extensionists are trained to train volunteer promotors who subsequently train farmers in their groups.

Actors

Actors in the Buena Milpa IP are listed in the table below. Buena Milpa works closely with Guatemala's national research institution ICTA, an IP member, to fine-tune existing technologies, practices, and

Table 5. Buena Milpa collaborators, November 2015

Organization	Role
MAGA, Ministry of Agriculture, Livestock, and Food	Government ministry dedicated to agricultural development; among other departments, includes a department of agricultural extension.
ICTA, Institute of Science and Technical Agriculture	Semi-autonomous government research organization dedicated to agricultural investigation.
ASOCUCH, Association of Organizations of the Cuchumatanes	An association of organizations that works to develop resilient and diverse farming systems through both participatory investigation and a network of farmer organizations.
CDRO, Cooperation for Rural Development of the West	Community-based association of various organizations providing various services to association members while focusing on social inclusion and the participation of all members of the community.
SerJus, Legal and Social Services (Servicios Jurídicos y Sociales)	Advocacy and service organization supporting various legal, economic development, health, education, and other development activities.
Save the Children	International NGO that shares the goal of diversifying farming systems through demonstration parcels and training sessions.
AgExport, Association of Guatemalan Exporters	Export market for smallholder vegetable and other producers.
ASODINE, Integrated Development Association (Asociación de Desarrollo Integral)	Assists farmers in vegetable production and commercialization with the support of AgExport.
ADIPO, Integrated Development Association for the West	Works directly with farmers to assist in the administration of sustainable projects that focus on community health, agriculture, and education.
ADIES, Integrated Development Association Sacapulteca	Work directly with farmers to improve onion production and food security among the communities in which they are involved.
Helvetas	A Swiss intercooperation organization that promotes basic rights of marginalized groups by supporting services provided by governments and other development organizations.
The Nature Conservancy	International NGO focused on making smallholder farming systems more productive and resilient to climate change through demonstration parcels and collaboration with other extension systems.

Source: Based on personnel communication, Lisa Eash, Semilla Nueva/Buena Milpa, November 2015.

processes and/or troubleshoot researchable problems that arise as technologies, practices, and processes are implemented in the field. Senior ICTA staff have championed Buena Milpa's approach to implementation. With the exception of ICTA, collaborating organizations focus largely on extension activities. Collaborators may however be involved in validating or experimenting with technologies and practices along with ICTA and farmers. IP members propose activities to Buena Milpa that meet their goals and interests and that are in-line with Buena Milpa's. For example, the establishment of maize seed banks, re-introduction of traditional vegetables in the farming system, and poultry projects to improve farm diversity and diets have been proposed by IP members for implementation.

Accomplishments

The Buena Milpa project has organized an inclusive team of experienced men and women from different disciplines and ethnicities to staff its Guatemalan office. Survey work on socio-economic status of farmers in the areas of Buena Milpa operation has been carried-out and will continue as will diagnostic work to identify farmer needs and preferences related to the technical areas of Buena Milpa focus. A lengthy process of identifying collaborators, explaining the Buena Milpa project to them, and forming an IP of initial collaborators has been accomplished. The IP brings together researchers, extensionists, and other development workers from both government organizations and NGOs. This represents a major achievement. Buena Milpa has held meetings, workshops, and capacity development events and has developed a small grants program to support IP members' work. Efforts to develop typologies of farmers based on their farming system are underway. Extension training to strengthen IP member extension staff capacity has been developed and delivered and includes training on maize improvement, natural resource management, farm-system diversification, and extension methodologies . Training and communication strategies have been developed to guide the work of Buena Milpa. Plans are to also develop capacities of researchers and farmers. Other extension events, such as rural fairs, have been held and informational brochures have been developed. The project has been in operation for about one year. Achievements related to scaling out have yet to be accomplished and will be key to Buena Milpa success.

Improved Research and Extension Coordination?

Buena Milpa has established an IP in which research and extension organizations are well-represented. For extension organizations, representatives from all three sectors—public, private, and civil society—are included in the platform with fewer private sector representatives than public and civil society representatives. This may be due to the focus of Buena Milpa, considered to be less on markets than on genetic diversity and natural resource management issues.

Within the limited time available for the review, only very preliminary conclusions about the success of the IP to improve research and coordination can be made. The structure for coordination is in-place as are the actors. Researchers and extensionists are interacting and in some cases planning to carry-out activities together (e.g., validation of improved bean seed). But, there are three major challenges that Buena Milpa must address to secure improved research and extension coordination and increase impact. All relate to the three dimensions of innovation earlier discussed herein. All have political, or as

per AIS language, institutional dimensions and the third has technological, organizational, and institutional dimensions.

Related Challenges

- ***Politicized Context.*** The most frequently heard critique of public-sector extension in Guatemala is that it is highly politicized. Critique centers largely on claims that extension staff positions are distributed based on party affiliations, resulting in hiring extension staff who do not have the requisite qualifications and in subsequent poor service. Reports indicate staff are compelled to campaign for or otherwise promote a given party or candidate/official. The distribution of inputs, or other goods, in which extension is involved is politicized, with those in the "right" party receiving them and others less so. Politicization is viewed as endemic in Guatemala, not only applying to extension services. Politicization creates resentment and distrust among the different actors engaged in extension and the AIS as a whole. This is a hard-core context in which AIS actors need to interact and develop relationships, making coordination between research and extension and among extension organizations all the more difficult.
- ***Distrust and Lack of Confidence.*** Given the above politicized context, the different actors in the AIS often do not trust each other, and/or have little confidence in each other. Underlying this distrust and lack of confidence is the reality that although the Peace Accords were signed in 1996, Guatemala is still viewed as a post-conflict country with all the negatives associated with such a situation. Further, NGOs are generally better resourced than public-sector extensionists which tends to create tensions. Questioning whether international donor resources should flow to government institutions or NGOs brings out related sensitivities. There are NGOs who are essentially unwilling to work with public-sector extension based on historical and trust-related issues and differing philosophies of development; others simply do not engage with public-sector extension for reasons such as the challenges associated with doing so. Some extensionists advise it is difficult to develop trust with the farm families they work with and that trust is critical to their work. This all seems not so much a distrust of individuals working in public-sector extension as it is of the government they represent.
- ***Organization of Research and Extension Processes.*** ICTA and MAGA have some experience working together in promoting production of ITCT-tested technologies. Per their current diagram of the research process, ICTA engages with extension in the last promotion and production (or transfer) phases of the research process. Extensionists must be involved earlier in the process, at testing and validation phases, in order to facilitate learning and the exchange of ideas among farmers, extensionists, and researchers. Per the diagram of the research process, ICTA testing/validation is carried-out on-farm with farmer evaluation of the technology and with ICTA's evaluation of the rate of acceptance of the technology. While ICTA should continue its role, it is recommended that extensionists be involved in meaningful ways at these early stages in order to learn experientially about the technology prior to its promotion, to engage with farmers in these processes, and to provide feedback to ICTA regarding the technology. This exemplifies changes needed to facilitate innovation and calls for new ways of organizing research and extension work along with new ways of working together emphasizing

joint learning and altering the 'rules of the game' institutional framework in which this work occurs. The current positive relationship between ICTA and extension, which is based on their experiences of working together and in the IP, coupled with the influence of ICTA champions who support Buena Milpa's implementation approach via the IP, lends optimism to aspirations that at least some changes and ways of working together can be achieved. While Buena Milpa can provide financial support and a project structure to facilitate short-term changes, funding and a supportive environment needed for longer-term change may emerge as particularly challenging constraints.

Building trust among IP members is a very high priority challenge. This is a particularly thorny challenge given the context. A way to begin addressing it is to investigate trust and collaboration theories and approaches (see Kramer & Tyler, 1996; Mattessich, Murray-Close, & Monsey, 2001; Sloan & Oliver, 2013; Wood & Gray, 1991). These may provide insights as to possible ways to build trust among IP collaborators. Trust-building possibilities could include openly discussing the issue and its impact on mutually-shared Buena Milpa and collaborator goals; experimenting with team building exercises; and actively modelling trust in relationships with collaborators. Building trust well-reflects the institutional dimension of innovations, that is, the 'rules of the game', the informal social norms governing individual behavior, ways of working, and structuring social interactions.

Strengthened Research and Extension Performance for Greater Impact?

It is too early in the life of the project to determine whether the Buena Milpa IP will strengthen research and/or extension performance for greater impact. There are a number of key challenges to be met in order for Buena Milpa to achieve this strengthening. These challenges are associated with the three dimensions of innovation: technological, organizational, and institutional. Challenges along with recommendations to address them are noted below.

Related Challenges and Recommendations

- **Innovation Systems.** Innovations systems concepts are not well-understood by IP collaborators and need to be clarified. Convening members to define and develop shared understanding of concepts is suggested, along with disseminating documented results of deliberation. The development of an IP strategy is needed to clarify IP vision, purpose, leadership structure and responsibilities, and financial resources available as well as to articulate clear roles and meeting and policy guidelines for participation (e.g., how will decisions be made and who will make them). Buena Milpa should promote and measure IP and IP activity diversity by integrating gender issues in all Buena Milpa training, developing an on-line short course focused on gender issues for use by IP members, and trying-out the Women's Empowerment in Agriculture Index to supplement Buena Milpa's existing strategy for measuring diversity in its efforts. As the project progresses, it may prove useful to provide additional capacity development in innovation brokering for those engaged in brokering processes.
- **Delivery System**. The organizations involved in the IP, and particularly the extensionists and the promotors and farmer groups they work with, are categorically critical to Buena Milpa success.

The key challenge is in finding the right organizations and people and ensuring they are well-prepared for their roles. It is recommended that IP members, including research and extension, collaboratively develop criteria to select these entities and people; that extensionists in particular, be amply trained for success in identifying and training promotors and in the technical aspects of the jobs they are to perform; and that adequate follow-up and monitoring of progress and problems be consistently provided. Recommendations to address the challenge of sustaining volunteer promotor participation focus on implementing a recognition program to acknowledge their contributions, supporting exchange visits and study tours, and exploring possibilities of promotors providing for-fee goods and services to their farmer groups (such as vegetable seedlings).

- **Capacity Development.** There are plans to develop capacities of extensionists, researchers, and farmers over the life of the project. Capacity development for extensionists is considered a first priority, has begun, and is the focus of this section. Other capacity development efforts have yet to be undertaken. Effective capacity development of extensionists is essential to achieving Buena Milpa objectives. Recommendations to strengthen existing extension training raining include: adopting a learning theory, improving learning diagnostics, including extension theory and nutrition in the curriculum, inviting Healthy Household Extensionists (typically women) to participate in training, including sections on facilitating reflection as a learning process and on joint learning, and in addition to existing measures, developing participants' personal narratives to document training impact. To respond to IP requests for additional training, a training exchange program is recommended whereby IP collaborators participate in each other's existing trainings.
- **Technologies, Practices, and Processes.** There is a lack of clarity in what is to be scaled out. This is prescribed to an extent by the three technical focus areas of the project: (1) milpa-maize germplasm improvement, (2) natural resource conservation in farming systems, and (3) maize-based farming systems and diversification. The challenge of determining what to scale with whom may be examined in two complementary ways. One, is for Buena Milpa to identify the already proven technologies, practices, and processes that Buena Milpa expects to offer and around which extensionists will engage with promotors, farmer groups, and others. The second is to facilitate farmer, and other key stakeholder, identification of their needs, preferences, and constraints related to the three technical focus areas and/or to the specific technologies, practices, and processes within focus areas and identify related entry points for interventions. Allowances must be made for responding to farmer identified needs and preferences and for further development and testing. This is critical in AIS. An important tension in the Buena Milpa project is the expectation of the existence of technologies ready to be scaled out compared with the emphasis on carrying-out further research for adaptation to local contexts. Small pilots to trial run a particular technology, practice, or process are recommended to work out the "bugs" in the system before efforts are undertaken to go to scale.
- **Politicized Maize.** There are issues related to genetic property rights that impact maize seed development. Indigenous populations in the operational area of Buena Milpa may view maize breeding activities as a threat to their native maize and thus to their culture. Mitigate this

possibility by using best practices in approaching communities such as involving local leaders and locals experienced in maize breeding activities, obtaining permission of community authorities, and emphasizing transparency in community relationships.

- **Balance between Research and Extension.** For historical and other reasons, achieving the appropriate balance between research and extension activities related to scaling out efforts represents a challenge. Recommendations suggest developing a typology of research to extension activities to track and report Buena Milpa activities in light of the typology and involving extensionists early in the ICTA validation of technology process in order to facilitate learning and the exchange of ideas among farmers, extensionists, and researchers.
- **Headquarters and Field Linkages.** Often a challenge in any organization, increasing opportunities for communications between headquarters and the field is needed. Recommendations to increase opportunities include scheduling video conference calls, announcing in advance the schedule and purpose of scientists visiting from headquarters, requesting that scientists brief local staff on results of their visits, implementing collaborative planning sessions, and sharing work plans.
- **Greater Impact via Increased Coverage.** Suggested actions to achieve greater impact through increased coverage are: engaging more with government structures, particularly MAGA which has more field staff than all other collaborators; inviting farmer apex organizations to directly participate in the IP; encouraging selected farmer group members to become promotors themselves and subsequently organize additional farmer groups; enhancing collaboration with USAID's Western Highlands Integrated Program; and including ICT training in extension training along with a competitive grants program to fund IP member use of ICT in extension activities.

3.2.3 Mozambique: Small Ruminant Value Chains to Reduce Poverty and Increase Food Security in India and Mozambique (imGoats)

Introduction

With funding from the European commission/International Fund for Agricultural Development, the imGoats project, a two and one-half year project, commenced in January 2011 and was completed in June 2013. This paper is concerned with the imGoats project in Mozambique and analyzes the same elements in the imGoats case as those earlier identified for mini-cases and for the Guatemala case. The analysis is based on an in-depth review of available project documentation and research reports, many of which are available at the imGoats website https://imgoats.org.[8]

---

[8] See also: Boogaard, Hendrickx, & Swaans (2012); Boogaard & Moyo (2015); Boogaard, Swaans, Hendrickx, & Cosijn (2013); Boogaard, Waithanji, Poole, & Cadilhon, (2015); Hendrickx (2013); Swaans, Boogaard, Bendapudi, Taye, Hendrickx & Klerkx (2014); Swaans & Hendrickx (2014); and National Steering Committee Reports and Innovation Platform Reports available at https://imgoats.org/documents/

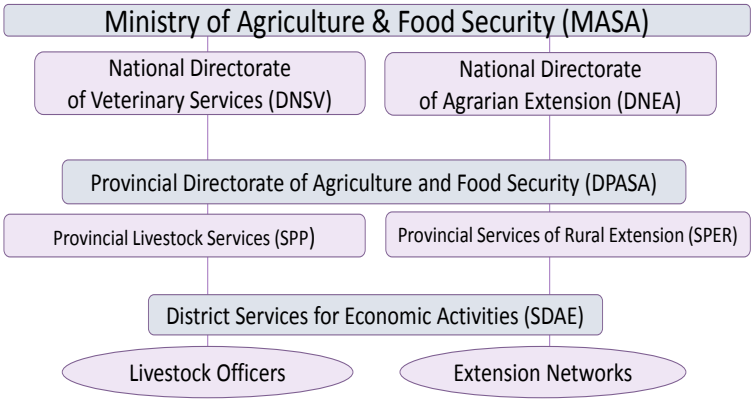
Background on Extension

Mozambique promotes pluralistic, decentralized, and market-oriented extension services. Mozambique's public-sector extension service, formally institutionalized in 1987, became operational after the close of civil war in the early 1990's (Gêmo & Rivera, 2001; Eicher, 2004). Beginning in the late 1990's, extension has been guided by Extension Master Plans effected through major national investment programs. The latest of these programs is a redesigned National Agrarian Extension Program (PRONEA). Among other issues, PRONEA highlights the need to improve the effectiveness and quality of supply-driven public extension, to develop demand-driven public extension including promotion of private and civil society extension providers, to promote innovative extension models, and to strengthen research and extension linkages (Gêmo & Davis, 2015). An important dimension of the Public Unified Extension System, which has been on-the-ground since 1999, is the consolidation of the work of generalists front-line extension staff to include crops, livestock, and agro-forestry activities.

The work and levels of operation of two Ministry of Agriculture and Food Security (MASA) directorates are of particular relevance in understanding the context in which the imGoats project operated. As shown in Figure 3, these are the National Directorate of Veterinary Services (DNSV) and the National Directorate of Agrarian Extension (DNEA), both under MASA. DNSV, the veterinary services, are primarily responsible for provision of expertise, technical, and methodological backstopping on complex livestock issues such as prevention and control of animal diseases and controlling cross-border traffic of animals whereas relative to livestock, DNEA extension has overall responsibility for ensuring extension and communication competence in co-managing and implementing relevant livestock extension activities focusing on small livestock species under close collaboration with DNSV (Gêmo, personal communication, February 2016).

At the provincial level, the Provincial Livestock Services (SPP) and the Provincial Services of Rural Extension (SPER), as well as other agriculture provincial services, function under the Provincial Directorate of Agriculture and Food Security (DPASA). Provincial-level subject matter specialists (SMS) for livestock and other services should work closely with SPERs and with extension networks at the district level. However, the availability of SMS varies from province to province.

Figure 3. Partial Structure of Ministry of Agriculture & Food Security



Source: Adapted from Gêmo & Chilonda (2013) & H. Gêmo, personal communication, Feb 2016.

At the district-level, livestock officers and extension networks (i.e., a team of extension agents) operate under the District Services for Economic Activities (SDAE). SDAEs are responsible for diverse economic

activities in the district including those related to agriculture and livestock. While there is typically one livestock officer at the district level, the numbers of extensionists in networks varies widely by district with up to eight in a district, usually far fewer. District-level extension reports to both the SDAE and the SPER.

Focus

Within the focusing framework of AIS and inclusive innovation, imGoats focused on improving the goat value chain in its area of operation; strengthening goat keepers participation in the chain (particularly women goat keepers); and increasing participants' benefits from engaging in the chain. This was to be accomplished primarily through establishing a pro-poor goat IP and implementing related activities within the context of the IP. In terms of livelihoods diversification, the intention was to commercialize goat production in order to increase incomes and asset accumulation. The project had an underlying research focus with various research surveys and other studies undertaken over the life of the project, a number of them conducted by Wageningen University faculty and graduate students and/or International Livestock Research Institute (ILRI) staff. Learning and reflection were important aspects of the project focus. Explicit efforts were made to facilitate learning and reflection among IP members.

To refine the focus on the goat value chain, IP members identified the major constraints along the chain from their perspective. These were prioritized first by identifying constraints shared by most IP members and second by ranking the three most important constraints. The IP initially focused on the resulting three constraints listed below, along with responses to constraints. The need for communal grazing emerged from later discussions among IP members. Constraints are also categorized in the table by innovation dimension.

Table 6. Focus of IP activity

Constraint Identified	Response	Innovation Dimension[9]
Lack of animals	Improve production	• Technological (improving goat husbandry) • Technological and organizational (improving animal health services—delivered by CAHWs)
Weak organization of producers, particularly for marketing	Strengthen marketing approaches	• Organizational (supporting animal aggregation and goat fairs, linking with new potential buyers) • Technological and institutional (introducing weighing scales as a marketing tool and standard to inform live-weight based sales)
Insufficient infrastructure	Improve infrastructure	• Technological (establishing treatment and slaughter areas, improving kraals/shelters)
Lack of communal grazing areas	Establish and manage communal grazing areas	• Institutional (developing/enforcing communal grazing legislation) • Organizational (establishing management associations)

[9] Adapted from Swaans et al. (2014).

		• Technological and organizational (providing guidelines/training on communal management)

Purpose

The overall purpose of the project was to increase incomes and food security in a sustainable manner by enhancing pro-poor small ruminant value chains in Mozambique. Two objectives framed the project: to pilot test organizational and technical models that strengthen goat value chains and to document and promote evidenced-based models for sustainable, pro-poor goat value chains.

Scope

The project was implemented in Inhassoro District, Inhambane Province, Southern Mozambique. With a budget of around USD .5 million, the project targeted 500 households in 18 villages representing about 3800 beneficiaries.[10] Given its focus on inclusive development, women and other groups such as households living with HIV/AIDS and female-headed households (FHH) were to be included in the target group (ILRI, 2011b).

Implementation

ImGoats was led by ILRI, the CGIAR system international research center which focuses on livestock, and carried-out in collaboration with the international NGO CARE. ILRI provided overall leadership and coordination while CARE concentrated on field-level implementation. ILRI staff functioned as innovation brokers, as did CARE staff, and researched various issues to facilitate IP progress. CARE had been working in Inhassoro in a project within which imGoats could be integrated and had specific experience training paravets (Community Animal Health Workers [CAHW]) to treat cattle. This experience would eventually contribute to the training of goat CAHWs.

National Steering Committee. To support implementation, imGoats convened a National Steering Committee comprised of key organizations/agencies having a stake in livestock development. The Committee was tasked with providing strategic guidance to the project, helping to communicate lessons from the project, and assisting with scaling up and out (ILRI, 2011a). Representatives from IIAM, the International Fund for Agricultural Development , USAID, the provincial-level livestock services SPP, CARE and ILRI made-up the Steering Committee which met three times over the life of the project.

IP Development and Processes. ImGoats established the goat IP to stimulate innovation and multi-stakeholder interaction. CARE led the process of identifying and inviting IP members with input

[10] Some reports (ILRI, 2011b) indicate a target of 350 households and 2,500 beneficiaries consisting of 25% FHH and 20% of families living with or affected by HIV/AIDS.

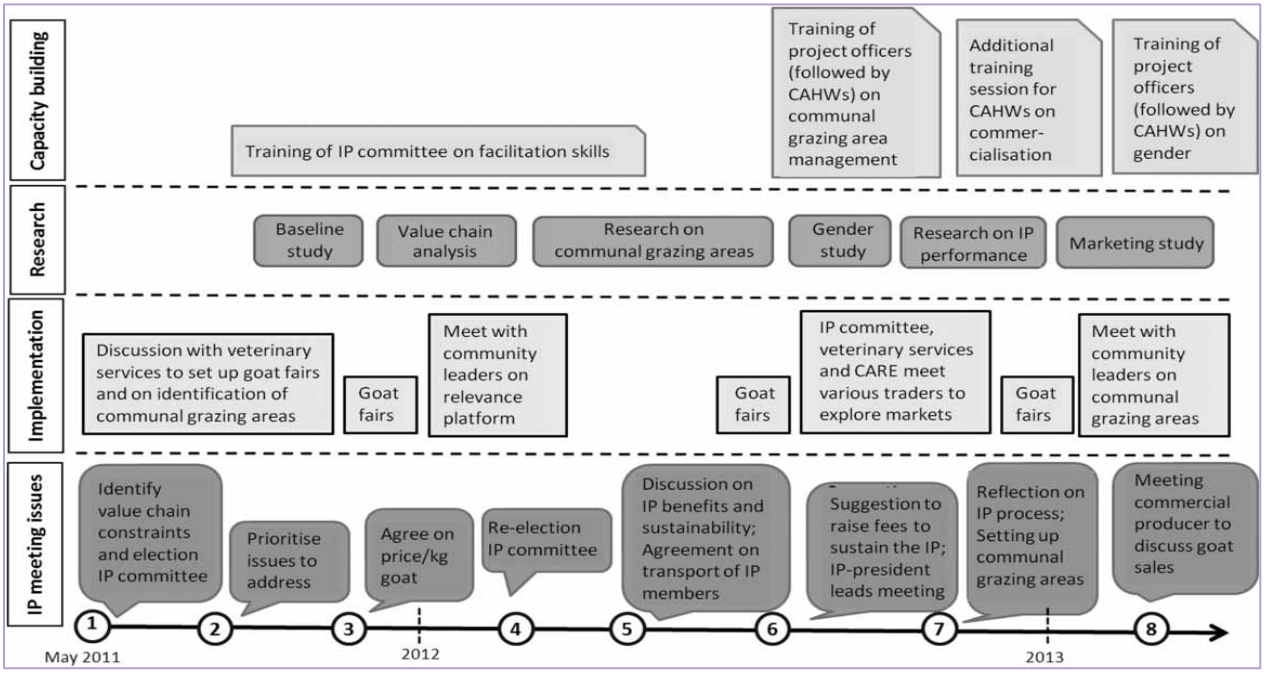
from the Provincial Director of SPP—who dealt with livestock issues at the provincial level—based on his knowledge of the value chain and position in the government. IP membership was open and voluntary.

Platform members met every two to four months to discuss and determine their activities and ways to move forward. During the first meeting, an IP Committee comprised of IP members, was established to act as Secretariat for the IP. A President, Vice President, Secretary, and Councilor were nominated. In addition to supporting the IP, the expectation was the Committee would eventually take-over the role of IP facilitator.

A total of nine meetings were convened. Participation in meetings was highly fluid. Excluding staff, a total of around 95 people attended at least one meeting. Of these, only five attended five or more meetings. Excluding staff, the number of participants in meetings ranged from 11 to 33 with an average of around 20. Women's attendance was very low. Around 15% of all those attending at least one meeting were women. Notably, IP participation of the few women who were group presidents was higher, attending on average about four meetings. ImGoats supported the meetings through brokering activities, providing lunch, and for the first five meetings providing transport due to the long distances participants needed to travel to reach meeting locations. Members were to provide their own transport following the fifth meeting and subsequently participation rates fell.

The figure below shows the time line of IP meetings and identifies the key issues discussed, or decisions taken, at meetings. The figure summarizes implementation, research, and capacity building activities related to and taken as a result of discussions/decisions.

Figure 3. Timeline of IP Meetings, Key Issues Discussed and Resulting Activities.



Source: Swaans et al. (2014), p. 245.

Extension approach. The extension approach utilized by imGoats primarily involved extension agents employed by CARE, CAHWs, goat keepers, community leaders (some of whom were also goat keepers), and livestock groups. These were the major groups participating in the IP. CARE extensionists met with CAHWs on a bi-weekly basis and apparently also engaged with goat keepers, community leaders, and/or livestock groups around the constraints and activities the IP identified. CAHWs were selected by their communities. They received project delivered training in communal grazing area management, goat commercialization, and gender as well as initial support from the project to provide certain animal health services to goat keepers in their community. Goat keepers were to pay for these services. CAHWs provided a critical link between the IP and communities. The role of community leaders in imGoat's extension approach is not entirely clear, although some leaders were also goat keepers. The support of community leaders is critical in extension activities and community leaders can act as key contact points for extension. They are typically expected to pass the information and practices discussed with extensionists on to others in their neighborhood or group. While there was some interaction with a few buyers, there was very limited extension activity with others in the value chain: transporters, investors, and input suppliers.

Actors.

ImGoats invested a good deal of time in documenting IP meetings.[11] Based on IP meeting reports, the major categories of IP participants were goat keepers, community leaders, buyers, CAHWs, government representatives, CARE extensionists and other CARE staff, and ILRI researchers and affiliated students. Others who participated on a very limited basis included investors, land chiefs, and retailers.

- **Goat keepers.** The majority of IP members were goat keepers. This category included producers, representatives of livestock groups elected by their group to participate in the IP, and some community leaders who were also goat keepers.
- **Community Leaders.** The type of community leaders was not reported but they constituted the second largest group of IP participants.
- **Buyers.** A very few buyers were members of the IP. IP members searched for additional markets and buyers with limited results.
- **CAHWs.** CAHWs were an especially important group in the IP, meeting regularly with goat keepers and livestock groups. As a group, they generally attended more IP meetings than the other categories of actors.
- **Government Representatives.** Referring to Figure 3 earlier presented in this paper, representatives from the provincial-level livestock SPP and the district-level SDAE participated in the IP. The SDAE Livestock Officer was Vice-President of the IP Committee, elected at the fourth

[11] See https://imgoats.org/documents/ for all reports.

meeting when elections were held to fill open positions on the Committee. Notably lacking were representatives of provincial (SPER) or district-level extension networks. This is particularly noteworthy because the job of the latter is reportedly to co-manage and implement relevant livestock extension activities focusing on small livestock species under technical backstopping of the SPP. Reasons for this were not discussed in imGoats reports. However, public extension may not have been operating in Inhassoro, the roles of livestock and extension entities at the provincial and district-level may be more intertwined than might be expected and one substitutes for the other in cases[12], and/or project decision-makers believed hiring their own extension workers was the better approach. For the latter, this may be an easier approach but lacks sustainability and does not address a tenant of AIS thinking: developing capacity of key AIS actors to innovate.

- **CARE Extensionists and other CARE staff.** Of the five CARE extensionists, one or two attended a majority of meetings. Other CARE staff led project field-level implementation, were closely involved in facilitating meetings, and mentored the IP Committee to eventually take-over the facilitation role.
- **ILRI Researchers and Affiliated Students.** ILRI provided overall leadership to the imGoats project including facilitating the IP and conducting various studies and applied research activities in support of the project. Several students also carried-out applied research projects related to imGoats issues.

Accomplishments

Many of the accomplishments are alluded to in the above discussion of the project. The following identifies important accomplishments of the imGoats project categorized by their relative relationship to IPs, Actors, and Livelihoods

IPs

- Establishment of a functioning IP and preparation of IP members to continue platform facilitation
- Significant documentation of the IP process
- Introduction of systematic reflection for learning with IP members
- Contributions through applied research to understanding IP's role in improving goat value chains and of goat value chains more generally

Actors

- **Improv**ed interaction among value chain actors
- Improved capacity of IP members through IP participation and engagement with CARE extension and CAHWs

[12] For example, one IP meeting report refers to the SDAE Livestock Delegate as an extensionist

- Strengthened capacity development of CAHWs

Livelihoods

- **CAHWs a**ddressing livelihoods issues by providing services and being paid by goat keepers for those services
- Improvements in animal health resulting in decrease in goat mortality figures
- Demonstration of improved goat shelters
- Experimentation with goat fairs and new marketing arrangements
- Establishment of several communal grazing areas and organization of formalized committees tasked with managing them

Improved Research and Extension Coordination?

The IP improved coordination between IP members which included CARE extensionists and ILRI researchers. It increased interaction with government provincial and district-level livestock entities. It apparently did not improve coordination between researchers and the government extension services (SPER and extension networks). Why the project did not reach out to government extension is unclear, although possible reasons have been earlier discussed in this paper. Depending on project reasons for not including government extension in the IP, an important opportunity may have been missed. This is particularly incongruous given the AIS and IP emphasis on inclusion of all key stakeholders.

Strengthened Research and Extension Performance for Greater Impact?

The life of the project was quite short at two and one-half years. Impact often requires a longer time-frame. While the above listed achievements indicate potential impact, the project has made, or has, little data available to demonstrate impact. Reports state that improved linkages between key actors had positive effects on goat management practices, production, and sales (Swaans & Hendrickx, 2014) but quantitative data are lacking. There is anecdotal evidence of increased herd size among producers in Mozambique but no strong evidence for a systematic change across households (Swaans & Hendrickx, 2014, p. 3). Goat keepers were reportedly selling more animals to distant traders due to lack of local demand. But whether selling to more distant traders is a positive or negative for producers is not clear. On balance, the performance of research and extension was likely strengthened, making some positive differences in beneficiary income from goats , but the quantity of those differences is not known.

Challenges

Several of the challenges faced by imGoats are not specific to the imGoats project but rather are applicable to development projects in general and there are also challenges specific to the imGoats project. Both are discussed below.

Difficulties in promoting women's participation in the IP. This may have been due to the time and/or financial resources required to travel the long distances to meetings, competing demands on women's time, other representatives from their community participating in their stead, and/or IP focus on

commercialization. There is some evidence to suggest women were being reached in other ways, through their livestock groups, which could influence their perceived need for IP participation.

Assumption that commercializing the goat value chain will help empower women. A gendered baseline study found that women were less involved in goat marketing than men and that women in male-headed households very rarely had control over incomes from goat sales (Boogaard, Waithanji, Poole, & Cadilhon, 2015). While this calls into question this often-held assumption, the study also found that women use goats to increase their social capital and thus are an important asset.

Communication and feedback. Within the IP, communication and feedback flowed relatively freely. There were challenges in ensuring communications from the IP to livestock groups and greater challenges in obtaining feedback from livestock groups. The expectation, that those who linked the IP to groups would be adept at communication processes, was not always met.

Reliance on a very few traders. Trader representation on the IP was very limited. The needs of traders were left largely unexplored by members of the IP, creating a gap in the value chain and may have lessened trader interest in IP participation. The incentive for their participation was difficult to assess. As well, most traders likely lived outside or did business outside the **communities in which the IP operated.**

Market demand not well-understood. The local demand for goat meat was less than expected. Attempts to develop or identify additional markets through goat fairs and contacting buyers in markets outside Inhassoro were less successful than needed to create increased sustained demand.

Communal grazing areas. Progress was made in establishing the areas and creating a system for managing. Remaining challenges pointed to the difficulties of collective management, concerns regarding theft of animals, whether women would benefit as watering and moving animals to/from grazing areas takes their time, and uncontrolled fires that destroy forage and cause other fire-related problems.

Sustainability of the IP. Although considerable effort was invested to develop internal capacity to facilitate the IP, the costs of transport to meetings, limited involvement of traders and women, and overall decline in numbers of IP participants, do not bode well for its sustainability. A core group of around 10 IP members may continue to meet and if this does occur, a challenge is how to and who could build on their initiative.

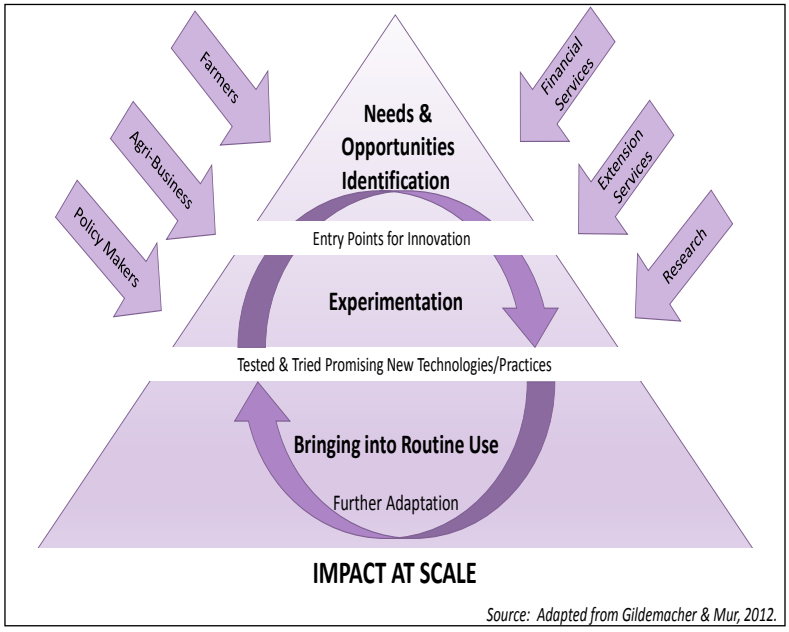
Sustainability of livestock groups. The sustainability of the livestock groups themselves represents an additional challenge. Some groups are better organized than others. Whether the CAHWs will continue to engage with goat keepers after the project closes is an important question. Unless CARE has another project in Inhassoro, or close by, CARE extensionists will not be in place to support CAHWs nor livestock groups.

Challenges of data collection along with the relatively short time-frame of the project resulted in limited evidence of project impact related to its purpose of increasing incomes and food security.

3.3 AN EMERGING MODEL

Informed by evaluation of the three mini-cases discussed above and two other RIU projects, an alternative model of the innovation process which depicts taking innovations to scale has been proposed (Gildemacher & Mur, 2012, p. 167). The model is not focused on IPs but on the larger process of agricultural innovation and is discussed here due to its relationship to the three IP mini-cases. The designers of the model emphasize it is not meant to suggest a linear process but is an oversimplification of a complex, often iterative process.

Figure 4. Focus on Scaling (FOS)
Process of Agricultural Innovation for Impact at Scale



For purposes of this paper, the model is referred to as the Focus on Scaling (FOS) model. FOS identifies three actions leading to three types of results (Gildemacher & Wongtschowski, 2015). Identifying opportunities and needs leads to identification of entry points (e.g., ideas, problems to be solved) for innovation. Experimentation under real-life realistic conditions to test and adjust entry points (e.g., technologies, new market relations, new ways of collaboration) leads to tested and tried promising new technologies and practices. Bringing into routine use involves further adaptation leading to impact at scale. Further adaptation to reach scale could include localized adaptation of the technologies or practices themselves; training or organization of producers, traders, and service providers; policy changes; and other organizational and institutional changes.

The model accentuates the experimental and adaptive nature of the innovation process. This has practical application to program planning. Projects charged with taking innovations to scale must plan for experimentation and adaptation of technologies and practices, likely throughout the life of the project. Even though technologies and practices have been proven in one context, their application in different contexts may result in identification of contextual issues to be resolved through further adaptation.

4. LESSONS LEARNED

Numerous lessons can be derived from the material in this paper. Many are noted below, categorized by AIS and aspects of AIS. Not all are newly-learned but confirm lessons learned and articulated in the literature and lessons learned through experience.

4.1 AIS

- AIS deals with both existing and new technologies, processes, and forms of organization.
- AIS is about more than research. It is the linkages, interactions, relationships, capacities, influences, and learnings among stakeholders in the AIS system that contribute to system operation, outcome, and impact.
- An expected outcome of AIS is innovation.

- AIS thinking has influenced some donors to move towards incorporating AR4D into the broader concept of AIS.
- AIS emphasizes the importance and inclusion of all actors in the system.

4.2 INNOVATION

- Forward-looking thinking maintains something is only an innovation if it is actually put into use, which is another way of saying if it is adopted.
- Innovation typically involves a re-ordering of relationships and interactions among AIS actors, representing a formidable challenge.
- Agronomic research is often not the key driver of innovation as innovation is not only technology but has organizational and institutional dimensions.
- Inclusive innovation mandates a special emphasis on engaging the often excluded poor in innovation processes.
- Innovation funds have been frequently used to support research innovation but could be used to support extension innovation or collective extension/research innovation.

4.3 IPs

- AIS is a strong analytical and diagnostic tool with IPs being the dominant practical application for putting AIS into action.
- Underlying IPs is a key AIS premise that increased interaction and more effective relationships among stakeholders will result in better ways to identify and solve problems.
- IP establishment, development, and operation tends to follow a replicable pattern although flexibility and context-specificity are hallmarks of successful IPs.
- IPs encounter challenges similar to those of projects having different implementation structures:
    - misdiagnosis of key critical constraints and opportunities
    - weak communications with stakeholders
    - stakeholders lacking capacities to fully participate in IPs/projects
    - failure of experiments undertaken or strategies applied to solve problems
    - weak reporting and M&E systems
    - limited evidence of impact
- Different iterations of IPs are emerging (e.g., Buena Milpa project)

- Initial support, perhaps tapering over the long term, for IP meetings is needed to encourage and maintain IP member participation. Things fall apart without transportation and/or refreshments.
- The political (institutional) environment in which IPs operate can have momentous impact on IP performance.
- IP sustainability often remains an unsolved problem; factors that can contribute to sustainability include clear identification of issues benefitting all IP members, IP champions, solid linkages with existing bodies able to support IP continuation, and planned project-exit strategy including a sustainability plan

4.4 IP ACTORS

- IP members need a clear vision of IP purpose, their roles in the IP, their incentives to participate, and they need to develop shared understanding of IP and innovation concepts.
- Innovation brokers are key to and perform critical roles in moving IPs forward.
- Extension must become more pro-active to succeed in its potential role as innovation broker. Innovation brokering is a natural expansion of extension's role, notwithstanding the current practice whereby most innovation brokers are researchers/research organizations.
- Engaging and maintaining the right mix of IP stakeholders requires considerable effort; an incorrect mix can jeopardize IP success.
- Opportunity costs of IP participation is seldom considered and has a negative impact on members and on their IP participation.
- Investments in developing stakeholder capacity to take on facilitation roles after project closure are a step in the right direction but do not guarantee IP sustainability.
- IP sustainability often remains an unsolved problem; factors that can contribute to sustainability include clear identification of issues benefitting all IP members, IP champions, solid linkages with existing bodies able to support IP continuation, and planned project-exit strategy including a sustainability plan
- The political (institutional) environment in which IPs operate can have momentous impact on IP performance.
- Power dynamics among stakeholders are influenced not only by their social and economic status but also by their philosophies of development.
- Attention to gender issues which directly affect IP progress is typically insufficient.
- Researchers and extensionists tend to view IP processes somewhat differently, apportioning more worth to differing aspects of IP processes.

4.5 SCALING

- There are successful cases of using IPs to take technologies to scale as exemplified by the Nigeria Cowpea IP. To replicate success, further understanding of factors influencing such success is needed.

- How to scale innovations is usually a tireless challenge and AIS thinking lacks vision in how to do this. Taking a page from the AIS playbook suggests that neither research nor extension alone are likely to successfully tackle this challenge, but perhaps together progress can be made.
- Scaling, within the framework of AIS and as a critical part of the innovation process, is receiving increased attention with attempts to develop prototypes to inform ways to accelerate the process emerging.
- There have been considerable large-scale long-term investments in developing and experimenting with ways to improve research impact (e.g., A4RD, RIU), less so for extension. Improving research impact suggests an emphasis on scaling and specifically on adoption. The lesson from AIS thinking is: agronomic or livestock research is often not the primary driver of innovation. Future investments in both research and extension together in order to combine comparative strengths has the potential to be transformational.

5. CONCLUSIONS

This section focuses on the concluding answers to the four key questions asked at the beginning of this paper. Can the AIS framework be used to improve coordination between research and extension? Can it be used to strengthen research and extension performance for greater impact? How has the framework been applied in low-income countries? What roles might extension play in AIS?

To place answers in context, it is helpful to clarify who is doing research and extension in the cases examined. The five cases reviewed are considered public-sector research/project activities. All five were or are being led by researchers. Extension service providers are NGOs or from the public-sector. NGOs were or are the major players in extension activity in three of the five cases. Private-sector extension providers were not involved in any of the cases possibly due to the relatively small-scale of activities and/or limited possibilities for sufficient profit to warrant private-sector extension engagement.

- In the Nigeria Cowpea mini-case, researchers led collaboratively with the federal research agency and with involvement of public-sector extension.
- In the Rwanda Maize case, researchers led collaboratively with an NGO which also provided extension services. Public extension may have been involved to a limited degree in Rwanda, but most available data suggest an NGO provided the majority of extension services largely through farmer and cooperative leaders (Rockefeller Foundation, n.d. RIU, n.d.).
- In the Malawi Pig case, researchers led along with farmers with public-sector extension involvement.
- Researchers lead the Buena Milpa project along with the national research agency. Various extension-oriented NGOs provide extension services but public sector extension is also involved.
- Researchers led the imGoats IP along with an NGO who hired their own extension agents. Public-sector livestock representatives were also involved and they may have performed some limited extension functions.

5.1. Research and Extension Coordination

In many developing countries there has been a distinct disconnect between research and extension. Research and Extension Liaison Committees, joint research on farmer problems, and tasking subject matter specialists to link research and extension have all been tried with overall limited success. Can the AIS framework be used to improve research and extension coordination? This has not been an objective of AIS per se as AIS is more about the coordination of all stakeholders in the system and its current practical application is via IPs. Cases discussed in this paper show a mixed-picture of the framework's influence, operationalized as IPs, on research and extension coordination. Conclusions regarding research and extension coordination are based on a qualitative assessment of three indicators of coordination: the types of interaction discussed in the cases, the level of activity in which both research and extension were most likely involved, and whether the project on balance was more rather than less successful.

Among the cases, Nigeria's Cowpea IP provides the clearest picture of coordination. In the Cowpea IP, public extension agents role is in-line with their general functions. They were trained by the research-led project and subsequently delivered that training to farmers, established demonstrations, carried-out other related work with farmers, and were the interface between the IP and farmers. While their role in the platform is unclear, the conclusion is coordination between research and public-sector extension improved.

The picture of coordination in Rwanda's Maize IP is less clear because a large government project, not framed by AIS, operated in the same area at the same time with the same focus as the Maize IP. The available evidence suggests research and NGO extension coordination did not improve but relationships between actors in the chain as a whole did. Research and public-sector extension coordination is unlikely to have improved based on the minimal involvement of public-sector extension.

Malawi's Pig Sector IP does not appear to have improved research and public-sector extension coordination. However, driven by government's policy-level interest in professionalizing cooperatives, public-sector extension and farmer association linkages were reinforced.

Whether or not the Buena Milpa IP will improve research and extension coordination is yet to be seen as the project was just getting underway at the time of the review. The probability that coordination will improve is high due to the inclusion in the IP's from the beginning of the national research agency, extension-oriented NGOs, and public-sector extension and the development of concrete financed plans for collaborative activity. Nonetheless, three challenges constrain the possibilities of improved research and extension coordination as well as of innovation. These are the highly political context in which the project operates, the distrust and lack of confidence among those in the AIS and the IP, and the current organization of research and extension processes.

ImGoats activities in Mozambique appears to have improved coordination between IP members which included researchers, NGO extensionists, and government livestock services representatives. It did not

improve coordination between research and public-sector extension as the latter were not part of the IP.

In conclusion, for the cases examined there is no clear pattern of the effect of using an AIS, operationalized through IPs, framework on research and extension coordination. And, there is insufficient information to determine reasons for this. The table below summarizes conclusions from this section.

The AIS framework provides a window of opportunity to strengthen research and extension coordination, particularly via joint participation in IPs. However, as this coordination is not necessarily an objective of IPs, it seems a concerted effort backed by appropriate incentives will be needed on the part of both research and extension to come to grips with the coordination issue.

Table 7. Effect of using AIS Framework, operationalized through IPs, on research and extension coordination.

CASE	Primary Extension Services Provider	Research and Extension Coordination Improved?
Cowpea IP, Nigeria	Public-sector	Yes between research and public-sector extension
Maize IP, Rwanda	NGO	Unlikely between research & public-sector extension No between research and NGO extension
Pig IP, Malawi	Public-sector	No between research and public-sector extension
Buena Milpa IP, Guatemala	NGO (& Public-sector)	Yet to be determined
ImGoats IP, Mozambique	NGO	No between research and public-sector extension (not in IP) Yes between research and NGO extension

5.2 Research and Extension Performance

A reason AIS and IPs have received so much attention is because greater understanding of AIS and its operational partner IPs is expected to increase the positive impacts of development processes and subsequently improve the quality of life of those who derive their livelihoods from agriculture. This section qualitatively assesses whether research and extension performance for greater impact was strengthened in the cases reviewed. Assessment is based on the accomplishments achieved and actors involved.

Nigeria's Cowpea IP is the one case providing quantitative data. The IP had a measurable positive impact on cowpea production and storage at the household level as shown earlier in Table 2. Extension appears to have been an important player in realizing impact as the technologies used had already been proven successful and there was little need for further experimentation. The proven technologies which were products of research coupled with trained extensionists, along with other factors, resulted in impact suggesting strengthened research and extension performance.

In the Rwanda case, maize productivity increased. This could not be attributed to the IP but rather to a large government maize-focused project operating in the same area at the same time. The contribution of the IP to strengthening research and extension performance was likely limited.

The Malawi Pig Sector IP apparently did not strengthen research and extension performance. There was very little impact at the household level. Farmers who benefited from the IP lived close to a market, had good transport, or were close associates with cooperative leaders.

It is too early in the life of the project to determine whether Guatemala's Buena Milpa IP will strengthen research and extension for greater impact. Although the right actors are engaged and the project acknowledges the importance of both research and extension, there are a number of key challenges to be met to facilitate research and extension strengthening. These include: developing shared understanding of AIS and IP concepts; developing capacities of various actors in the AIS, particularly extensionists and promoters; more clearly identifying interventions; and expanding public-sector extension involvement in the IP.

In Mozambique, the short time-frame for the project made determining impact difficult. There is anecdotal evidence to suggest positive effects on goat management practices, production, and sales but quantitative data are lacking. Nonetheless, the various achievements of the IP suggest that on balance the performance of research and extension was likely strengthened.

In conclusion, the IPs examined neither targeted nor specifically reported on strengthening research and extension performance for impact. Based on these cases, there is a mixed picture of the effect of using an AIS, operationalized as an IP, framework on research and extension performance. In one case, such use appears to have strengthened performance, in another it apparently did not. In another case applying the framework likely had little effect and in another it likely strengthened research and extension performance. And, in one case it is too early determine any effects. Further focused study is needed to clarify the conditions under which the AIS framework, more specifically IPs, could be used to strengthen research and extension performance for impact.

5.3. AIS Application in Low-Income Countries

The AIS framework has been applied primarily as an analytical framework for studying innovation processes and has led to various diagnostic studies, particularly those diagnosing innovation capacity. IPs are currently the primary practical application for putting AIS into action (Nederlof et al., 2011). There is an extensive literature on IPs and numerous key documents have been earlier referenced. No other practical applications with documentation approaching that of IP documentation were found in the literature reviewed as background to this paper. There is an emerging model Focusing on Scale, earlier discussed, that could be applied to explore its efficacy and/or further develop the model. There are a very few references to innovation support facilities designed as delivery mechanisms to coordinate action for innovation. A good example at the national-level is the Agricultural Research and Development Facility established in Papua New Guinea which builds on the AR4D framework (Mbabu & Hall, 2012). The Facility can be characterized as a project that focused on supporting a wide-array of national organizations and stakeholders to develop their capacity to innovate. There are various

innovation-related activities and organizations, such as Technology and Innovation Support Centers, but they are not specifically functioning within the AIS framework.

The conclusion is the most frequent operationalization of the AIS framework in practice is via IPs and the framework has been dominantly applied in developing countries as operationalized through IPs.

5.4 Extension Roles in AIS

What roles might extension play in AIS? In the cases reviewed, extension performed many of the roles they typically perform. They helped to organize or supported farmer groups, developed individual farmer and farmer group capacity through training, conducting village-level demonstrations, and through other activities such as facilitating exchange visits; developed capacity of others involved in service delivery (e.g., extension interaction with animal health workers); participated in training themselves; liaised between project staff and farmers; and arranged for visits between farmers and project staff, and donors. Less typical, they linked producers to buyers and participated in IPs. Their role in IPs varied with some few acting as platform facilitators, or brokers..

There may be slight differences in IP facilitators and IP brokers with the latter having a broader role outside of meeting venues. The role of broker represents a challenging and newer role for extension involving bridging gaps among those in AIS, bringing stakeholders together, and facilitating their interaction for learning and innovation. To successfully perform the role will require capacity development for extensionists to consolidate and expand their existing skills and knowledge. They will need strengthened capacity to move through the main steps in innovation brokering: establishing IPs, analyzing context, assessing needs/opportunities and articulating demand, planning for action and learning, facilitating IPs for interactive learning, problem solving, and conflict resolution; and developing brokering function exit strategy (Klerkx & Gildemacher, 2012). Of equal, if not more, importance are the changes needed within extension and research organizations and adjustments in the formal and informal rules and regulations surrounding extension work in order for extension's role as innovation broker to be accepted and supported. Recognition of the importance of the role is one such needed change. These changes and adjustments are likely to be more challenging than those related to developing the capacity to broker innovation.

As an institution, extension has wide-experience with scaling technologies. Leveraging these experiences to contribute to envisioning, designing, and implementing scaling activities are additional roles extension could play. To bring extension expertise to scaling processes, extension organizations could decide to institute a new category of subject-matter specialist, that of scaling subject-matter specialist. A scaling subject-matter specialist would specialize in and be responsible for facilitating the design, implementation, monitoring and evaluation of specific scaling activities in collaboration with research and other stakeholders. This expands the role of innovation broker to include a specific additional emphasis on design and monitoring and evaluation of scaling activities. The role of innovation broker could be encompassed within the responsibilities of scaling subject-matter specialists.

As noted earlier, a vision for how to get to scale is missing in innovation system thinking (Gildemacher & Mur, 2012, p. 169). The AIS framework is weak in guiding analysis to better understand scaling and

practical approaches to scaling efforts within the AIS framework are lacking. It may be that extension and research could collaboratively and innovatively create the vision and operationalize the framework needed to address this gap in AIS thinking. This is a large and grand undertaking. Still, it offers a focused collaborative extension-led research activity. As resulting practical applications were tested, adapted, and became available, the role of extension scaling subject-matter specialists would be to apply the framework to the design, implementation, and monitoring and evaluation of scaling activities.

In conclusion, extension has been playing a number of roles important within the AIS framework. However, a shift in extension thinking to encompass the wider-arena of AIS is needed. The role of innovation broker represents a challenging and newer role for extension. To realize the role will require capacity development for extension brokers of innovation and substantial organizational and institutional changes in extension and research organizations to support such a role. Extension as an institution has a very challenging conceptual role to play in collaborating with research to address the scaling gap in the AIS framework by creating a vision within the framework of how to get to scale. A related and new role for extensionists, as subject-matter specialists in scaling, would bring extension focus to designing and operationalizing scaling activities and would require significant support to achieve.

6. RECOMMENDATIONS

Various options for investments in AIS have been discussed in this paper. Recommendations, which target strengthening extension performance and impact within an AIS framework but also consider the role of research, are put forward for consideration. Underlying recommendations is the aspiration of promoting a learning environment by experimenting with innovative ideas, practices, and processes and acknowledging there is some space for some failure, or alternatively stated, less than desired success, as such situations represent learning opportunities.

Recommendation One: Focus on scaling and on public-sector extension.

Develop the Capacity to Innovate. For sustainability, to leverage extension experience, and to build government capacity to innovate, prioritize capacity development for public-sector extension.

Supporting recommendations are:

- Design and deliver an AIS capacity development program for selected extension staff at national, provincial, and district levels. The program should focus on preparing a cadre of innovation-savvy extensionists ready to promote innovation. Participants should be able and equipped to exploit ICT to support their AIS work. The program should strengthen the extension system's capacity to manage internal organizational change and to coordinate a pluralistic extension system.
- Provide specialized training in innovation brokering for selected extension staff to prepare them for leading existing and/or future IPs.
- Investigate the feasibility of and requirements for integrating earlier discussed extension scaling subject-matter specialists, within the extension system (DNEA or SPER level).

- Convene an extension-led AIS community of practice to include other AIS actors.
- Establish a virtual learning platform to advance learning about AIS and to encourage exchange of related experiences.
- Embed an innovation expert in DNEA to support DNEA in moving the AIS agenda forward.

Design, Test, and Document a Scaling Activity. The model to take innovations to scale, earlier discussed and referred to as Focus on Scaling (FOS) in this paper, is a prototype. In order for public-sector extension to develop expertise in scaling within the AIS framework, practical resourced experience in doing so is needed. Within the priority areas of USAID agricultural activity, there are technologies and practices that need to be identified, adapted, and/or taken to scale. There are likely already technologies and practices that have been identified but yet need to be further adapted to local conditions and transitioned to scale. To address these needs requires the input and expertise of both extension and research. Supporting an activity based on the FOS contributes to meeting these needs and has the potential to demonstrate improved research and extension coordination and improved performance for impact. Supporting recommendations include:

- Engage both research and public-sector extension, clearly tasking extension with activity leadership and overall responsibility while promoting joint cooperation between extension and research.
- Finance a mechanism to support extension leadership and joint research and extension cooperation.
- Use pilot-tests to transition promising technologies and practices to scale.
- Charge the activity with including women in all processes.
- Integrate IPs into the design, taking into account lessons learned and previous research and extension experience in promoting innovation processes.
- Ensure opportunities for extension to demonstrate the utility of using extension innovation brokers in innovation processes.
- Document and widely-disseminate to AIS stakeholders lessons learned through designing and testing the activity.
- Include activity documentation and learning in the extension AIS capacity development program.

Recommendation Two: Invest in the AIS system.

An AIS assessment is recommended to inform actions to build the capacity of the system as a whole. A first step is to identify the key actors and elements in the system and the strengths and weaknesses in their capacities to innovate.. The assessment will help to inform and pinpoint next steps in building system capacity which steps could include some of the following.

- Strengthening farmer groups, associations, and cooperatives.
- Improving access to agricultural credit and financial skills training to processors, traders, and input suppliers.

- Linking larger agricultural projects with smaller efforts to experiment with problematic elements of the larger project (e.g., marketing, input supply development, aggregation of products, new processing practices).
- Reviewing ongoing agricultural projects against guiding principles for innovation processes, earlier discussed, to assess interventions suitable for promoting innovation.
- Supporting the engagement of the Mozambican Forum for Agricultural Extension Services, a forum designed to share information and increase professional interaction among extensionists, in AIS activities.
- Establishing an IP to address the complex problems and challenges of research and extension coordination.

Recommendation Three: Experiment with various funding mechanisms.

- Create an office-wide Innovation Support Project to test-out and adapt innovative solutions to extension, AIS, and other economic development challenges.
- Use competitive and matching grants to target innovative ideas for strengthening extension performance.
- Co-fund collaborative extension and research activities to facilitate coordination, help balance power relationships between the two, and combine the relative strengths of each to address target issues and problems.

REFERENCES

Aerni, P., Nichterlein, K., Rudgard, S., & Sonnino, A. (2015). Making agricultural innovation systems (AIS) work for development in tropical countries. *Sustainability 2015*, 7, 831-850. Retrieved from http://www.mdpi.com/2071-1050/7/1/831

ARD. (2010). *Mozambique agricultural research competitive grants program: Final report.* Burlington, VT: ARD. Retrieved from http://pdf.usaid.gov/pdf_docs/pdacw436.pdf

Benor, D., & Baxter, M. (1984). *Training and visit extension.* Washington, DC: World Bank.

Boogaard, B., Hendrickx, S., & Swaans, K. (2012). *Characterization of smallholder goat production and marketing systems in Inhassoro District, Mozambique: Results of a baseline study* (ILRI Research Brief 1). Retrieved from https://cgspace.cgiar.org/handle/10568/21698

Boogaard, B., & Moyo, S. (2015). *The multi-functionality of goats in rural Mozambique: Contributions to food security and household risk mitigation* (ILRI Research Report 37). Nairobi: ILRI. Retrieved from https://cgspace.cgiar.org/handle/10568/67395

Boogaard, B., Swaans, K., Hendrickx, S, & Cosijn, M. (2013). Reflection on innovation processes in a smallholder goat development project in Mozambique. In Triomphe, B., Waters-Bayer, A., Klerkx, L., Schut, M., Cullen. B., Kamau, G., & LeBorgne, E. (Eds.), *Innovation in smallholder farming in Africa: Recent advances and recommendations-Proceedings of the International Workshop on Agricultural Innovation Systems in Africa (AISA), 29-31 May 2013, Nairobi, Kenya* (pp. 66-70). Montpellier: CIRAD. Retrieved from http://aisa2013.wikispaces.com/ais+workshop

Boogaard, B., Waithanji, E., Poole, E., & Cadilhon, J-J. (2015). Smallholder goat production and marketing: a gendered baseline study from Inhassoro District Mozambique. *Wageningen Journal of Life Sciences,* 74-75, 51-63. Retrieved from http://www.sciencedirect.com/science/article/pii/S1573521415000172

Buena Milpa. (n.d.). *Work plan 2015: Feed the Future – fighting poverty and malnutrition through fostering sustainable, resilient, and innovative maize-based farming systems in Guatemala.* Guatemala: Author.

Byrnes, K. (1989). A *review of A.I.D. experience with farming systems research and extension projects* (A.I.D. Evaluation Special Study No. 67). Washington, DC: USAID.

Bymolt, R., & Wennink, B. (2012). The Malawi pig sector innovation platform. In Gildemacher, P., & Mur, R., *Bringing new ideas into practice; experiments with agricultural innovation* (Learning from Research Into Use in Africa [2]) (pp. 1330-162). Amsterdam: KIT Publishers.

Davis, K., & Heemskerk, W. (2012). Investment in extension and advisory services as part of agricultural innovation systems. In World Bank, *Agricultural innovation systems: An investment sourcebook* (pp. 179-260). Washington, DC: World Bank.

Eicher, C. (2004). Mozambique: Building African models of agricultural extension. In Rivera, W. & Alex, G. (Eds.), Volume 5. *National strategy and reform process* (pp. 12-20) (Agriculture and Rural

Development Discussion Paper 12, Extension Reform for Rural Development). Washington, DC: World Bank.

Ekboir, J. (2012). How to build innovation networks. In World Bank, Agricultural Innovation systems: An investment sourcebook (pp. 44-51). Washington, DC: World Bank.

Emechebe, E., Ugbe, U., Sanni, A., Jokthan,G., & Philemon, P. (2012). Cowpea value chain innovation platform, Nigeria. In Gildemacher, P., & Mur, R., *Bringing new ideas into practice; experiments with agricultural innovation* (Learning from Research Into Use in Africa [2]) (pp. 21-42). Amsterdam: KIT Publishers.

FAO. (2010). *Corporate strategy on capacity development*. Rome: FAO

FAO. (2014). *The state of food and agriculture: Innovation in family farming*. Rome: FAO.

Foster, C.. & Heeks, R. (2013). Conceptualising inclusive innovation: modifying systems of innovation frameworks to understand diffusion of new technology to low-income consumers. *European Journal of Development Research,* 25(3), pp. 333–355.

Gêmo, H., & Chilonda, P. (2013). *Why did Mozambique's public extension halt the implementation of the National Agrarian Extension Program (PRONEA)?* (IFPRI, Mozambique Strategy Support Program, Working Paper 6, June 2013). Washington, DC: IFPRI

Gêmo, H., & Davis, K. (2015). *Addressing human capital development in public agriculture extension in Southern Africa: Assessing Mozambique's experience* (IFPRI Discussion Paper 01466). Washington, DC: IFPRI.

Gêmo, H., & Rivera, W. (2001). M*ozambique's move towards a pluralistic national system of rural extension* (Agricultural Research & Extension Network, Network Paper No. 110). London: Overseas Development Institute.

Gildemacher, P., & Mur, R. (2012). *Bringing new ideas into practice; experiments with agricultural innovation* (Learning from Research Into Use in Africa [2]). Amsterdam: KIT Publishers.

Gildemacher, P., & Wongtschowski, M. (2015). *Catalysing innovation: from theory to action* (KIT Working Paper 2015-1). Retrieved from http://www.kit.nl/sed/wp-content/uploads/sites/2/2015/06/WPS1_2015_online.pdf

Global Donor Platform for Rural Development. (2013). On common ground-Donor perspectives on agriculture & rural development and food security & nutrition: Revised version following member consultation in 2012-2013. Global Donor Platform for Rural Development. Retrieved from https://www.donorplatform.org/agricultural-research-for-development/on-common-ground

Hall, A. (2007). *The origins and implications of using innovation systems perspectives in the design and implementation of agricultural research projects: Some personal observations* (UNU-MERIT Working Paper Series #2007-013). Maastricht, Netherlands: United Nations University. Retrieved from http://www.merit.unu.edu/publications/working-papers/abstract/?id=2829

Heemskerk, W., Klerkx, L., & Sitima, J. (2011). Brokering innovation. In Nederlof, S., Wongtschowski, M. & van der Lee, F. (Eds.), *Putting heads together. Agricultural innovation platforms in practice* (Bulletin 396) (pp. 45-48). Amsterdam: Royal Tropical Institute (KIT).

Heinemann, E., & Biggs, D. (1985). Farming systems research: An evolutionary approach to implementation. *Journal of Agricultural Economics*, 36, 59-65.

Hendrickx, S. (2013). *Small ruminant value chains to reduce poverty and increase food security in India and Mozambique [ImGoats]* (Report of the end of project workshop). Maputo: ILRI. Retrieved from https://cgspace.cgiar.org/handle/10568/33558

ILRI. (2011a). Report of the first imGoats India National Advisory Committee meeting, 17 August 2011. Nairobi, Kenya: ILRI.

ILRI. (2011b). *Small ruminant value chains to reduce poverty and increase food security in India and Mozambique (imGoats).* Nairobi: ILRI. Retrieved from https://cgspace.cgiar.org/handle/10568/3171

Independent Evaluation Group. (2014). *World Bank Group support for innovation and entrepreneurship— An independent evaluation.* Washington, DC: World Bank.

Klerkx, L., van Mierlo, B, & Leeuwis, C. (2012). Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions. In Darnhofer, I., Gibbon, D, & Dedieu, B. (Eds.), *Farming systems research into the 21st century: The new dynamic* (pp. 457-483). Dordrecht, Netherlands: Springer Science + Business Media.

Kramer, R., & Tyler, T. (Eds.). (1996). *Trust in organizations: Frontiers of theory and research.* California: Sage Publications, Inc.

Leeuwis, C., & Van den Ban, A. (2004). *Communication for rural innovation: Rethinking agricultural extension* (3rd ed.). Oxford: Blackwell Science Ltd.

Mattessich, P., Murray-Close, M., & Monsey, B. (2001). *Collaboration: what makes it work – A review of research literature on factors influencing successful collaboration* (2nd ed.). Minnesota: Amherst H. Wilder Foundation.

Mbabu, A., & Hall, A. (Eds.). (2012). *Capacity building for agricultural research for development: Lessons from practice in Papua New Guinea.* UNU-MERIT, Maastricht: Netherlands.

Mur, R., & Audet-Belanger, G. (2012). Nyagatare maize innovation platform. In Gildemacher, P., & Mur, R., *Bringing new ideas into practice; experiments with agricultural innovation* (Learning from Research Into Use in Africa [2]) (pp. 97-130). Amsterdam: KIT Publishers.

Nederlof, S., Wongtschowski, M. & van der Lee, F. (Eds.). (2011). *Putting heads together. Agricultural innovation platforms in practice* (Bulletin 396). Amsterdam: Royal Tropical Institute (KIT).

Norman, D. (2002, November). *The farming systems approach: A historical perspective.* Paper presented at the 17th Symposium of the International Farming Systems Association, Buena Vista, FL. Retrieved from http://conference.ifas.ufl.edu/ifsa/papers/invite/norman.doc

Oxfam. (n.d.). I*nclusive development: Ensuring benefits for all* (Oxfam – Briefing Note Inclusive Development). Oxfam. Retrieved from https://www.oxfam.org/sites/www.oxfam.org/files/inclusive_development.pdf

Posthumus, H., & Wongtschowski, M. (2014). *Note 1: Innovation platforms* (GFRAS good practice note for extension and advisory services). GFRAS, Retrieved from http://www.g-fras.org/en/download.html?...231...note-1-innovation-platforms

RIU. (n.d.). Maize innovation platform. Retrieved from http://www.researchintouse.com/programmes/riu-rwanda/riu-rw41innovplat-maize.html

Rockefeller Foundation. (n.d.). Maize network. Retrieved from http://b.3cdn.net/rockefeller/8f06ae934a12606dc6_pxm6buyia.pdf

Rogers, E. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Rajalahti, R., Janssen, W., & Pehu, E. (2008). *Agricultural innovations systems: From diagnostics toward operational practices*_(Agriculture and Rural development Discussion Paper 38). Washington, DC: World Bank.

Rivera, W., Alex, G., Hanson, J., & Birner, R. (2006). Enabling agriculture: The evolution and promise of agricultural knowledge frameworks. In Vreyens, J. (Ed.), Association for International Agricultural and Extension Education Proceedings of the 22nd Annual Conference Volume XXII "International Teamwork in Agricultural and Extension Education, Clearwater Beach, FL, May 14-19, 2006 (pp. 580-591). Retrieved from https://www.aiaee.org/attachments/article/847/580.pdf

Röling, N. (1990). The agricultural research-technology transfer interface: A knowledge systems perspective. In Kaimowitz, D. (Ed.), *Making the link: Agricultural research and technology transfer in developing countries* (pp. 1-42). Boulder: Westview Press, Inc.

Shaner, W., Philipp, P., & Schmehl, W. (1982). *Farming systems research and development: Guidelines for developing countries*. Boulder: Westview Press, Inc.

Sloan, P., & Oliver, D. (2013). Building trust in multi-stakeholder partnerships: Critical emotional incidents and practices of engagement. *Organization Studies,* 34(12), 1835-1868.

Spielman, D. (2005). *Innovation systems perspectives on developing-country agriculture: A critical review* (ISNAR Discussion Paper 2). Washington, DC: IFPRI.

Spielman, D.; & Birner, R. (2008). *How innovative is your agriculture? Using innovation indicators and benchmarks to strengthen national agricultural innovation system* (Agriculture and Rural Development Discussion Paper 41). Washington, DC: World Bank.

Spielman, D., Ekboir, J., Davis, K., & Ochieng, C. (2008). An innovation systems perspective on strengthening agricultural education and training in sub-Saharan Africa. *Agricultural Systems,* 98(1), 1–9.

Swaans, K., Boogaard, B., Bendapudi, R., Taye, H., Hendrickx, S., & Klerkx, L. (2014). Operationalizing inclusive innovation: lessons from innovation platforms in livestock value chains in India and Mozambique. *Innovation and Development,* 4(2), 239-237. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/2157930X.2014.925246

Swaans, K., & Hendrickx, S. (2014). *Using innovation platforms to stimulate innovation and multi-stakeholder interaction in small ruminant value chains* (ILRI Research Brief 17). Nairobi: ILRI.

Tui, S, Adekunle, A., Lundy, M., Tucker, J., Birachi, E., Schut, M., . . . Mundy, P. (2013). *What are innovation platforms?* (Innovation Platforms Practice Brief 1). Nairobi: ILRI. Retrieved from https://cgspace.cgiar.org/handle/10568/34157

Tropical Agriculture Platform [TAP]. (n.d.) *Capacity development for agricultural innovation systems – key concepts and definitions.* Retrieved from http://www.tropagplatform.org/capacity-development-agricultural-innovation-systems-concepts-and-definitions

USAID/DIV. (2015). *Disseminating innovative resources and technologies to smallholders (DIRTS)* (DIV Website). Retrieved from https://www.usaid.gov/div/portfolio

Wennink, B., van der Lee, F., & Muir, R. (2011). Innovation platforms in Sub-Saharan Africa: Moving towards a new way of organising the agricultural extension system? Proceedings from *Innovations in Extension and Advisory Services International Conference.* Nairobi: CTA. Retrieved from http://extension.cta.int/pages/Documents/Learning%20Networks/1.Research%20and%20Extension-Driven%20Networks/CTA129%20Research%20and%20Extension-Driven%20Networks_Wennink_04.pdf

Wood, D., & Gray, B. (1991). Toward a comprehensive theory of collaboration. *Journal of Applied Behavioral Science*, 27(2), 139-162.

Woodhill, J., & Wennink, B. (2014). From principles to practice. In Pyburn, R., & Woodhill, J. (Eds.), *Dynamics of rural innovation - A primer for emerging professionals* (pp. 32-35). Arnhem, Netherlands: LM Publishers.

World Bank. (2006). *Enhancing agricultural innovation: How to go beyond the strengthening of research systems.* Washington, DC: World Bank.