FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

FEED THE FUTURE INNOVATION LABORATORY FOR SMALL SCALE IRRIGATION

Annex to Mid-Term Report, 2014-2016
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Submitted to USAID on Behalf of:
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The Texas A&M University System (Lead Institution)

International Food Policy Research Institute (IFPRI)

International Livestock Research Institute (ILRI)

International Water Management Institute (IWMI)

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Texas A&M AgriLife Research

USAID FROM THE AMERICAN PEOPLE · THE BORLAUG INSTITUTE · TEXAS A&M AGRILIFE RESEARCH · THE TEXAS A&M UNIVERSITY SYSTEM · IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE · IWMI · ILRI · NORTH CAROLINA A&T STATE UNIVERSITY

Mid-Term Report Annex
Table of Contents

1. Introduction - Annex to the Mid-Term Report

ILSSI was established by a cooperative agreement with USAID for five years, beginning in August 2013. As required by the sponsor, a mid-term report was prepared and submitted to USAID on November 6, 2016. With the consent of the Administrative Officer's Representative, this report was organized to include the information deemed relevant to the upcoming External Review of the agreement. A recent review of this document shows that the contents remain current.

However, ILSSI leadership has determined that there are a number of new inputs that are also relevant to the review. Accordingly, this document has been prepared to provide thirteen new papers and reference to a recently completed video which we request be made available to the Review Committee. These are supplemental to the original mid-term report and to the semi-annual report prepared in April 2017. The following is a synopsis of the Annex.

- Extract from the Mid-Term Report of the Exit Strategy – this is provided as a frame of reference for the added materials in the annex – the annex papers extend and expand the original exit strategy.

- Conceptual Framework and Vision – this is a working draft of a paper that provides more detail on our vision of the way forward if the Agency decides to invite a renewal proposal.

- PIESTAR - this is a commercial company that partners with and provides administrative support to several FtF laboratories. We propose to establish that partnership in phase II of ILSSI.

- Decision Support Tool - Based on demonstrated utility in other venues, we propose to develop a dashboard approach enabling stakeholders at multiple levels from government to farm to use the integrated decision support system for planning and evaluating options for investments at levels from national to farm. The system will allow users access to the power of the IDSS in a simplified user-friendly format.

- Summary of Accomplishments - this paper provides a brief overview of the major accomplishments of ILSSI in the first three and a half years.

- Scaling Methods – ILSSI assesses the application of interventions studied at field levels to larger scales, including national levels. This brief paper describes the unique multi-modal approach that is used to make these assessments and predictions.

- Comparison of Achievements to Contractual Requirements - this paper lays out a side-by-side comparison of what has been achieved relative to elements in the statement of work. Over and under achievements are summarized.

- Summary of interventions, including equipment, evaluated in research in farmer's fields - this tabular summary shows the equipment, know-how, and analytic capabilities produced by ILSSI.

- Economic Consequences – this paper describes the methods and summarizes the results of assessment of the economic consequences at multiple levels of scale for interventions studied under ILSSI. A stochastic approach is taken for estimating profit and long term sustainability of the interventions.

- External Advisory Committee – this paper shows the composition, terms of reference and results of the ILSSI external advisory committee.

- Country Level Summaries – national summaries for Ethiopia, Tanzania, and Ghana provide an overview of the results of ILSSI research and outreach cast in the context of the specific country.

- Stakeholder Engagements – this paper provides a summary of stakeholder engagements at multiple levels and over the life of the project, showing how the project is demand driven and how stakeholders have been continuously involved in advising and learning.

- Video of Field Studies - a recent video of field studies with engagement of farmers and national partners provides a report on interventions and how they are being used by stakeholders.

2. Extract from the ILSSI Mid-Term Report – Exit Strategy

The following is an extract of the Mid-Term Report submitted to USAID in November 2016. The MTR annex is a series of papers and reports that amplifies and extends this report with more on future plans and new results since the initial report. It is intended as input to the USAID External Review.

In this section, the projected achievements of the project at the end of its five-year term are summarized from the more detailed descriptions in the previous sections – and expressed in terms of deliverables. This section also identifies opportunities and approaches to build on and extend the work in ILSSI Phase 1, should a second phase of the project be considered.

1. Achievements

- An integrated team of U.S. universities, international centers, and national institutions in three countries with established procedures of interactive engagement addressed the complex issues and opportunities to make small scale irrigation technologies available and useable for smallholders
- An integrated decision support system was developed with capability to assess the production, environmental and economic consequences of the introduction of new small scale irrigation technology with the ability to scale up or out the results of field studies and household surveys at levels of scale from farm to country. A new methodology was developed and demonstrated to quantitatively estimate outcomes and impact of research inputs and outputs for SSI and other related farming systems enterprises.
- Identification and verification via stakeholder engagement of the constraints to adoption of new small-scale irrigation innovations and analysis to show the pathways to mitigation of these constraints were conducted.
- Established an ongoing engagement with stakeholders at multiple levels in three countries – including investors in future technology development, decision makers in government, private sector entities providing supporting infrastructure for farming systems using small scale irrigation, local practitioners of SSI such as farmers and extension workers.
- The products of initial research for development with smallholder farmers to evaluate equipment and practices for small-scale irrigation and engagement with local and regional entities helped to facilitate infrastructure development and to advance the adoption of new technology.
- The results of household surveys conducted before and after the introduction of small scale irrigation to smallholder communities helped to estimate the impact of irrigation, especially in the dry season, on economic and nutritional status of the household and define the gender related issues, opportunities and constraints on the adoption of small scale irrigation systems.
- The application of the IDSS to 1) identify natural resources at the local to national levels appropriate to the sustainable smallholder farming systems using irrigation, 2) estimate the consequences of alternative interventions for SSI at scale from farm to country, 3) identify constraints and propose mitigation strategies at multiple levels of scale and 4) provide ex post analysis of results as decision tools for a variety of stakeholders and users.
- Education and training in the use and limitations of the SSI systems was developed in Phase I of ILSSI for farmers, those providing related infrastructure to support SSI operations, faculty and students in national universities, and government actors and private sector investors.

2. Opportunities to complete, build on and extend SSI development in Phase II.

- Identify and address gaps in knowledge resulting from ILSSI Phase I – including the completion of any unachieved objectives deemed critical to future progress in the use of SSI.
- Continue and extend farm level research in broader areas of the three ILSSI countries to more comprehensively provide biophysical understanding of SSI covering the geographic diversity of the countries.
- Engage in expanded stakeholder collaboration to put in place and demonstrate the utility of SSI interventions at farm and regional levels of scale – moving the main emphasis from research to demonstration along value chains in Phase II.
- Extend regional and national household and other surveys in the three countries and perhaps new countries to evaluate the impact of SSI as it is put in place and practiced – with continuing focus on economic, nutritional results and identification and mitigation of gender related limitations to adoption of SSI.
- Develop joint efforts with private sector developers of small scale irrigation technology to develop and implement business plans for the infrastructure to develop alternative water lifting and delivery systems for irrigation.
- Assess cross-country common factors involved in SSI and develop transnational databases and analyses to provide further knowledge on the use of SSI across Sub-Saharan Africa and to develop inputs to the global decision making process.
- Extend the IDSS to provide the capacity to do value chain analyses on relevant commodities using small-scale irrigation as part of the farming system.
- Develop derivative management tools from the IDSS for farmers and planners at local levels that can be used for planning and evaluation at the enterprise level in developing countries.
- Continue and expand capacity building with practitioners, investors, decision makers and university faculty and students across multiple countries.
- Establish a web-based capacity for users of the IDSS in developing countries to streamline training and use of the system with mentoring from the IDSS group at Texas A&M.
- Extend the SSI thrust to address related critical questions related to climate change and climate smart agriculture – addressing how to best use water and other limited natural resources for production of food and other ecosystem services most efficiently in the future and which SSI technologies are best equipped to deal with varying climatic changes in the three countries.
- Expand ILSSI to two additional USAID FtF countries where SSI can make a dramatic difference to people's lives.
- Continue to seek partnerships with other FtF Innovation Laboratories and other research and development efforts to better leverage and extend ILSSI resources.

3. Conceptual Framework for ILSSI Phase II

(Note: This document is a working draft)

Approach
As part of the ILSSI External Review and final report, our team is providing a vision and conceptual framework for Phase II of the ILSSI Project (hereinafter Phase II). This conceptual framework and vision planning are an important component of the overall Exit Strategy of the ILSSI Project Phase I. We are building on and extending the results of Phase I, taking the concept beyond the initial approach of Phase I, as per required in the ILSSI RFA. The framework showcases our comparative and competitive advantages, highlighting the value of the exemplary team that has been built and its capacity to exploit and extend the results of Phase I. The framework clearly demonstrates how stakeholders' needs for new innovations and analytic methods will be met with Phase II.

This paper is intended to provide a framework for continuing partner engagement leading to a compelling consensus based statement for the future of ILSSI. The collaborative final product reflects a more integrated approach showing concisely how the components of ILSSI come together to create a new capacity for engagement, which will be used as a springboard to catapult our team and partners to the next level of conceptual sophistication. This document results from discussions by the Texas A&M management and implementation team of ILSSI, as well as from comments and valuable feedback received from international partners and the ILSSI External Advisory Committee (an example of EAC reports can be found in Annex 10 of the MTR). As previously stated, this document is intended to be a point of departure for further inputs.

Partners in Phase II
As a point of departure, this paper assumes there is continued strength in the team that has been established and that a substantial outcome of Phase I is the ability to continue to build on and use this capacity in Phase II. Consideration will also be given to extending the consortium to new members where appropriate in order to achieve the intended outcomes and objectives of Phase II.

While funding may ultimately be a limiting factor in our conceptual framework, we will not focus too heavily on limited resources during the conceptual design phase, but will make the case for the opportunities and capacities that ILSSI provides, especially in Phase II. This paper proposes that we advocate multiple sources of funding for Phase II.

Overarching Strategy
Phase II will exploit the stakeholder engagements and relationships developed in Phase I to further engage, better understand, and respond to stakeholders' needs at multiple levels of scale. Phase II will involve more extensive engagement with stakeholders to plan and conduct studies that directly address these needs with outcomes and impacts. Stakeholders include partners ranging from national to local levels and a more explicit engagement with the related USAID Missions in each country of the project. Phase II will focus more on assuring research products create demand-driven outcomes and impacts that directly impact the urgent need to make better use of water and other natural resources at all levels of scale.

Phase II will directly link to the 2016 Global Food Security Act, in which resilience is added as one of the three key objectives (i.e. agriculture-led growth, resilience and nutrition). See also the Global Food Security Strategy 2017-2021 (https://www.usaid.gov/sites/default/files/documents/1867/USG-Global-Food-Security-Strategy-2016.pdf)

The focus of Phase II will go beyond that of just small-scale irrigation; it will build on the broadening of the agenda that has been enabled by the ILSSI-SIIL partnership and moving towards developing and assessing the impact of sustainably intensified production systems – with outcomes focused on economic, nutritional, and environmental consequences. The focus of Phase II will be on "water-centric" production systems that emphasize outcomes directly contributing to enhanced sustainability and resilience at multiple levels of scale. We will consider the high priority interests of USAID such as resilient agricultural systems and the role that water has in all three areas of the Global Food Security Strategy: agriculture-led growth, resilience and nutrition. Water is cross-cutting to most food producing strategies including crops and livestock.

Phase II research and analysis will be enhanced by relating the role of water in value chains for various crops and animal sourced foods. The focus of Phase II will continue to be at multiple levels of scale; it will recognize that one of the major comparative advantages of ILSSI, and more specifically IDSS, is the ability to scale from local to national levels. This capability will be further developed and utilized in stakeholder driven applications of the IDSS for (a) planning, (b) collaborating in analyses, (c) training of national analytic staff, and (d) backstopping national analyses as stakeholders gain capacity and capability.

In Phase II, increasing emphasis will be placed on engagement with, support of, and collaboration with national and international stakeholders who will put ILSSI research and modeling results to practice; stakeholders are policy makers in government, private sector investors, donors of all kinds and practitioners like farmers who use the products of our research. Field studies will be designed to address specific needs and gaps for this approach. Survey studies will take a broader perspective to continue to assess the consequences of new technology on food security, resiliency and sustainability. Surveys will be more closely linked to the stakeholder decision processes being studied in other parts of Phase II.

Components of Phase II

Two kinds of impact are envisioned in Phase II

(1) Enhanced adoption of interventions from field studies measured in terms of number of farms, hectares occupied, economic, nutritional results, contributing to sustainability and resilience
(2) Intensified impact of the application of the IDSS in providing quantitative assessment of the impact of development and implementation of policy, planning, allocation of resources and evaluation of consequences of national and regional activities that address the application of water-centric technology, policy, and support to create improved nutritional, economic, and environmental consequences.

Both kinds of interventions depend on performance of stakeholders at multiple levels of scale. Phase II will be directed at broader, but closer, and more explicit linkages with stakeholders to help them succeed in fostering the adoption and use of new methods to achieve more resilient and sustainable food systems.

The processes of scaling from farm level upward and the application of modeling to predict outcomes and impacts at larger scales will be more closely integrated at the initial experimental design phase and maintained throughout the life of the Phase II agreement. In Phase II, our approach to scaling will be better integrated and applied building on the strengths of two approaches:

- International centers approach scaling from farm level experiments outward, helping to encourage the development of infrastructure that enables application of relevant technology.
- The IDSS uses quantitative modeling to scale results to estimate consequences at multiple levels of scale from field research, other data, expert opinion, and stakeholder advice.

Fundamental Questions for Phase II Design and Implementation
Initial deliberations provide preliminary answers to the following questions

(1) How much continuity with Phase I?
We will plan on including at least one country in South Asia and give further consideration to including the current three countries in SSA where appropriate.

(2) Will there be a shift to more stakeholder engagement and less research?
Phase II will focus on a more demand driven agenda with increased engagement of stakeholders at all levels of scale. More ex ante engagement with USAID Missions will create new ownership by them of the ILSSI agenda

(3) Who will be collaborators and what will be their roles?
We will continue an active engagement with national stakeholders and partner with them where possible, support their endeavors to use ILSSI products and provide training where needed to assure successful adoption.

(4) How will we approach partnerships with other FtF Innovation Labs and other key players?
We will actively maintain existing and seek new partnerships with other FtF Laboratories leading to joint research proposals and bilateral funding opportunities.

(5) Will the Phase II strategy focus on in depth studies in key countries or broader engagement in multiple countries?
Initially, we will plan a combination of in depth studies in selected countries with well- structured stand alone projects in other countries – all of which are aimed at demand driven outcomes and impacts.

Approaches
In Phase II, increasing emphasis will be placed on engagement with, support of, and collaboration with national stakeholders that will put research and modeling results to practice. Field studies will be designed to address specific needs and gaps for this approach. Survey studies will take a broader perspective to continue to assess the consequences of new technology on food security, resiliency and sustainability. Surveys will be more closely linked to the stakeholder decision processes being studied in other parts of Phase II.

In consultation with USAID, our project partners and collaborators, and stakeholders we will determine whether to take the approach of having (a) a consistent agenda for multiple countries or (b) focus more in depth in a few targeted countries in order to transform the specific national level agendas into the impact mode, and then utilize these experiences from the targeted countries to expand to additional countries. While there will be country specific factors affecting the policy and approaches used, there will be a substantial amount of commonality in the ILSSI approach in multiple countries. We will consider proposing work in at least one Feed the Future country in South Asia.

Specifically, the Phase II approach will:
(1) Assign IDSS representatives in the partner countries and with partner institutions.
(2) Emulate other successful ILs in getting Mission buy in through early engagement and commitment.
(3) Obtain possible mission expression of interest that has the potential of funding downstream in selected topics.

(4) Encourage early and ongoing direct engagement with key stakeholders – "what can we do to help"
(5) Design a coordinated approach with international partners, while not assuming they are the sole representatives of ILSSI to stakeholders.
(6) Gradually increase engagement in stakeholder projects – contributing to analysis, data, and expertise.
(7) Assist key stakeholders, such as ATA, develop the internal capacity to use the IDSS – at working levels in order to to avoid some of the turn over that occurs higher in the institutions.
(8) Partner with Texas A&M's Texas Center for Applied Technology to develop a dashboard approach to providing tools for use by stakeholders in application of ILSSI results.
(9) Partnership with PIESTAR for planning, writing the proposal for Phase II, evaluating and facilitating reporting of results to USAID – and linkages with other ILs.

IDSS Perspective for Phase II

From the IDSS perspective for Phase II of ILSSI, a number of general tenets will be considered:

(1) Continue to develop and use a demand driven approach – apply modeling methods to outcomes and impacts.
(2) Application of the IDSS to collaboration with other ILs.
(3) More definitive and integrated experimental design more effectively linking all of the ILSSI components.
(4) A primary deviation for IDSS in Phase II will be the direct involvement of the IDSS team along with country based partners in key stakeholder engagement to ascertain needs of stakeholders at all levels of engagement in targeted countries.
(5) For countries in the current ILSSI portfolio, we will utilize the remainder of year 4 and year 5 to continue to strengthen the linkages between the IDSS and national stakeholders.
(6) Early stakeholder engagement includes pre-planning with the key Missions in selected countries to create (a) awareness, (b) ownership and (c) commitment to consider support on agreed areas of work.

Funding

As is being done with other USAID innovation labs, ILSSI will propose multiple sources of funding to support an ambitious agenda. Engagement with Missions in advance of writing the Phase II plan could identify areas of interest and a funding plan that seeks mission funding as part of the total package. We will consider proposing funding coming through collaboration with IL and other partners. We should expect the core funding from the Bureau of Food Security to partially support the full agenda and be prepared to deal with uncertainties of the future budget situation.

Partner Inputs

In response to this concept paper, partners are requested to provide their input on (1) modifying and/or expanding the overall vision laid out here and (2) their vision on how the how they would contribute to the next generation of ILSSI components – field, survey, analysis and capacity building. Inputs from partners will be aggregated and exchanged iteratively until we have a final conceptual framework and model in place. Discussion on the design of Phase II is an agenda item at the PMC, which took place in Ethiopia May 10-20, 2017.

The final version of this document will not be lengthy. It will, however, clearly demonstrate a creative and forward looking vision that builds on what we have accomplished to date; recognize the interests and priorities of USAID; identify an agenda that is creative and responsive to stakeholder needs; and lay out a compelling proposition for Phase II.

Next Steps

(1) Initial inputs have been received from partners and this second draft modified accordingly.
(2) Input from each partner on the vision and framework for Phase II in their areas of expertise is still needed and will be incorporated where appropriate.
(3) Develop the next generation document after consultations at the PMC meeting.

Relevant Supplemental and Background Documents

(1) The final proposal submitted to USAID in July 2013, which indicates the initial thought process in developing the concept and implementation of ILSSI.
(2) The Mid-Term Report submitted to (and approved by) USAID in November 2016.

4. Piestar - Data and Project Management System for ILSSI

Feed the Future Innovation Laboratory for Small Scale Irrigation (ILSSI)

The USAID Feed the Future Innovation Laboratory for Small Scale Irrigation is a multi-institutional effort led by The Borlaug Institute for International Agriculture at the Texas A&M University System with participation by three CGIAR Centers and one additional U.S. University. The agreement is a five year effort involving research in Ethiopia, Tanzania, and Ghana. The overall goals of the effort are to evaluate, select, conduct field research on, and assess the impact of small scale irrigation technologies for smallholder farmers. The effort is highly demand driven and counts on effective linkages with stakeholders at multiple levels from national to regional and local strata and farmers and farmer organizations.

Planning, Evaluating and Reporting Results of USAID Sponsored Projects

Accurate and responsive management of data for USAID projects is increasingly important to the success of the Innovation Laboratories (ILs), and is required for all USAID-funded projects. The format and content of reports to USAID must be comprehensive and detailed. Individuals using the reports in the Agency look for information in a prescribed format. Dependable, reliable program and data management requires solid planning followed by systematic reporting. ILSSI, as other ILs, has multiple collaborators contributing from different national and institutional cultures. Assurance of compliance and accurate reporting is critical to the success of ILSSI. Therefore, ILSSI will partner with Piestar, Inc. to ensure adherence to compliance regulations, accuracy of reports, and effective management of project data.

Piestar

Piestar is a cloud platform designed to support collaborative data and project management systems. The Piestar data/project management system is specifically designed for the purposes of monitoring, evaluation, and reporting of impact data. Piestar currently serves and supports over 200 projects for USAID, USDA, and NSF research programs in over 60 countries. The Piestar data/project management system also serves and supports five USAID Feed the Future Innovation Laboratories and is currently utilized by researchers from several other Innovation Laboratories.

The Piestar data/project management system provides features to conduct the following actions.

- Capture research project data online, from anywhere, at any time, on any device.
- Submit reports and monitor reporting progress.
- Create customized modules and reports.
- Administer and receive automatic email messages and reminders.
- Collect and submit data, documents, photographs, presentations, and files of any size.
- Facilitate travel and equipment requests.
- Correct multiple records, typos, and duplicate data entry errors.
- Monitor data and activities of research projects.

The staff members of the Piestar data/project management system provide the following services:

- On-demand service and support from a team of experienced software engineers.
- Continual improvements, enhancements, and software updates.
- Unlimited storage for data, documents, files, photographs, and videos.
- Documentation, training modules, and technical resources.
- Secure site hosting, continual data backups, and routine maintenance.
- Customized modules and reports to meet funding agency compliance regulations.

Piestar and ILSSI Phase II

ILSSI collaborates with the Sustainable Intensification Innovation Laboratory (SIIL) at Kansas State University and, through that relationship, has two years of direct experience using the Piestar system. This positive experience has allowed the comparison of the data and project management of SIIL with the ILSSI internal management approach, which has demonstrated the need for ILSSI to have a more customized, comprehensive, and dependable online database to effectively manage data and projects for reliable reporting of impact data.

As a relatively small innovation laboratory with limited resources committed to administration, ILSSI needs streamlined reporting capabilities offered by the Piestar system to capture data and produce information to meet objectives while maintaining compliance requirements. Progress toward achieving goals and meeting objectives will be continuously monitored through the Piestar online data/project management system. Project data and outputs will be collected through customized online modules to facilitate reporting, evaluation, and collaboration among partnering researchers and institutions. The Piestar system provides secure site hosting, continual data backups, routine maintenance, and unlimited technical support from an experienced team of software engineers.

Accordingly, in ILSSI Phase II, the plan is to engage Piestar, Inc. as a partner in the cooperative agreement wherein they will participate in the conceptualizing of Phase II, assist in drafting the data and project management portion of the proposal, provide leadership and engagement in management of impact data, and offer a system for the multi-institutional elements of ILSSI for effective preparation of integrated reports to the sponsor.

5. TCAT Dashboard for the Application of The IDSS To Stakeholder Decision Making

Feed the Future Innovation Laboratory for Small Scale Irrigation (ILSSI)

The USAID Feed the Future Innovation Laboratory for Small Scale Irrigation is a multi-institutional effort led by The Borlaug Institute for International Agriculture at the Texas A&M University System with participation by three CGIAR Centers and one additional U.S. University. The agreement is a five year effort involving research in Ethiopia, Tanzania, and Ghana. The overall goals of the effort are to evaluate, select, conduct field research on, and assess the impact of small scale irrigation technologies for smallholder farmers. The effort is highly demand driven and counts on effective linkages with stakeholders at multiple levels from national to regional and local strata and farmers and farmer organizations.

Integrated Decision Support System (IDSS)

ILSSI employs an integrated suite of quantitative, spatially explicit stochastic models that assess the impact and consequences of small scale irrigation innovations on production, environment, and economic outcomes. The suite of models has been used to plan and evaluate results of field studies in the three countries where ILSSI currently conducts research. Results of field studies can be scaled to national levels using the IDSS. There is interest, need, and opportunity to make this capacity available in a simplified and user-friendly format for stakeholders ranging from farm consultants at local levels to planners and investors at national government agency and private sector levels.

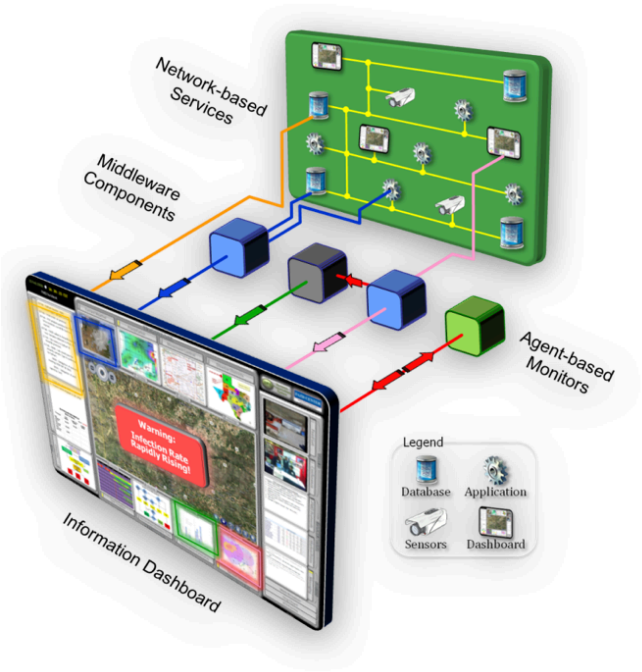
Texas Center for Applied Technology (TCAT)

TCAT is a research center under the Texas A&M Engineering Experiment Station, a component of the Texas A&M University System. Previously, TCAT has developed a technology framework (the Information Dashboard Framework – IDF) to produce common integrated displays for integration, organization, visualization, and analysis of data to support the overall decision-making process. Embedded software components allow seamless interfacing with existing data management systems, sensors, models and simulations, and other external applications, and then the integrated data visually presented to the end-user. IDF-based tools allow for user-definable display and sharing of data/information across stakeholder communities to support planning and management efforts. This framework has been the basis for numerous decision support systems in the agriculture domain ranging from biosurveillance and emergency response for early detection and ongoing management of animal disease outbreaks, to water management and irrigation scheduling for crops in Texas. This previous experience and existing technology framework will be leveraged to develop an information dashboard that can serve as a decision tool for the application of the IDSS.

Concept for the IDSS Information Dashboard

The dashboard will provide the capability to use the full power of the multiple models and their interaction in the IDSS without requiring the user to be an expert in the specifics of any single model. The dashboard provides an input-output function that will allow use of the IDSS to answer specific questions tailored to the individual needs of a user. It will provide visual analytic displays, the ability to evaluate different "what-if" scenarios, and the generation of reports based upon the assimilated data/information. The dashboard will be used to provide a decision tool that can be used by extension workers advising individual farmers on annual crop planning and management. It will also provide the capability for accessing and using the IDSS at the national level to evaluate alternative investment decisions on strategies for sustainable use of water in irrigation and other applications, *inter alia*. The general structure of the system will be generic and made country specific by the information provided. The conceptual framework for the information dashboard is shown in the following diagram.

The Information Dashboard Framework (IDF)



- The Information the Dashboard Framework (IDF) supports the construction of user-defined operational pictures
- These common integrated displays are composable and customizable based upon the set of included "pluggable" dashboard components
- Components represent function and access

- Presentation Layer – Implemented as a thin client and can be used on mobile devices
- Middleware Layer – Direct presentation from a service, transformation and presentation from two or more services, data routing from one service to another
- Network-based Services – Network services include: data, applications (esp. models and simulations), sensors, and other dashboards
- Agent-based Monitors – Cautions, alerts, and warnings based on threshold values

Action Plan

Funding permitting, a pilot study will be initiated in ILSSI Phase I that will provide a prototype of the dashboard. This will build on the very simple decision tool that is currently being developed for management of fodder systems in Ethiopia. Early and ongoing engagement with stakeholders at multiple scales will be maintained to ensure the utility of the product. For example, we will provide this tool for the Agricultural Transformation Agency in the Government of Ethiopia. In ILSSI Phase II, the dashboard system will be more broadly developed for the countries involved in that phase, and used to demonstrate the usability and usefulness of the IDSS in practical applications and to train and enable stakeholders to apply the system to their needs.

6. Summary of Accomplishments & Technology Overview for ILSSI

The following provides a substantial number of tangible public products that are emerging with varying levels of maturity. These products demonstrate the success of ILSSI's comprehensive research for development approach and how the ILSSI project is having and will continue to have an impact beyond the scope of the project.

Examples of Products of ILSSI Research

- Assessment of water availability for SSI and demonstration of methods for planning siting of small-scale irrigation schemes.
- Demonstration of the performance of multiple small-scale irrigation systems in three countries with examples of related infrastructure development such as microfinance and availability of purchased equipment and its maintenance.
- Production, environmental, economic, and nutritional consequences of interventions evaluated to date.
- Ex ante and ex post analyses of SSI outcomes for three countries.
- Constraints and gap analyses with evaluation of alternative mitigation strategies.
- IDSS-IFPRI modeling suite with related national training and application.
- Networks of scientists and practitioners in the three countries that communicate and collaborate on the use of quantitative modeling.
- Establishment of an explicit IDSS team at Bahir Dar University to teach and use the system in a national setting.
- Specific applications that have emerged at multiple locations

    - Workbooks and manuals on use of SSI and IDSS analytic tools
    - Databases that enable future analytic efforts
    - Value chain analytic capacity with application for fodder
    - Wetting front detector application
    - Solar powered pump application

Products for long-term use by stakeholders

1. The IDSS-IFPRI modeling will be a major product from the project that technical staff in government agencies and researchers at national universities can use and apply in the future. Many staff have been trained on components of the modeling suite.
2. Other capacity building and training activities will support future analysis of irrigation intervention scaling out across various types of stakeholders in the three countries. The project has established a network of scientists and practitioners in the three countries that communicate and collaborate on the use of the model suites. Specifically, the project has established an explicit IDSS team at Bahir Dar University to apply the IDSS models and to teach their application to BDU students.
3. Household survey data can be used by students and researchers for many other analyses after the data have been uploaded to dataverse. The protocols are already available on dataverse.
4. Other products that will be available for future use include the important stakeholder reports on constraints and opportunities for small-scale irrigation; all published journal articles; workbooks

and manuals on use of SSI and IDSS analytic tools; databases that enable future analytic efforts; and focus group discussion protocols.

5. Results from new applications that can be replicated elsewhere, such as value chains for irrigated fodder; wetting front detector applications, and solar power application (together with Africa RISING).

Key Messages from ILSSI Research, Analysis and Capacity Building

In Addition to the above products, ILSSI has and continues to show, through both modelled and empirical work, that smallholder irrigation has the potential to transform rural livelihoods. ILSSI informs on the entry points to sustainable, gender-sensitive uptake of small-scale irrigation in Ethiopia, Ghana and Tanzania with impacts beyond. ILSSI and SSI interventions contribute to global development goals in the following ways:

1. The sustainable small-scale irrigation potential is large, estimated approximately 6 million ha or nearly 5.3% of the landmass in Ethiopia based on ILSSI modeling
2. Small-scale irrigation of crops increases yields, on average, by 35.5 percent and income 1.8 times compared to rainfed farmers in Ethiopia; similarly moving from buckets to pumps increases 2.4 times net revenues (for example vegetables in Ethiopia);
3. Irrigated fodder is viable in Ethiopia and likely for Tanzania;
4. Smallholders with limited animal resources may find sale of fodder as a cash crop more attractive than feeding it to owned livestock;
5. Gender can act both as a constraint or a potential to women's empowerment in small-scale irrigation;
6. Small-scale irrigation increases dietary diversity through increased incomes;
7. Small-scale irrigators spend less time on collecting water for domestic uses (statistically significant Ethiopia).

Success stories

For further example of ILSSI achievements and successes, visit the ILLSI website for a collection of success stories that provide anecdotal evidence and real world examples of the impacts our project has had at the various levels of scale.

Please reference the Microsoft Excel document labeled "6. Phases of Technology ILSSI v4" for a comprehensive summary of ILSSI accomplishments and technology overview.

7. Scaling Methods & Results from Field to National Levels

The Innovation Laboratory for Small Scale Irrigation (ILSSI) is comprised of the following components:

(1) practical research in farmers' fields in three target countries (Ghana, Tanzania, and Ethiopia);
(2) household surveys in larger surrounding samples to evaluate economic and gender factors related to small scale irrigation (SSI);
(3) integrated modeling applications to evaluate economic, environmental and economic consequences of SSI interventions; and
(4) capacity development at multiple scales in the private sector, government and universities.

The effective scaling of results from the field level to national levels involves a complementary combination of scaling outwards and upwards from the farm level, coupled with modeling the application of SSI interventions based upon the geographic equivalence of the intervention. Geographic equivalence is critical because targeted locations are where established modeling methods are used to define areas at the watershed levels and national levels that have corresponding geographic features to the sites where research was conducted and are, therefore, candidates for the application of the interventions at larger scales. Scaling at the national level involves an IFPRI agent-based model that links with the Integrated Decision Support System (IDSS) noted below.

Each of the ILSSI partners and stakeholders plays a complementary role in ensuring that the targeted innovations are effectively scaled outward and upward. For ILSSI, scaling outward and upward from research in farmers' fields involves:

(1) a highly participatory process of selecting research interventions perceived by stakeholders as being the most beneficial applications for targeted areas;
(2) comprehensive training of farmers in the use of innovations involved in research;
(3) early engagement of local extension workers in planning experiments and evaluating results and creating awareness for surrounding farmers;
(4) field days and demonstrations of results;
(5) technical assistance and engagement with enabling infrastructure to support the selected innovations, including promoting options for microfinance and maintenance of equipment;
(6) ongoing and continual communications with stakeholders at multiple levels of scale in order to inform and seek guidance on emerging capacities and constraints.

The IDSS provides an integrated suite of models that assess the production, environmental, and economic consequences of interventions including those studied in field experiments and other more general options. The IDSS is used to plan and strategize the location of new small-scale irrigation sites based on the sustainable availability of water, land resources, slopes and distance to roads and markets. Once locations are determined, the IDSS is used to forecast and assess the results of small-scale irrigation experiments and interventions in the context of the overall farming system in which the intervention is introduced. The IDSS outcome provides a quantitative stochastic estimate of the consequences of the intervention – either technology or policy – for the geographic area studied and modeled.

For scaling, the IDSS provides a spatially explicit quantitative estimate of the potential suitable areas at the national level where the intervention studied could be successfully introduced/adopted. Using the new IFPRI agent based model with the IDSS, the prediction is at a 10 km by 10 km scale and provides estimates of both biophysical and economic consequences. Finer scale resolution (e.g. at 1 km by 1 km) models will also be developed in areas that have high potential for food and other ecosystem services production. The IDSS models and outputs create an assessment of quantities of natural resources available and help define the land area that can be sustainably used to adopt the intervention and the

number of farms that could be affected. The system also enables the potential sponsor to estimate the consequences of the application of the intervention at specific locations in the target country.

The end users of the IDSS products are (1) national policy or decision makers, (2) private sector investors providing supporting infrastructure such as finance and equipment, (3) international donors (4) researchers who would like to build diverse scenarios (e.g. impacts of global environmental change) and conduct analysis at national level as well as selected locations in the country and (5) practitioners or users of the intervention at local levels including farmers and their advisors.

Results and experiences in the application of interventions at the farm and community level provide input to the scaling assessment using the IDSS. IDSS results at the farm or community level inform practitioners' decisions at local levels. Results of household surveys provide input to both the IDSS modeling and to the decision-making process at local levels. Survey results, in particular, inform decision makers on options to improve the gender neutrality application of new interventions.

Capacity development at all levels of scale and for all investors is a critical component of the overall project and of its application at multiple scales. Capacity building is used as a primary channel in establishing engagement with key stakeholders, which includes participants from government institutions, private sector, NGOs and universities.

Overall, the sum of experiences and analysis across all components of ILSSI are interactive and provide a unique perspective for planning, monitoring, and evaluating results of investments in natural resource use and conservation. The combination of results allows planners, decision makers and practitioners to make informed and strategic decisions about the future application of innovations, technologies, and interventions.

The scaling analysis is underway in year four. A draft of the paper describing the combined IDSS and agent based modeling is referenced here. Upscaling analysis – From small river basin to county.

8. Comparison of ILSSI Achievements to Original Cooperative Agreement

Overview of expectations

ILSSI research "will evaluate alternatives in terms of integrated and linked products; define key data, knowledge gaps, and constraints; recommend strategies and interventions for improving access by small holder and women farmers, and use existing and develop new linkages with international and national research organizations, national and local policymakers, investors, and institutions to take research results to practice. The product of this program will assist and enable policymakers, national researchers and scientists, engineers, other decision makers and investors in sub-Saharan Africa to analyze the impacts of small scale irrigation technologies and advanced water management practices on the following: crop and livestock productivity and production, environmental impacts such as soil organic matter and macronutrient availability, soil erosion and sedimentation, soil nutrient losses, stream flows, aquifer recharge, lake and reservoir levels, irrigation water availability, household and village-scale nutrition and economic well-being, risk of crop failure with associated impacts on nutrition and household/village economics, and gender-sensitive labor requirements."

Summary

ILSSI is half way through its year 4 activities and has completed 3.5 years of a 5-year project. Most milestones to this point have been reached and the status of the cooperative agreement (CA) is good. In the remaining 1.5 years emphasis will be placed on stakeholder engagement with the objective of moving as far as possible towards adoption and use of the SSI products, with increased emphasis on the use and application of IDSS.

Areas where we have exceeded expectations

Over the course of this project ILSSI has conducted over 10 workshops on the use of IDSS; through this effort over 500 agricultural and development professionals have been trained, which has led to informal training taking place within Tanzania, Ghana and Ethiopia. As a result, the IDSS tools are now incorporated in several curricula at various universities in the respective countries. Moreover, the demand for IDSS is beginning to grow. Organizations such as the African Transformation Agency, USAID mission staff, as well as other stakeholders are beginning to meet with ILSSI Staff to explore opportunities for training. In addition the project is examining micro-finance for small-scale irrigation, based on stakeholder engagement and national priorities. This was extended to training of local microfinance cooperatives and organizations in Ethiopia in response to identified needs. The project is also providing training on irrigation scheduling methods and tools, also based on stakeholder demand. The materials are being made available so that the project's capacity development efforts can also be scaled. The interaction between the field studies and the IDSS has supported adapting the APEX model to groundwater modeling; other opportunities to adapt the IDSS to the developing context are being developed. Samples collected and analyzed for water quality, related to various risks according to the stakeholder engagement.

Areas where we have underperformed

The project began by exploring opportunities with partners in each country to develop private sector linkages. However, the irrigation technology supply chain was found to be underdeveloped; specific manufacturers noted in the proposal were not operating in the project countries.

Bridging elements from phase I that will take us into new work in phase II

An overview of the experience and accomplishments of ILSSI suggests a number of observations, opportunities and issues that will be addressed in a Phase II of the project. These include a continuation

and extension of farm level research in broader areas of the three ILSSI countries to more comprehensively provide biophysical understanding of SSI covering the geographic diversity of the countries. In addition ILSSI will further engage in expanded stakeholder collaboration to put in place and demonstrate the utility of SSI interventions at farm and regional levels of scale – moving the main emphasis from research to demonstration along value chains in Phase II. We will also look to extend the SSI thrust to address related critical questions related to climate change and climate smart agriculture – addressing how to best use water and other limited natural resources for production of food and fiber most efficiently in the future and which SSI technologies are best equipped to deal with varying climatic changes in the three countries. Additionally, we will extend the IDSS to provide the capacity to conduct value chain analyses on relevant commodities using small-scale irrigation as part of the farming system, and we will develop derivative management tools from the IDSS for farmers and planners at local levels that can be used for planning and evaluation at the enterprise level in developing countries.

Specific notes from the research program document as relevant to ILSSSI and possible gaps

Research program section and excerpt	ILSSI compliance/progress
R4D approach	
linkages to proposed private sector actors, such as iDE and Jain irrigation, with whom IWMI and IFPRI have established relationships, will help ensure that the private sector is integrated into the research process and invested in the results. ….. Jain Irrigation will help to ensure that the private sector is integrated into the research process and invested in the results Training in the use of the integrated methodologies will be provided at multiple levels of scale. Over the course of the five-year program at least 10 IDSS training workshops, as well as other educational activities, will be conducted in cooperation with national and international stakeholders. This will assure active technology transfer to over 250 agriculture and development professionals in the targeted FtF and other sub-Saharan African countries. These training activities will provide theoretical and hands-on experiences with small-scale irrigation systems, a review of relevant field research and demonstrations, and use of the SWAT, APEX, and FARMSIM models to design and predict the performance of small-scale irrigation systems on a wide variety of horticultural and field crops and mixed crop-livestock systems in FtF countries and other nations of interest to USAID. Throughout the course of the five-year program strong linkages with USAID Missions and Washington bureaus will be maintained to IFPRI will train at least 50 local National Agricultural Research Institutes (NAREs) and university staff in each of the three countries on topics including field survey design linking irrigation technologies with	There have been linkages with IDE throughout the project in most countries: meetings, informal consultation, invitation to workshops, etc. And NCAT is subcontracting iDE in Ghana. Jain is mentioned several times. However, I was unable to find Jain representatives in the project countries IFPRI has linked a CGIAR WLE funded activity in northern Ghana that directly works with iDE. iDE is supplying motor pumps to farmer groups and the ILSSI survey is used to survey the households. Linkages to various private sector providers have also been made during various outreach events, such as at Stockholm Water Week and the Nebraska Water for Food Conference. ILSS has provided over 10 IDSS workshops and has trained over 500 professionals, which intern helps to train other users within each country. There are several orders of multiplication factors in this effort. ILSSI also worked with graduate students in each of the three countries as well as supported a cadre for training at Texas A&M on advanced IDSS methodology. The IDSS tools are now incorporated in several curricula at various universities in the respective countries. As a result of our intervention demand for IDSS is beginning to come from ATA, other stakeholders, as well as USAID mission staff. While demand is starting to grow our limited resources creates a limit our ability broaden the scope of our trainings.

Nutrition and health indicators. In all interactions, partners will work with local collaborators to highlight the importance of understanding gender differences. IFPRI has a long history of supporting and working with NAREs to not only strengthen data collection efforts, but to also encourage and support in-country data analysis and integration into decision-making, through the Regional Strategic Analysis and Knowledge Support System (ReSAKSS) and their country support strategies.	In 2016, ILSSI trained 150 stakeholders including USAID mission staff on gender and irrigation during three workshops held in Ethiopia, Ghana, and Tanzania, respectively. A project note with guidelines on gender-responsive irrigation was produced as a result of these workshops. In addition, in Tanzania, the National Irrigation Policy is going under review and the director expressed interest in improving attention to gender in the new policy. Further information on the workshop, including the policy note, is available here: https://wle.cgiar.org/thrive/big-questions/what-should-we-be-asking-understand-gender-dynamics-irrigation/investigating In addition, IFPRI trained approximately 60 female and male enumerators in Ethiopia, Ghana and Tanzania on survey enumeration techniques, nutrition and health measurements and ethics rules around collecting data.
strong linkages with USAID Missions and Washington bureaus	We have documented meetings, presentations, etc. Likely engagement will be increasing in the last 2 years of project.
Identifying promising, context appropriate, small-scale irrigation interventions, management and practices for poverty reduction and improved nutrition outcomes	
IWMI and ILRI will build on the Rapid Participatory Opportunity and Constraint Analysis (RPOCA) framework… IWMI and ILRI will apply this methodology, together with national and international research partners, to identify and evaluate promising small-scale irrigation technologies and the key constraints and opportunities to improve smallholder farmer access to them. Efforts will be made to ensure that local stakeholders, including farmers, and especially women farmers, participate as researchers… The technologies and practices will be chosen on the basis of their known site-specific success, as well as their potential (as determined by application of the SWAT, APEX, and FARMSIM models and expert opinion) to be employed successfully across a wider range of environmental and socioeconomic conditions in Sub-Saharan Africa. IFPRI will evaluate the candidate new small-scale irrigation technologies using extensive household surveys relating smallholder irrigation with nutrition, gender and health. Qualitative follow-up work will use local	IWMI developed a framework for identifying communities and households based on similar categories/criteria, which could be seen as a simplified PROCA. Farmers and local stakeholders were engaged through a documented process of consultation and self-selection to participate. IWMI is now using the combined experience of AgWater Solutions and ILSSI to update the PROCA and improve documentation to expand use of the tools. ILSSI has completed the ex ante analysis reports, as well as the gap and constraint reports for Ethiopia, Ghana and Tanzania. IFPRI is continuing to collect field data to compare before and after understanding of the impact of small scale irrigation interventions. ILSSI is poised to complete the ex post analysis in year 4, this will help to verify the ongoing field research and study the impact of small scale irrigation before it is used to scale up to regional and national level.

enumerators and partners to understand how these investments can lead to improved nutritional outcomes; IFPRI and partners will take efforts to involve local farmers, women, and girls as researchers when possible. Farmer groups and representatives will be involved in identification of relevant research questions and agendas and in the trial and testing of research protocols. Results will be linked to geo-spatial databases, to ensure that the limitations imposed by Africa's limited transportation and other rural infrastructure are correctly reflected. Explicit consideration of biophysical realities, farm ownership, input availability, market limitations, nutritional needs, and gender and other societal considerations will doubtless limit feasible implementation of small-scale irrigation. But comprehensive *ex ante* analysis that considers all these possibly limiting factors will reduce the probability of policy failures and increase the probability that areas and technologies selected for small-scale irrigation development projects will succeed in meeting production, socioeconomic, environmental, and nutritional goals. IFPRI will evaluate the candidate new small-scale irrigation technologies using extensive household surveys relating smallholder irrigation with nutrition, gender and health. Qualitative follow-up work will use local enumerators and partners to understand how these investments can lead to improved nutritional outcomes; IFPRI and partners will take efforts to involve local farmers, women, and girls as researchers when possible. Farmer groups and representatives will be involved in identification of relevant research questions and agendas and in the trial and testing of research protocols. Results will be linked to geo-spatial databases, to ensure that the limitations imposed by Africa's limited transportation and other rural infrastructure are correctly reflected. Explicit consideration of biophysical realities, farm ownership, input availability, market limitations, nutritional needs, and gender and other societal considerations will doubtless limit feasible implementation of small-scale irrigation. But comprehensive *ex ante* analysis that considers all these possibly limiting factors will reduce the probability of policy failures and increase the probability that areas and technologies selected for small-scale irrigation development projects will succeed in meeting production, socioeconomic, environmental, and nutritional goals.	IFPRI has finalized a paper on irrigation-nutrition linkages for Ethiopia and Tanzania and is currently drafting a separate paper focused on Ghana. These are all based on the baseline survey. IFPRI has finalized a descriptive paper on gender-irrigation linkages. IFPRI implemented (with IWMI) qualitative work to better understand linkages between small-scale irrigation and women's time burden (which is linked to time available for childcare and thus nutrition). The question regarding nationwide transferability or adoption potential of small-holder irrigation technologies is investigated as part of the upscaling analysis, which is ongoing. In collaboration with the TAMUS team, IFPRI has developed an agent-based model to facilitate the analysis. This model maps success probability of small-scale irrigation technology adoption over a country at a high resolution by allowing for the integration of multiple geospatial data produced under the ILSSI project with factors influencing small-scale irrigation adoption. The model has been applied to Ethiopia and initial results are available. Final products of the Ethiopia case study will be released shortly and work on Ghana and Tanzania has started.
Evaluating impacts, trade-offs, and synergies of small scale irrigation technologies and practices	

Expanding smallholder farmers' access to technologies for small-scale irrigation can increase the quantity and nutritional quality of food consumed, and *may also increase water availability for hygiene and quality of drinking water*. Small-scale irrigation has the potential to affect men's, women's, and children's nutrition, *health*, and well-being through several pathways.	The AOR mentions health and water quality frequently. However, in the research program description, it is included in the modelling and in the IFPRI survey, not as part of the field interventions. IWMI has added water quality testing parameters to data collection and sample analysis.
The IDSS will be used to analyze the consequences of and desired conditions for adoption of these Technologies linking production, environmental and economic outcomes into an integrated product. These analyses will include the impacts, trade-offs, and synergies of water capture, storage, and delivery to croplands and households. The SWAT and APEX models will be used to evaluate the production and environmental impacts, trade-offs, and synergies of water capture and small scale irrigation. Impacts and trade-offs will vary with climate, topography, land use, and soil conditions, as well as crop, livestock, and human requirements for irrigation and drinking water throughout the year. The SWAT and APEX models run on a daily basis, facilitating analysis of production, environmental and economic sustainability, and labor metrics to be calculated on daily, weekly, monthly, or annual bases. FARMSIM will use the outputs of APEX and SWAT to simulate farm family-scale and/or village-scale economics and nutrition, including risks of inadequate household income and nutrition.	This task has begun in the fourth year of this project, thorough scale up activities and to assess the trade-offs of various small scale technologies including agronomic practices such as what crops to grow during dry seasons by working with IFPRI. It is expected Ethiopia will be completed in year 4 and Ghana and Tanzania will be completed in year 5.
BI will make use of data collected by IWMI, IFPRI, and ILRI (and their national counterparts) to develop better APEX models of major horticultural crops and the impacts of developing small-scale irrigation on household water quality, family food production, and supplemental feed for livestock, especially during the dry season…. IWMI and ILRI, guided by their experience in AgWater Solutions and other relevant research, will assist BI in providing primary data and parameterizing and using APEX, SWAT, and FARMSIM… where relevant experimental and experiential data are available and in other areas lacking field and farm-scale data	We have submitted various data, some field and some sources from national entities. Evidence of adapting/adding to APEX to consider the context and demands from stakeholders. This is also part of the ex post analysis and is ongoing into the 4th year of this project. Note the adaptation of APEX to consider shallow groundwater.
BI will attempt to engage with private irrigation companies (such as iDE) that have well-established programs in the three target countries. These private companies are testing different approaches or	This is an ongoing effort; work is being undertaken to engage with private groups and broaden the reach of our research

packages of irrigation technologies and services, such as extension and credit in order to develop an experimental approach. BI will work with these partners to identify communities where packages of technologies and accompanying services are being offered and similar communities where such technologies and services are not yet available. This will enable us to attribute differences in nutrition, health, well-being, and gender outcomes between communities to irrigation interventions. BI will, in addition, provide international and national collaborators with training and the necessary basic biophysical input data for them to use APEX and SWAT for farm- and watershed-scale analyses anywhere in Africa. BI will make certain that these trainers include both men and women, from diverse backgrounds. To analyze the impacts, trade-offs, and synergies of small-scale irrigation technologies on health, nutrition, rural livelihoods, and women's empowerment, IFPRI will use a mixed-method approach, including qualitative and quantitative components. The qualitative component will consist of participatory rural appraisals in selected communities to assess pathways through which the use of production technologies improves nutrition, health, livelihood, and empowerment outcomes. IFPRI and local partners, when possible, will involve farmers organizations and cooperatives as investigators, working with participants to not only collect data but to interpret and analyze it, using action research methods and approaches to ensure that research collection and data make contributions to sustainable use of this information. The quantitative component will involve surveys of men, women, and children from randomly selected households in selected communities to assess the impacts, trade-offs, and synergies of the use of small-scale irrigation on nutrition, health, and women's empowerment in agriculture. Again, local partners will be used to conduct the survey in each country and both male and female enumerators would be selected from the local communities participating in the survey. The survey instrument will take the form of a household	This has been achieved through our training programs. The IDSS tools are now incorporated in several curricula at various universities in the respective countries. As a result of our intervention demand for IDSS is beginning to grow. Organizations such as the African Transformation Agency, USAID mission staff, as well as other stakeholders are beginning to meet with ILSSI Staff to explore opportunities for training. IFPRI implemented 3 baseline and one endline survey using national partners (at two universities and one NGO) with female and male enumerators drawn from national partners for quantitative and qualitative fieldwork.

questionnaire, covering a range of topics including household demographic and socioeconomic characteristics; agricultural production; use of irrigation technologies; asset ownership; food consumption; health behaviors and health status; nutrition outcomes; and the components of the WEAI (http://www.ifpri.org/publication/womens-empowerment-agriculture-index).	
efforts will be made on how to reduce gender and demographic inequities in benefits derived from smallholder irrigation, reducing potential resource conflicts and ensuring improved guardianship of natural resources	It was not clear if this referred to field level or to the models… Gender inequities being addressed in research and TAMU-IFPRI have worked on issues around models. Nothing directly on resource conflicts or NRM/guardianships, though the paper jointly developed by IWMI and IFPRI suggests a framework that shows household level decision making on use of natural resources (specifically water)
Where appropriate and feasible, IWMI and ILRI will install and evaluate the selected small-scale irrigation technologies… to highlight and demonstrate possible solutions to some of these complex issues. In-situ field experiments will provide information necessary to parameterize and validate field- and farm-scale simulation of biophysical processes (hydrology, crop performance, soil erosion, nutrient cycling, etc.) and economic performance and nutritional outputs	This appears to be addressed in field trials and research. Reference to complex issues etc. leaves it open to include irrigation scheduling etc.
In terms of scaling out, the team will also draw on associated work on the constraints to wider adoption and uptake of smallholder irrigation, including those related to market access, taxation, information and capacity as well as institutional support.	Market access in various economic studies by IWMI, as well as IFPRI survey. Maybe in IDSS? IWMI has not done any work on taxation directly for ILSSI. Should this be considered in any private sector research, if undertaken in future phase. Information issue already noted – included in gender research. Capacity and institutional issues across various studies.
Identifying key constraints and opportunities to improve access to small scale irrigation technologies and practices	
Opportunities include the refinement and validation of small-scale irrigation solutions, strategies and business models already identified through the AgWater Solutions project in selected FtF countries within relevant food crop value chains; development of additional solutions identified through stakeholder engagement (with particular emphasis on small-scale irrigation technologies useful to women and men farmers); and utilization of biophysical and economic	No business model development thus far under ILSSI, but data from ILSSI contributed to business models for other projects. Upscaling potential being addressed in IDSS.

models in conjunction with AgWater project-designed tools to monitor and evaluate the actual agricultural productivity, livelihoods, health and nutrition, gender, and environmental impacts of small-scale irrigation systems. AND: IWMI and ILRI will build on the results obtained through Components 1 and 2 above to examine opportunities for upscaling promising solutions through strategic refinement of AgWater Solutions small scale irrigation business models and development of new business models… solutions will be tailored to country needs… The SWAT and APEX modeling activities will identify key biophysical (climate, hydrologic, topographic, soil, and environmental sustainability constraints and opportunities to improve access to small-scale irrigation technologies and practices. BI will use the FARMSIM model to identify constraints and policy options to enhance income for families and related social structures. These will include the feasibility of adequate water harvesting and/or groundwater availability to sustain small-scale irrigation adequate to improve crop and livestock production and human nutrition. FARMSIM will also be used to process economic and labor force data collected by IFPRI, IWMI, and their national cooperators. These data, in conjunction with biophysical crop production and environmental impacts modeling with APEX and SWAT, will be used to assess the nutritional, economic, and environmental risks associated with both current practices and implementation of appropriate small-scale irrigation systems. These models will also serve as training and decision tools as the national and international partners in FtF countries gain experience in their use.	Work is underway, with a product produced for Ethiopia on the physical constraint of potential for irrigation as well as constraints. This product is used in the expansion of regional and national analysis. A product for Tanzania and Ghana will follow at the end of year four and into year five.
At least three regional meetings in Ethiopia, Tanzania, and Ghana will be organized and conducted to further discuss with key stakeholders the selected technologies and the potential to improve their performance under local environmental and socioeconomic conditions. These stakeholders will include relevant private sector interests, including technology providers and financial service providers, in addition to government extension employees and advisory services providers.	Private sector, technology providers or financial services not directly targeted in previous consultations. Need to be considered for next round of consultation workshops.
several societal constraints to the expansion of irrigation technologies. These include input and output	Being done through: • gender focus groups and IFPRI survey

market access (for fertilizers or irrigated produce), economic constraints (such as the cost of irrigation and crop prices), information constraints (on how to acquire, operate and manage irrigation technologies), and environmental constraints (such as the amount of water available for irrigation, suitability of arable land, and climate change). Using data collected from the household surveys and focus group discussions described above, the consortium will identify the main barriers to men's and women's adoption of small-scale irrigation technologies and explore ways to increase adoption of irrigation technologies.	• microfinance/adoption surveys • crop price information (Ghana, not sure if that is being collecting regularly in Ethiopia) • environmental constraints (models and field interventions) • information constraints are captured in the IFPRI survey
During the initial phase of the project, stakeholder analyses will be conducted which will build on and further develop existing stakeholder maps of relevant national and regional institutions actors, reviewing their inter-relationships and roles in influencing outcomes in the irrigation sector.	The stakeholder lists by type, etc were updated in Year 1 from AgWater Solutions. This has been done again as part of the MTR and evaluation. Part of the impact pathway work. Would be strengthened by mapping the private sector but unclear if this is for current phase? IWMI has done an assessment of supply chain for solar pumps in Ethiopia, and one is underway for Ghana. These were done under a different project (WLE and IFAD funded), but some of that research could be used for a separate paper or report for ILSSI, as needed.
IWMI will take a leading role in reaching out to various agricultural and water-related networks in the region	IWMI does this generally but will need to ensure clearly targeted in next workshops and share results of project more directly. Some of the network listed in RFP are now defunct or not appropriate to our outputs so need to target carefully. Seems a small point/issue.
BI will obtain and share key data and analytical tools with each other and with cooperating national African partners and international development agencies and universities. This activity will reduce or eliminate current gaps in data availability related to weather, surface and groundwater resources and hydrology, soils, topography, land use, vegetation, crops, livestock, human populations and nutrition, societal differences in gender roles, and costs and prices of food and agricultural products. Data and analytical tools will be shared via project web sites, personal contacts among researchers and development professionals, training of graduate students, and short courses IFPRI will utilize frameworks linking agriculture, nutrition, and gender to understand the processes through which investments in irrigation are made, who is able to make the investments, and the outcomes of	IDSS training for tools. Unclear on reducing data gaps via website but this seems to be planned by TAMU. We have developed new soils information at the country level, as well as SPAM (Crop/land use databases) at a finer scale 1km resolution at the country level. In additional several weather data bases developed and already shared through SWAT website. IFPRI developed a series of frameworks linking agriculture, nutrition and gender, with frameworks evolving over time. One such framework was published as Domenech (2015), a second framework is included in Passarelli

such investments. The IFPRI team will include and consult with experts in its Poverty, Health, and Nutrition Division (PHND) and the Agriculture for Health and Nutrition (A4NH) research program. By establishing linkages with organizations such as the Ethiopia Health and Nutrition Research Institute, the project will bring new partners into the nexus of agriculture and health research.	(under review). The latter adapts the Spring framework. IFPRI established linkages with the Ethiopia Public Health Institute to sensitize them on the positive and negative effects of small-scale irrigation. Similarly, IFPRI established linkages with the Ethiopian ATA on gender and irrigation.

9. Description of Interventions and SSI Equipment

Please reference the Microsoft Excel document labeled "9. Summary of Interventions and Equipment."

Explanation of contents: This document accurately and definitively describes the SSI equipment that is being researched under ILSSI by country. What follows is organized to meet the needs of a potential user – either at the local or higher levels of scale. To that end this report provides the following:

- Design specifications or description of the device – what is it and how can it be manufactured?
- Under what conditions should the technologies be used (Drip vs Furrow)
- Engineering drawings or equivalent, if available.
- Performance characteristics of the device
- Farming system application of the device or combination of devices – capacities for SSI – how much water, how much land, how often
- irrigation is applied etc.
- Description of operational experience using the device – function, problems, reliability
- Source of the device in each country or regions of countries – where can it be obtained
- In-country resources to maintain and upgrade the device - Private sector enterprise to maintain operational status
- Cost of the device in local currency
- Cost of maintenance - annual

There are five tabs in this spreadsheet including this explanation. Others are the overview of technologies, Ethiopia, Ghana and Tanzania.

It should also be recognized that this is a living document and evolves as this project matures. What is represented here is reflective of the mid point of the project.

10. Economic Consequences of ILSSI

Profitability and Sustainability of technology Being Developed in Ghana
The ILSSI experimental design with four components is devised to provide an integrated picture of outcomes and impact of the SSI water lifting and delivery systems coupled with an overall farming system approach. It also evaluates farming practices and related input (purchased) and marketing (prices for farm products) and an assessment of the nutritional consequences of interventions at the household level.

IWMI conducts cost benefit analyses on the specific interventions that provide an explicit link to their field experiments. The Integrated Decision Support System (IDSS) evaluates production, environmental and economic consequences of these interventions at levels of scale from farm to national. The models used are SWAT, a watershed hydrology model, APEX that is a farm level model of production practices and FARMSIM, which models economic and nutritional responses to farming systems – in this case that allows evaluation of specific experimental interventions. FARMSIM broadly acquires regional, national and local date from multiple sources to enrich the inputs that come from the farm level experiments done by IWMI and ILRI. FARMSIM produces a stochastic output. The FARMSIM outputs are stated as the probability of achieving various outcomes at the end of five years using the interventions. FARMSIM explicitly models net profit at the end of five years, net present value at the end of five years and other products that are directly related to the "profitability and sustainability" of the interventions. The combination of local assessment of specific outcomes and the more comprehensive application of the IDSS provides a clear and detailed assessment of "profitability and sustainability". This capacity represents a unique ability to evaluate outcomes and impacts of USAID investments that could be used more broadly by the agency. A dashboard approach to making the IDSS useful and usable by various stakeholders at different geographic scales is being planned for ILSSI Phase II.

A recent analysis of the economic outcomes of studies in Northern Ghana resulted in the following conclusions.

This report provides the examples of profitability and economic feasibility assessment of selected SSI technologies field piloted by ILSSI in northern Ghana. Depending on the specific local biophysical and socio-economic conditions, various technology options can be proposed and implemented to benefit smallholder farmers and ensure the sustainability of technology adoption. Economic analysis of SSI technologies provides key decision support evidence for promoting technology adoption and upscaling. This report assessed the profitability and economic feasibility of four different dry season irrigated crops under five SSI technologies in two communities/sites based on data collected by the University of Development Studies, project researchers' field observations and interviews with participating farmers, and relevant secondary data. Results show that some crop-technologies were profitable and economically feasible: (a) Cochorus production: use of pump-tank-hose irrigation technology; (b) Cochorus production: use of watering can irrigation technology; (c) Onion-amaranths intercropping' system: use of pump-tank-hose irrigation technology; (d) Onion-amaranths intercropping' system: use of watering can irrigation technology. Comparison of the economic results on watering can and motorized pump technologies showed that watering can was relatively more profitable, though highly labor intensive. The variation in levels of profitability – with motor pump less profitable - is mainly due to the cost of fuel and capital investment required to purchase a pump. However, rainwater-harvesting using poly tank storage and drip required large capital investment that could not be recovered from the current yield level and market price of cowpea. Lower cost technologies would need to be considered to intensify cowpea production.
The economic analysis results suggest three main policy implications. First, rainwater harvesting for dry season irrigation is an expensive technology for irrigation purposes, especially when poly tanks are used for water storage combined with drip equipment. This technology is not financially feasible for upscaling,

even with higher value crops. Secondly, the high cost of borrowing in Ghana makes the upfront investment in irrigation technologies very expensive. This is supported by other studies that show smallholder farmers are credit-constrained in northern Ghana (Balana et al. 2016). Targeted assistance is needed to ensure that smallholders at lower levels of economic status can access credit on appropriate terms (Namara et al 2013)[1]; otherwise, poorer farmers, such as women, risk being left out of market-oriented production activities. Third, alternative energy options, notably solar pumps, could be a promising option for smallholder farmers to reduce labor while decreasing reliance on fuel. Studies have shown that agriculture labor costs in Ghana are high, as is the opportunity cost of labor employed in agriculture in absolute terms, particularly as rural households increasingly depend on non-farm activities to boost income (Nin and McBride 2014). The upfront cost of solar pumps is expensive in Ghana compared to fuel pumps, and may deter smallholder farmers from adopting solar-based irrigation technology, unless affordable credit or innovative loan schemes become available.

A description of the more general application of the FARMSIM model to estimate the consequences of small scale irrigation technologies is provided in the following summary.

FARMSIM
Summary of Methodology

Farm level modeling has been used extensively to demonstrate the impacts of alternative technologies and policies on the sustainability and survival of farmers in developed agricultural systems (Richardson, et al. 2017, 2016, 2013). The policy and technology analyses developed by Richardson and the Texas A&M AgriLife Agricultural and Food Policy Center have been made possible by an extensive data base of representative farms and the Farm Level income and Policy Simulation model, FLIPSIM (Richardson and Nixon, 1981). The opportunity exists with Richardson's new model for developing countries, FARMSIM, to apply this same modeling capability to analyze the profitability and sustainability of alternative technologies for farming systems in developing countries (Richardson and Bizimana, 2017).

For the past three-years the FARMSIM model has undergone extensive testing and application for modeling the profitability and sustainability of alternative irrigation systems in Ethiopia, Tanzania, and Uganda (e.g., Bizimana, et al). Numerous representative farms have been developed using primary data obtained by our AID partners and secondary data from various government agencies. The representative farms are at the kebele level and the results are reported at both the kebele and individual household levels. In keeping with the FLIPSIM methodology, FARMSIM uses probability distributions for crop yields, livestock production, and prices received to simulate the risk inherent in the production and marketing of agricultural products.

Analysis of alternative irrigation systems has been the focus for the current project and the results are presented in terms of the probability of how alternative irrigation systems can improve the ending net cash income, wealth, and health of a farm family which adopts the technology. The results are best described by presenting Stop Light charts showing the probabilities associated with three irrigation technologies for the Robit kebele in Ethiopia. Alternative 2 has a 53% chance of NPV greater than 220,000 ETB, while the Baseline has only a 4% chance, and the Baseline has a 49% chance of NPV being less than 110,000 ETB (Figure 1). The chance of annual net cash income being less than 20,000 ETB per year is 88% for the Baseline and only 1% for Alternative 2, which has a 39% chance of annual net cash income greater than 44,00 ETB (Figure 2). Figure 3 shows that only Alternative 2 has a zero probability

[1] The majority of farmers that adopt SSI technologies on their own are usually wealthier. See: R.E. Namara, G. Gebregziabher, M. Giordano, C. De Fraiture (2013). Small pumps and poor farmers in Sub-Saharan Africa: an assessment of current extent of use and poverty outreach. *Water International* 38(6): 827-839.

of ending cash being less than 100,000 ETB, while the Baseline and other alternatives have as much as a 49% chance of low ending cash reserves. FARMSIM Stop Light charts can also show the probability of the family consuming the minimum daily requirements for protein, iron, fat, calcium, and vitamin A for alternative farming technologies.

FARMSIM can readily be used to conduct probabilistic ex post and constraints analyses. The representative farms and alternative technologies used for the ex ante technology assessments are the first step for conducting ex post analyses as field information is obtained. Presently ex post analyses are underway using the representative farms and survey data obtained from field tests for alternative irrigation systems. Probabilistic results from FARMSIM will enhance understanding of the long-run benefits of technology transfer.

The advantage of using FARMSIM to pretest alternative farming systems, is that we can forecast the probability of economic success and sustainability for technologies without disrupting the local economy through experimentation on farmers. The use of farm level simulation is widely accepted and FARMSIM is a tool which is much more powerful than previous farm models because it incorporates yield risks based on forecasted probability distributions generated by APEX and SWAT in the IDSS. APEX and SWAT use historical weather data for the local area, local soils data, and local irrigation water capabilities to estimate the underlying yield distributions for alternative crops and farming systems used in FARMSIM. Thus, the FARMSIM probabilistic forecasts of economic survival and sustainability of a technology is based on local agronomic and climatic conditions that have been observed and have a high probability of being observed in the future.

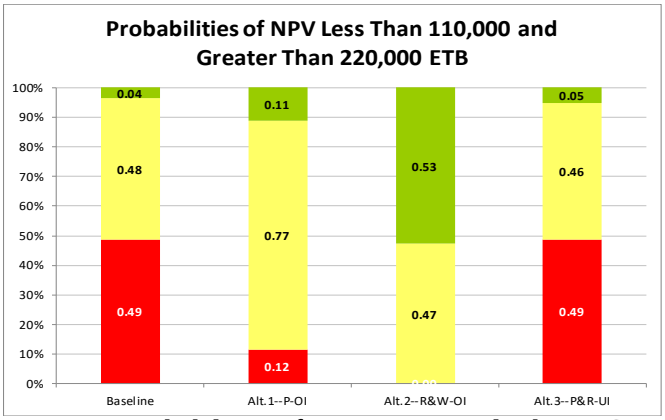


Figure 1. Probabilities of Net Present Value being Greater than 220,000 ETB for the Baseline and Three Alternative Irrigation Technologies in Robit Kebele, Ethiopia.

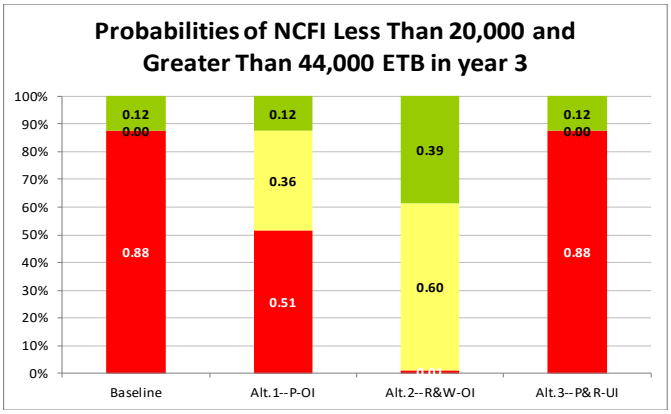


Figure 1. Probabilities of Annual Net Cash Farm Income being Greater than 44,000 ETB for the Baseline and Three Alternative Irrigation Technologies in Robit Kebele, Ethiopia.

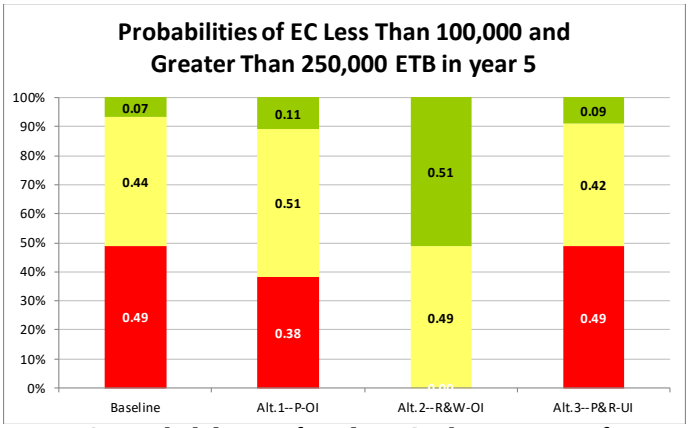


Figure 3. Probabilities of Ending Cash Reserves after Five Years being Greater than 250,000 ETB for the Baseline and Three Alternative Irrigation Technologies in Robit Kebele, Ethiopia.

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11. External Advisory Committee – History and Function

The Laboratory
The USAID Feed the Future Innovation Laboratory for Small Scale Irrigation is a multi-institutional effort led by The Borlaug Institute for International Agriculture at the Texas A&M University System with participation by three CGIAR Centers and one additional U.S. University. The agreement is a five year effort involving research in Ethiopia, Tanzania, and Ghana. The overall goals of the effort are to evaluate, select, conduct field research on, and assess the impact of small scale irrigation technologies for smallholder farmers. Linkages with previous and ongoing related feed the future projects is a key part of the overall strategy. The effort is highly demand driven and counts on effective linkages with stakeholders at multiple levels from national to regional and local strata and farmers and farmer organizations. The project employs an integrated suite of quantitative spatially explicit models that assess the impact and consequences of small scale irrigation innovations on production, environment, and economic outcomes. Training and technology transfer to stakeholders are active components of the project.

Performance of the Committee
Over the course of the first three and a half years, the External Advisory Committee (EAC) has met jointly with the Laboratory's Program Management Committee (PMC) annually in all three of the countries in which ILSSI works. At each meeting, the committee receives briefings and background papers from ILSSI's leadership team and has ample time for discussion. Recommendations are developed as part of the minutes of each meeting. The PMC reports on actions taken in response to the recommendations at subsequent meetings. The committee is scheduled to travel to northern Ethiopia in May 2017 to witness first-hand field research. The EAC will have an active role in facilitating stakeholder engagement in each country where ILSSI does research as Phase I of the project matures and technology transition is emphasized.

Terms of Reference for the Committee
The purpose of the EAC is to provide advice and counsel on program priorities, strategy and plans, evaluation of results, communication and linkages with relevant national and regional stakeholders and governmental agencies, and to help assure continuity of purpose and outcomes across the three countries.

It is anticipated that the EAC will meet either in person or electronically once per year and participate in the annual meeting of the project where possible. Semi-annual interim engagements will involve review and response to planning and results of research. The annual commitment of time will be approximately 10 days. We will make use of electronic communication where possible to be sensitive to the demands of committee members' time. Remuneration will be provided for airfare and per diem using the USAID policies and schedule for such payments. An honorarium of $500 per year will be provided at the time of the annual meeting of the EAC.

The EAC will be composed of one representative from each of the three countries, one regional representative and one representative from the private sector. The five member committee will be invited to serve over the five year lifetime of the program. The committee will elect a chairperson annually. The chairperson may serve for more than one year. The project co-director of the ILSSI will serve as liaison between the committee and program management. USAID Washington will be invited to have a representative to the committee.

Specifically, the EAC will review and advise on:
- The five year and each annual plan for the program
- Results reflected in semi-annual and annual reports

- Presentations and discussion at annual meetings
- Linkages between this program and related national and regional activities related to small scale irrigation
- Intercurrent related national and regional programs and activities for cooperation
- Methods for effective technology transfer to national programs and private sector
- Bring to the attention of ILSSI any other national or international programs working on similar issues.
- Gender mainstreaming and capacity development
- Advocacy to attract further funding for the project

External Advisory Committee Members
The ILSSI EAC is currently comprised of the following members:

Dr. Saa Dittoh (Ghana):
University of Development Studies – Ghana
Specialty: Irrigation economics and gender
Senior lecturer and researcher at the University of Development Studies, Food and Nutrition Security.
PhD agricultural economics.
Research interests: food security and climate change, irrigation system design and management, and participatory approaches.
Worked early in his career in the private sector for commercial farms, and currently serves as Chairman of the Board of the Savanna Farmers Marketing Co. Worked with: FAO, World Bank, UNICEF, UNDP, IITA, IWMI and CIAT.
Consultant to the Ag Water Solutions Project, including on stakeholder engagement.

Dr. Getachew Gebru (Ethiopia):
Specialty: Livestock - Ethiopia
PhD in Animal Sciences from the University of Wisconsin-Madison
Regional trainer on pastoralism and pastoral policy.
Co-founded MARIL, a private research and development organization,
Formerly: senior lecturer at Alemaya University;
Worked with ILRI.
Currently serves as President of the Ethiopian Society of Animal Production
Member of the steering committee of Camel Forum Ethiopia;
Country working group member of the East African Dairy Development Program II Co-Coordinator of the Endogenous Livestock Development Network.

Engineer Mbogo Futakamba (Tanzania):
Specialty: Water and Irrigation – Tanzania
Retired Permanent Secretary, Ministry of Water and Irrigation
Served in many roles in the Ministries of Agriculture and Water and Irrigation

Phillip Riddell (Private Sector):
Specialty: Advisor to international development organizations (Private Sector)
Almost 40 years of experience in AWM, expertise in the private sector.
Widespread irrigation policy work: establishment of enabling environments and leverage instruments to attract FDI and catalyze domestic investment in SSI;
Rockefeller funded study “Impact Investing in Commercial African Agriculture”;

Advising on commercialisation of Ghana's irrigation services for the World Bank, reviewing PPP opportunities in Ghana's irrigation sector;
Investment advisory services for FDI players and/or deal promoters in Ghana and Tanzania.
Wrote FAO's position paper on PPPs in irrigation service delivery and co-authored FAO "Demand for the Products of Irrigated Agriculture in Sub-Saharan Africa"

Dr. Evelyn Namubiru-Mwaura (Regional):
Specialty: Land and Gender (Regional Level)
Policy Officer (Land/Property Rights and Environment/Climate Change), AGRA
PhD in Public Policy from Indiana University; a Master's degree in Environmental Management and Development from the Australian National University, and BSc. in Forestry (Honors) from Makerere University.
15+ years development focused on gender, land tenure and natural resource management.
Currently: Policy Officer at Agra, leading land and environmental policy work and working with governments to design and implement land and environmental policies to accelerate the uptake of green revolution technologies; gender work in the Policy and Advocacy unit.
Currently: vice president of the African Association of Agricultural Economists.
Expertise on land tenure and property rights, women's land rights, sustainable forest resource management, REDD and Climate Change through appointments with AGRA, the World Bank, UNREDD, UNDP-GEF, International Forestry Resources and Institutions (IFRI) and Makerere University.
Formerly: Senior Manager, Africa Program and Senior Land Tenure Specialist at Landesa
Designed and implemented assessment methodologies for resource tenure and governance

Example of EAC Meeting Notes and EAC Member Reports
The following sections provide an example of general committee report, as well as individual committee member reports/recommendations. This information is carefully assessed by the PMC and incorporated into programmatic activities, as appropriate.

NOTE: The following reports are include verbatim as submitted to the PMC.

Feed the Future Innovation Lab for Small Scale Irrigation (ILSSI)

Report of the External Advisory Committee
Following Its Annual Meeting at Morogoro, Tanzania

July 28, 2015

Introduction

The External Advisory Committee was asked to prepare a brief summary of its impressions and reflections following its annual meeting in Morogoro, Tanzania. Members of the Committee prepared statements which were submitted to the Committee's secretariat. As previously agreed by the committee, a summary of the findings and recommendations of the committee was prepared by the secretariat from these reflections. This document presents the draft summary, followed by the reflections of each of the members. The Management Entity proposes to keep the final version of this document, with individual member reflections, for the record. It may use the summary for presentation to busy readers. Thanks are expressed to Ms. Tigist Endashaw of ILRI for her outstanding support of the EAC in the preparation of these notes and in arrangements for travel.

Background documents relevant to this report:

1. Summary of the ILSSI-IDS Workshop Day 1
2. Presentations from the Program Management Committee to the EAC
3. Meeting notes – EAC-PMC with summaries of presentations and discussion by the EAC

Meeting Agenda and Objectives

This meeting is the first meeting of the EAC where all members were present. The EAC members have greatly helped in forming some of the activities by committing their time and interacting with the various stakeholders.

The objectives of the meeting were to provide (1) a review of the progress made so far, (2) feedback on the plans for year three and (3) discussion of strategic considerations that will need to be implemented for the life of the project. Committee members were provided advanced reading materials providing background for the topics to be considered.

The Committee joined the first day of the training workshop on the Integrated Decision Support System (IDSS) where trainers presented overviews of the SWAT, APEX, and FARMSIM models and their application as an integrated suite to assess the production, environmental and economic consequences of the introduction of new technology and policy for smallholders in Sub Saharan Africa. The workshop was attended by 65 students from several Tanzanian universities and others interested in applying the IDSS in their research and development activities. This provided an opportunity for the Committee to evaluate progress that has been made since their last meeting in June 2014 in the methodology and to see results of the ex ante analyses that have been done in Ethiopia in year two.

The committee met jointly with the ILSSI leadership to review progress and discuss future plans. It met separately for further discussion and to plan next actions as a group.
The committee agreed to provide a status report to ILSSI leadership on progress, plans and future strategy.

Summary of EAC Findings

The Committee noted the substantial progress that has been made in the development and application of the IDSS in the year since its last review of the method. They see the potential and utility of the analyses to enhance planning and interpretation of results of investment options. They see solid evidence of the technical and scientific quality and validity of methods and results.

The Committee advises that current efforts at stakeholder engagement be continued and expanded with care given to ongoing efforts to obtain feedback and guidance from potential users of the results at all levels of scale. Particular importance was attached to enhancing the engagement with various levels of government in Tanzania to be sure that appropriate exchange enables evaluation and decision making on results. The importance of the national extension system in facilitating adoption of results was noted.

The Committee encouraged the interaction between the field, survey, and analytic components of the project for creating the total result, noting the importance of the integrated product to the acceptance and success of the project as regards outcomes and impact. Adoption at multiple levels of scale requires that the integrated product is presented to stakeholders in a persuasive and meaningful context.

The Committee believes that the methodology used in this project lends itself well to a downstream value chain approach for enhancing the utility of results. Value chain analyses for specific commodities as well as a value chain for the water is deemed both feasible and desirable, and the committee offers to extend its advice on the approaches that have worked in other scenarios. It was noted that the specific focus on livestock-fodder as a commodity offers the possibility of an early value chain analysis.

The Committee encourages continued and more focused effort on consideration of gender related issues and applications of the project, especially as it pertains to research on the use of conservation agriculture and drip irrigation for kitchen gardens. Specific issues affecting adoption of technology by women such as availability of credit, decision making on land use, and effects of increased use of small scale irrigation on labor for women were noted.

The Committee encourages the continued attention of the project to ensuring that the interventions proposed are environmentally sound and sustainable and that there is a plan for sustainable use of available natural resources to support the recommendations and findings.
The Committee continues to support the general objectives of the project to consider an integrated product that provides a balance in enhancing production, sustaining the environment, and providing improved economic income for smallholders.

The Committee offers to have active and continuing involvement in advising on planning and interpretation of results. It recommends that country representatives on the committee participate in planning and stakeholder engagement in their countries during the course of the project. The Committee agreed to prepare a report following this meeting that on their assessment of results and future plans for the project.

The Committee is keen on visiting sites where field research is being conducted. The next meeting of the committee will be in Ghana. It appears the appropriate time to see field studies would be in January or February 2016. Further planning for the concurrent EAC and PMC meetings will be done in the near future.

The Committee also emphasized that due attention needs to be given to the following points.

- More data needs to be generated to make the results meaningful
- Understanding investment and paradigm risks - it is essential that risk identification and mitigation matters must be well understood with respect to any innovation which is ultimately promoted as a result of ILSSI.
- There is need to make institutional arrangements that are specific to the context of each country in which the project is implemented.
- Policies may have to be revised or replaced in order to create the enabling environment for sustainable intensification based on i) irrigation innovations; and ii) the value chains needed to compound their benefits.
- Measure the effectiveness / efficiency of the program. ILSSI innovations are intended to be scaled up into actual development initiatives. However it is crucial to ensure that the technologies are scalable, affordable and sustainable.
- The role of the private sector needs to be spelled out clearly and also the role of the farmer in the private sector will also need to be emphasized.

- More work needs to be done to better link with local USAID initiatives; and also to create a platform for sharing information

Chair person

Evelyn L. Namubiru-Mwaura was unanimously elected as Chair for EAC for the next year.

Reflections of Individual External Advisory Committee Members

PHILIP RIDDELL - CONSULTANT AGRICULTURAL WATER POLICY AND SECTOR PLANNING REPRESENTATIVE - PRIVATE SECTOR ISSUES

The following notes are intended to capture and provide a somewhat subjective commentary on key issues that arose during the 2nd meeting of the ILSSI EAC. This writer has identified seven such issues, one general, the rest are specific and in some cases interlinked. Other members will almost certainly identify other issues and address them in their notes.

General

The actual EAC meeting was preceded by a day of plenum sessions during which preliminary results from the various IDSS components provided the committee members with an interesting overview of the scope and utility of the said models. Although: i) the exact relationship between the IDSS and the ILSSI initiative is not completely clear[2]; and ii) not enough data has as yet been generated to make the results meaningful, the models' scope, aptness and sophistication are already clear.

In like manner, the team's ability to answer every question put to it are also signs that the ILSSI has been well thought out and that all the bases on this complex programme, although needing some nuancing in some cases, are being covered to one extent or another. Finally in general terms is the great diversity of participants (and their affiliations) that had turned up for IDSS training. They were all very well informed about the IDSS and all seemed very focused with respect to their expectations of the training and indeed in most cases, how they intend to use the results.

This clearly confirms that there is convincingly holistic demand for the IDSS, especially as all involved were responsible for financing their participation.
However, ILSSI is not about the IDSS – accordingly the EAC's focus is on the lab itself and the use of the IDSS only for ex-ante and ex-post evaluations of strategies and their results.

Transition from Laboratory to Best Practice

It is also necessary to understand that the ILSSI is indeed a laboratory, so its assessment should use indicators that reflect the demand for, performance levels and sustainability of the various field demonstrations involved rather than mouths fed or areas irrigated etc. Also, if the ILSSI is to have maximum utility, it must demonstrate and evaluate new ideas, not revisit old ones but innovation involves risks (see next section) and this has two implications. First, there is no need for every demonstration to succeed – for a laboratory such as ILSSI it is just as important to know what doesn't work as what does, and why. Secondly, there is a risk that even the best idea's emerging from the lab will have disastrous results if not managed or regulated effectively. The EAC learned for instance, that in Ghana, butternuts were oversold to too many farmers as a result of which the market dropped out due to oversupply.

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2 One could be forgiven for thinking that the ILSSI is just a convenient way to roll out the IDSS.

Similarly, too many farmers grew onions in Ethiopia with similar results. In neither case[3] were the crops inappropriate, but they were rolled out without any capacity building re: markets and marketing on both a technical and institutional sense. Similarly, there may also have been regulatory shortcomings in both countries.

Despite these risks, it must be understood that at some point, the most promising ILSSI innovations will be scaled up into actual development initiatives. By then it will have been necessary to understand which of these innovations could be considered top-down and which bottom up. For some EAC members, everything must be demand-driven. But others note that there is little value if all the choices are business-as-usual. An innovation lab has to introduce and promote convincing new ideas which farmers can "demand" if they so wish. For this to work producers have to understand the risks and make them clear to the farmers; hence ILSSI must identify and evaluate the risks associated with each innovation.

Clearly, a conversation about the relative merits of demand driven development at the grass roots and top down promotion of new ideas will have to be initiated significantly before ILSSI's NTE date. The EAC therefore look forward to being kept informed about this – not least because of the heated discussions the subject has already inspired.

Understanding Risks

In this context risks can be thought of in two ways:

- ***Investment Risk:*** which is the risk a farmer takes when trying a new farming system and farmers are generally risk averse. The challenge is therefore to make sure that the risks and mitigation measures of all new ideas are well understood and made clear to potential beneficiaries. Even so, investment risk will ultimately remain that of the producer.

- ***Paradigm Risk:*** is the risk that arises when a Government wishes to change the nature of (in this context) its agricultural sector. Egypt for instance is aware that it has to increase the economic productivity of water by irrigating more high value crops than is currently the case. Similarly, in his White Paper of 2012, Vietnam's Prime Minister challenged deeply help perceptions of food security by demanding a robust diversification away from economically questionable rice to the irrigation of less resource intensive crops that are currently being imported at great cost. In such cases, it is valid to expect Governments to share the farmers' perceived risks, and there are several ways to do this. They include time bound production subsidies; improved extension services and markets of both first and last resort.

At the very least it is essential that risk identification and mitigation matters must be well understood with respect to any innovation which is ultimately promoted as a result of ILSSI.

Value Chains

The further down a value chain that farmers take their price:

- Increased revenues in real terms increase in turn the virtual size of the land holdings involved. If other words a farmer getting $X at the farm gate for a given farm, receives $2X further down a value chain, it is as if the land holding itself had doubled.

[3] Neither of these examples were ILSSI initiatives – but their story is nonetheless relevant to ILSSI.

- The natural resources involved produce more livelihoods per hectare or cubic metre than if the food produced merely goes into a household food store. And these livelihoods moreover are diversified and not limited to on-farm activities.

- Where perishables are concerned, there is less post-harvest wastage, because instead of rotting at the roadside due to market saturation, all produce goes into the value chain.

- Farmers become market makers not price takers because there is potential to purchase other producers' crops as raw material for the value chain.

It should be recognized that many of the ILSSI innovations are likely to make sense only as part of a value chain.For instance, the EAC learned about two high potential crops which may be unprofitable if sold at the farm gate, but which have a significant value chain. Despite enormous markets for onions[4] in the Asian sub-Continent, producers in Ethiopia that had been encouraged to grow as a cash crop, lost money in so doing because they took their price at the farm gate and there was no linkage between them and the export market. However, had they been part of a grading, packaging, transportation and export value chain, then instead of being dependent on a limited local market, they would have benefited from the value added between the farms and the CIF price of their onions when sold into an unsatisfied market elsewhere.
Similarly, irrigated fodder as currently conceptualized is not making money for ILSSI collaborators in Ethiopia. Yet there are i) a well-established commercial and sophisticated[5] fodder sector in Ethiopia and ii) an historic market across the red sea to the Arabian Peninsula which although currently subject to local export barriers is being reviewed at policy level.
Accordingly, it is recommended that ILSSI begins to take a more robust and strategic look at value chains than it has done so far. Enhanced social and economic connectivity are essential for sustainable intensification and value chains are a very effective way to establish the necessary connections.It will be necessary however, that ILSSI's work is not limited to the quantitative elements needed by the models. There will also be institutional implications.

Institutional Complexities

There is a risk that even the most convincing innovation could remain in the realm of academic research in the absence of an enabling environment for scaling it up. Traditional institutional arrangements in the form of irrigation departments embedded in line ministries and largely responsible for infrastructure are unlikely to catalyze and serve a diversifying sector for which irrigation is merely part of a broader value chain. In future, the kind of producer that will embrace and benefit from the ILSSI programme will need institutions that can deliver not just irrigation schemes, but also a wide range of services that provide producers with i) the information they need to choose, implement and profit from new farming systems; ii) the advice they need to access financial, insurance and subsidy services; and iii) the legal advice they need when establishing the need for outgrower production models, producer groups, cooperatives, limited companies and equity participation in value chains.

A radical re-specification of the institutional arrangements needed for a modernized irrigation sector is likely to question the value of keeping the institutional arrangements within a line ministry. Better is to capacity build and establish a holistic irrigation service institution as an autonomous or semi-autonomous entity embedded in a non-line ministry or office of the President or Prime Minister.

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4 Which ILSSI is using as an indicative dry season crop in a FARMSIM model of a small catchment in Ethiopia.
5 Sophisticated because the fodder is price differentiated by brand in the market place.

Clearly, the ideal arrangement will differ from country to country. Equally, institutional reformulation and capacity building may be considerably beyond ILSSI's remit. Nonetheless any durable recommendations emerging from ILSSI must at least identify and acknowledge any institutional challenges likely to be faced when scaling them up.

An importance aspect of this revisit the question of risk. The concept of resilience is increasingly encountered in the climate change literature these days and can be thought of as a farmer's ability to mitigate the risk of changing weather. In other words, if climate change adaptation concerns a basic, long term shift from one kind of farming system to another better suited to a climate which is changing over the longer term, resilience allows a farmer to make the best use of seasonal changes in weather by selection of a crop best suited to the weather conditions expected during the season. However, resilience is impossible without reliable and dynamic information services from the institutions and this is almost certain to involve capacity building and perhaps even a more commercialized institutional concept.

There are also institutional issues at the producer level.It is likely that ILSSI value chains will require economies of scale which suggests that producers will have to organize themselves into groups. There are several options for this including cooperatives and limited companies; but there is also the question of how much of a value chain a producer group owns. It is foreseeable for instance, that a group could have equity in a value chain which involves other investors. An example might be a fruit processing operation part owned by the producers and part by an external investor wherein the producers are paid a glut price for their produce at harvest and later, their share of the added value accruing to their delivered produce. In addition, their producer group would also receive dividends according to its equity in the value chain.

Again, it is not clear how much of all this falls within the ILSSI remit. Even so any need for reformulated institutional environments and possibilities must be well understood as an essential component of the eventual ILSSI roll out.

Policy Implications

It may well be that policies have to be revised or replaced in order to create the enabling environment for sustainable intensification based on i) irrigation innovations; and ii) the value chains needed to compound their benefits. The need for a revised fodder policy in Ethiopia has already been noted; but policies may also be necessary with respect to i) how farmers can form producer groups; and ii) enter into partnerships with third party investors.

Similarly, the reconceptualization, reformulation and relocation of an irrigation sector's apex body is almost certainly to require policy level measures, as might the measures by which Governments share risks with producers when trying to inculcate sectoral paradigm shifts as from, for instance a self-sufficiency paradigm to an export and trade led alternative.

Once again, although policy formulation is not an ILSSI deliverable, it is reasonable to suggest that an element of policy diagnosis is.

Inside the Black Box

Finally, the EAC unanimously agreed that it would be good to visit some of the demonstration plots. Until this is done, ILSSI will remain something of a black box. There are two options for such visits. The first is obviously that a site visit could be included in the programme for all subsequent EAC meetings. In such cases it would best service the committee's interests if its members could select which site to visit. Secondly, the three country members could always visit schemes within their countries at any time, while the two non-country members could visit sites of interest whenever on mission in any of the three countries.

MBOGO FUTAKAMBA
PERMANENT SECRETARY - MINISTRY OF WATER - TANZANIA
REPRESENTATIVE - TANZANIA

1. INTRODUCTION

The meeting of EAC members in Morogoro-Tanzania gave a very important opportunity of exchanges among the members and the sharing which proved to be very useful.

The projects being undertaken in the meantime are more research oriented with great anticipation of upscaling. This being the case it is our hope that the findings on these projects will guide policy and decision making for the countries involved in this project. It is crucial to have a participatory approach so that all the beneficiaries are aware and could assume ownership of the activities being undertaken as failure to this all the activities being done may prove futile.

It is my hope that activities started in Tanzania will have a high absorption impact.

2. REFLECTIONS

During the EAC meeting, following were the reflection realized

2.1 Institutional Linkages

- It is worthwhile to visualize the linkages between various institutions which are involved in the same activities or thinking irrespective of their precision. We need to explore the working ground in the local authorities and even in the government institution.

- Capacity building for the stakeholders using the available local institutions should be looked into so that the institutional memory for whatever activity being taken could easily be traced.

2.2 Technology

- Since our involvement is the Innovation lab, it is worthwhile to research on technologies which are appropriate, user friendly and affordable.

- Following the climate change, all developed models should have an input of the climate change so as to give a realistic and practical outcome.

- The technology being used should result in to attracting the market for whatever output emerging from its implementation.

- Replication of the technologies should be made easy, especially if its fabrication, local material can be used.

- Establish local teams for fabrication in the recipient country if possible.

- If there are improvement in the technology, let there be cooperation with the available local research institute to undertake innovation or any structural improvement.

2.3 Policy

There is a need of involving and referencing to the existing policies especially on issues pertaining to Water, land and Environment.
This is crucial to the extent that any research findings can be supported by the existing policies.

2.4 Awareness Creating

In whatever research being undertaken, awareness at all levels should be created. This will help in mainstreaming the activities in to the existing development plans.

2.5 Integration

The activities being undertaken should ensure integration as there are times mixed farming is involved leading to the necessity of integrating crops, animals/livestock in the scarce water utilization.

2.6 Gender Sensitivity

- Research should assist in solving some of the atrocities being faced by women (Specifically).
- In this aspect, sensitivity should go along with acceptability.

3. CONCLUDING REMARK

- The project and all planned undertakings are important what is needed to be looked into is the easiness for upscaling, its impact to the livelihood of the communities, sensitivity to environment, and affordability.
- Embark on the overall Water use efficiency and its impact to crop production.
- Avail the information accrued from the researches.
- Clarity of measurement and record keeping is necessary.
- Initial investment support to irrigators deems to be forthcoming for absorption of whatever have emerged from research findings.

EVELYN L. NAMUBIRU-MWAURA
EXECUTIVE DIRECTOR - POLICY INNOVATIONS
GENDER AND REGIONAL REPRESENTATIVE – KENYA

These notes provide a summary of key issues that arose during the 2nd meeting of the ILSSI EAC which took place on 28th July 2015 at the University of Sokoine, Morogoro.

Introduction

The meeting which took place on the 28th of July was attended by all the advisory committee members. This was the first meeting where all members of the committee were present. It was an informative meeting where many questions raised by the committee were answered by the program team leaders. Two sessions were held one in the morning with the program team and a second a closed meeting which was attended by the EAC, Neville and Tigist who took notes.
A lot seems to have been achieved since our last meeting in 2014 with most progress having taken place in Ethiopia followed by Ghana.

The consultations carried out in the first year and reflections of the EAC were taken on board by the program managers. For example, there seemed to have been greater emphasis on national capacity building.

I did not attend the training session but I had very good reviews about it. One important aspect that was mentioned was that there seems to be more local people involvement in the research and that they was great understanding of the methods used in the research by the local people.
In the section below, I highlight some of the concerns that were raised or that I had.

Effectiveness/efficiency of the program

We note that some of the LSSI innovations will be scaled up into actual development initiatives. However questions remain as to whether they will be affordable and sustainable? Can the externalities be managed? Who will bear the cost of externalities? How is the team planning to mitigate negative impacts of the innovations/ technologies?

At the moment, it is not clear how efficient or effective technologies/innovations currently used in the research program will be. Can we say that these are cost effective innovations/ technologies? While some are commendable, questions remain as to how many farmers will be impacted positively by the program and what the cost per farmer is of these innovations. Will farmers or even governments afford the technologies? Do we know the long term environmental impacts of these innovations? These are important questions that need to be answered now and if necessary changes made now so that more effort is put into technologies that are not only affordable but will sustainably improve lives of communities and not a few individuals.

Gender Equity

Although effort has been made to include women in the project, there is still a concern that the technologies introduced may not positively impact women. The team needs to ensure that the innovations will not result in more hardship for rural women. Given that the irrigation will mostly be used for cash cropping, how is this likely to impact livelihoods and nutrition in the homes? How much more work does this entail for women? Again, these are important issues to consider and address especially during this research period. My understanding is this program/research is ultimately aimed at improving the livelihoods of people both men and women and therefore safety nets/measures need to be put in place to ensure that the program does not do harm and benefits both female and male community members.

Methodology

While the models used in this research are commendable, there are some concerns about the data and assumptions being used. For example, some studies used as few as 12 farmers while some seemed to have been based on best scenario not necessary basic needs of the people in the areas of study. This is of concern because the results of these analyses will ultimately influence policy and the livelihoods of people. It is therefore important that proper analyses are carried out based on data with external and internal validity. Feedback on the research results/validation from the local people will be very important and should be incorporated in the studies over time.

The danger is that statistics alone may not realistically show what the situation is on ground. Qualitative information may be needed to show the impact of the program. I think it was mentioned that this would be taken into consideration but I am hoping it will play a greater role than the numbers in this lab. For example, it might help demonstrate more clearly the linkage between nutrition and irrigation.

Not business as usual

It would be great to see this research program resulting in real positive and sustainable changes in the communities where the new technologies are applied. This should be life changing research where communities will be transformed once innovations are scaled up.
It is also hoped that the research is not a replication of old research that has been carried out many times. For example, conservation agriculture has been carried for many years in Africa, the question then becomes how different is the CA in this program different? What is being done that is different from previous research and or capacity building?

For the ILSSI research results to move beyond academic research there is a critical need to involve early on not only policy makers but also village/community leaders in the research. If these important stakeholders are not involved, the success of this program will be compromised. Since innovations will ultimately be implemented by local people, there is a need to involve as many stakeholders as possible at this stage if they are to have a sense of ownership for the innovations. Institutional capacity building will also need to be taken into consideration. Do government institutions which usually have the mandate to govern water/irrigations schemes have the capacity to widely disseminate/implement these innovations? What needs to be done at this stage of research to ensure that once the promising innovation are identified, government institutions are able to not only provide these technologies but also give farmers the support they need to use these technologies?

Field Visits

There was a general consensus among the advisory team members that we need to have field visits so we can see what is going on in the fields. These visits could be scheduled a day or two before the EAC meeting.

GETACHEW GEBRU
PRESIDENT, ETHIOPIAN SOCIETY OF ANIMAL PRODUCTION (ESAP)
REPRESENTATIVE - ETHIOPIA

Comments and suggestions

1) Recalling the status of the IDSS during the June meeting in Addis in 2014, I am of the opinion that the accomplishments thus far are impressive

2) More clearer and articulated presentation made by Africans indicates that effective capacity building has been carried out

3) The need driven capacity building as evidenced by institutions willingness to cost share the IDSS training. One question I had was "Where are the local implementers/govt people (University and Research Institute) that have worked with the team? Have they also attained the capacity that is seen with the post docs and graduate students"

4) Not sure how trainees made choice of the type of model they want to be trained on? Where enough exposure given on the models prior to choice?

5) Are there sufficient representations of the trainees' vs model of choice vs institutions? It is wise to do a purposive selection of trainees so that at least individuals coming from same University/institutions are trained in different models so that they can effectively work on the integration

6) In the IDSS wheel, why were the PHYGROW and NUTBALL given less emphasis?
   a. I see these were later discussed in the APEX and FARMSIM presentation, but not in the SWAT
   b. There is a strong need for more elaborate analysis to be made in the IDSS and also integrating animal component. We are looking into mixed farming systems, and so need to have analysis on how the irrigation interventions and scenarios tested impact on animals –production and income
   c. More work expected on functionally linking the NUTBALL and PHYGROW, and analysis output.

7) In the SSI project, we do not have to necessarily see forage development, but see if the additional income generated from the diversified on-farm activities is partly channeled to input provisions for livestock. For instance, see if added income diversification because of say Onion production translates, if any, to input for animal management- feed supplement or vet drug purchase or pay for insemination

8) Overall it looks like there is strong emphasis on publishing papers! No problem in that but there must be also emphasis on the type of deliverables that address the needs of stakeholders and the local partners (what have we done thus far in getting this preliminary info to the stakeholders…how do we want to move now?)

9) Noug cake and doubling milk production…. In the FARMSIM model -results need to be clarified

Comments based on the 28th August presentation

1) Working with women groups is a welcome development, however, at least in the case of Ethiopia 'groups' are not legal entities and need to be nurtured to grow into cooperatives, to be legally certified and access loans. It is suggested that the project needs to put emphasis on the organizational capacity building of these groups, so that they become cooperatives, before the project phases out. It will be essential to work closely with the local level cooperatives promotions offices so that the required capacity building continues post project completion.

2) The project is multi-dimensional and potentially can engage diverse actors and impacts of the project can affect multiple institutions. It is suggested that more country level relevant institutions be brought on board at the reflective meetings. For instance there is a strong link with the Natural Resources State Ministry in Ethiopia, however bringing on board the livestock state ministry and the cooperative agency can add value.

3) The interpretation of the preliminary results was not strong in some cases. Some sections were not thoroughly thought prior to presentation. It is advisable that the presentations to the EAC are preceded by consultations amongst the PMC members; and it is advisable that the presentations by consortium members clearly reflect the complementarity amongst institutions

4) Scalability of some of the results is a concern given the limited number of households used in data collection (e.g. IFPRI results)

5) In the future, I suggest the presentations be made initially at country level where each country member of the EAC attends. At the country level meetings there will be good opportunity for the policy makers and other stakeholders to better understand the project from a country context and also gauge the accomplishments. Later, the summary of these presentations and key messages, by country, can be discussed at the annual EAC meeting.

6) Where the EAC meeting is held it might be a good idea to invite the government representatives and local stakeholders to attend the annual meetings so that the EAC also gets a chance to talk to these actors.

7) How are the suggestions put forward by ILRI as "complimentary work" fitting into the year 3 plans? There must be some provisions made to address these

8) Provisions need to be made for the EAC to attend the country reflective meetings: i.e. it is recommended that the EAC country representative should be invited to attend. The ideal way will be for the EAC members to visit works on the ground prior to the annual review meetings.

9) Prior to the annual EAC meetings, efforts must be made so that major outputs essential for the EAC review are produced e.g. the availability at the meeting of the ex-ante analysis of lives and Africa rising work would have been useful.

10) More work needs to be done to better link with local USAID initiatives; and also to create a platform for sharing information

SAA DITTOH
AGRICULTURAL/RURAL SOCIO-ECONOMIST
UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE - GHANA
REPRESENTATIVE - GHANA

1. The aims and modalities of the project is now much clearer. The presentations of the models on the first day were very useful.

2. The static nature of the models, especially the FARMSIM, is however a bit worrying. Quantity-price relationships, for example, are very dynamic.

3. There seemed to be some disappointment over the risk averse tendency of farmers. I think we should expect it to be so because of the many failures of interventions in the past. Farmers are constantly being used as "guinea pigs" and when experiments (researches) fail they bear all the losses. Farmers regard participation in researches which they put in their resources (land, labor, cash, time etc.) as very risky.

4. Presentations by ILSSI Lead Researchers need to be a little more detailed and greater attention paid to differences in the three countries and indeed the different sites within countries. Some of the presentations give the impression of little knowledge of activities on the ground.

5. Some of the researchers need to study carefully the objectives of the Lab. It is Innovations Laboratory for Small Scale Irrigation. Small scale irrigation in the African context does not suggest any significant level of specialization. I however agree that there are differences between the countries.

6. I think there is need for much more brainstorming on the irrigated fodder as a cash crop model being propounded. Irrigated fodder as supplementary livestock feed by small farmers (who mostly undertake mixed farming) is easy to see working. Some of that fodder can be sold, but specializing in fodder production (the typical neoclassical model) I am afraid will end up putting farmers into great difficulties.

7. It is difficult to see the gender and nutrition components of the project. Some emphasis should be put on those because they are central to the project.

8. At the country level, members of the EAC (representing the countries) should participate in the planned reflection meetings to have more insight into the ILSSI activities in the respective countries.

9. Engagement of policy and decision makers is critical for success especially when the project intends to get to an upscaling level.

10. Sustainability of the interventions have been stressed. It is important farmers are very clear from the beginning what they will repay and what is being given to them. Some farmers may opt out if all the details are explained to them. That is important to ensure the project is not abandoned mid-way.

11. I think it is high time all of us recognize small farmers as an important component of the private sector. Indeed in Ghana and several other countries they are the most important component of the private sector.

12. Country Level Summaries

For the country level summaries and field briefs, please reference the attached PDF documents labeled:

- 12. FtF ILSSI Field Brief – Ethiopia
- 12. FtF ILSSI Field Brief – Ghana
- 12. FtF ILSSI Field Brief – Tanzania

13. Summary of Stakeholder Engagements

Chapter IV of the Mid-Term Report of November 2016 contains a detailed description of stakeholder engagement and capacity building along with numerous relevant references to specific events and reports occurring over the course of the project in the first three years. These engagements will continue over the life of the project. Country level stakeholder meetings are planned for year five of the project to summarize results and recommendations to stakeholders.

The following paper reports on the three national stakeholder meetings held in the June-August 2016 time frame to enlist stakeholders in a workshop on identification of constraints to the adoption of SSI technologies. This formed the basis for further analysis using the IDSS of the impact of these constraints and of methods for their mitigation.

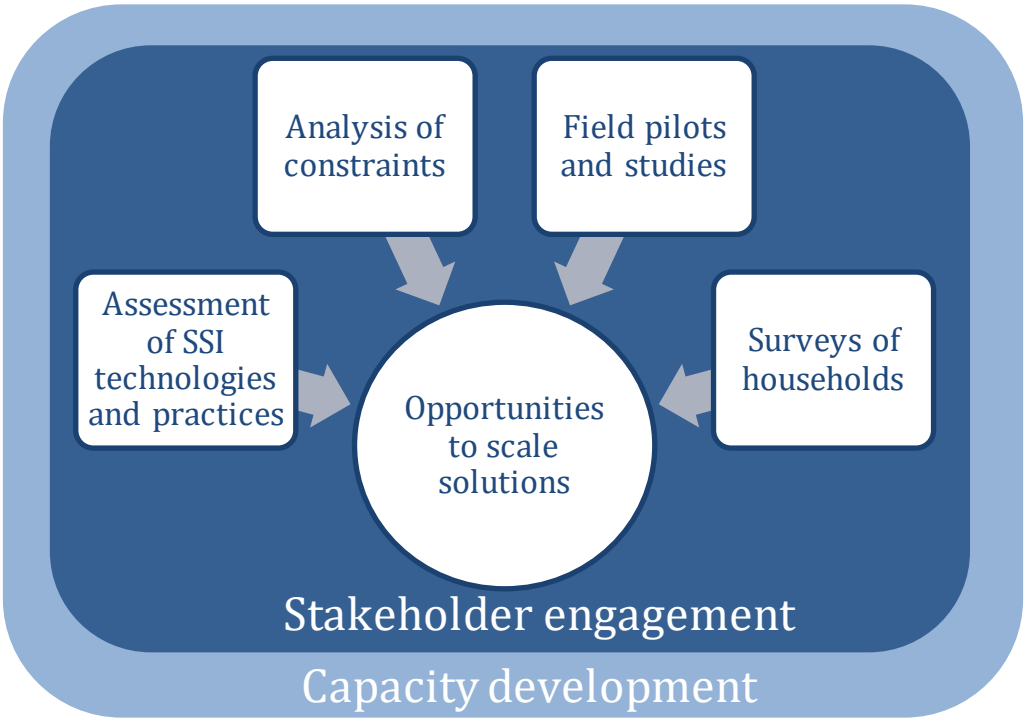
Participants were asked to contribute their expertise and perspectives to evaluate constraints to adoption and use of small scale irrigation technologies that are under study in field, survey, and Integrated Decision Support System analysis components of ILSSI. Constraints should be identified in line with national and institutional strategic agendas. This input shape the constraints analyses using an integrated modeling approach following the workshops, toward identifying opportunities to outscale potential solutions.

Project Overview

ILSSI is a research project working in Ethiopia, Ghana and Tanzania that aims to contribute to increasing food production, improving nutrition, and accelerating economic development while protecting the environment for smallholder farmer development.

- Assessment of promising small scale irrigation (SSI) technologies
- Field level interventions and piloting of small scale irrigation and related practices
- Surveys of farm households
- Integrated analysis using the Integrated Decision Support System (IDSS) of the production, environmental and economic consequences of small scale irrigation options, including but not limited to interventions studied in farmers' fields

The five year project ends in 2018. The project components are integrated to identify high potential opportunities for outscaling small scale irrigation and are embedded in continuous stakeholder engagement and targeted capacity development.



ILSSI research approach and process

Assessment: Initial analysis of factors influencing the sustainable use of available natural resources, such as ground and surface water, soil, weather history, and estimates of the production and economic consequences of using small scale irrigation systems was completed. The Integrated Decision Support Systems (**IDSS) ex-ante studies** at watershed level provided an estimate of the production, environmental, economic and nutritional consequences of the use of small scale irrigation in the study area. This initial assessment was based on the best data readily available combined with expert input. The results showed where, and under which conditions surface and groundwater are available, the amount that can be sustainably used for irrigation, and land areas within the watershed suitable for the application of smallscale irrigation technologies. Focus is particularly on the dry season when much of the irrigation would take place. Experts reviewed the product and assessed the consistency with experience and practice.

Field Research: Based on **stakeholder consultation** at multiple levels and in coordination with local leaders and farmers, a set of **small scale irrigation (SSI) interventions for vegetables, fodder and fruit trees** are being piloted and studied in farmer's fields. Supporting quantitative and qualitative studies are carried out based on emerging constraints and issues identified with farmers. Multiple water lifting, distribution systems and farm practices at field level are being evaluated in collaboration with national university partners. The field interventions provide primary biophysical and socio-economic data on small scale irrigation and the watershed.

Site	Small scale irrigation interventions
Ghana	
Bihinaayili, Savelugu, Northern	Drip irrigation technologies, irrigation scheduling
Zanlerigu, Nabdam, Upper East	Roof water harvesting, gardens, drip irrigation Drip irrigation technologies, irrigation scheduling
Dimbasinia, Kassena Nankana East, Upper East	Motor pumps in furrow irrigation, irrigation scheduling
Ethiopia	
Dangila and Robit, Amhara	Pulley, Rope and washer pumps, irrigation scheduling, Restrictive layer (groundwater recharge) in Robit only
Adami Tulu, Oromia	Motor pumps in furrow irrigation, Rope and washer, irrigation scheduling
Lemo, SNNPR	Solar pump, rope and washer, service provider & drip, irrigation scheduling
Tanzania	
Rudewa and Mkindo, Morogoro	Motor pump with furrow irrigation, irrigation scheduling, pocket gardens Drip irrigation (Rudewa)

Household Surveys: In the area surrounding the sites for field studies, household surveys are done early in the study to provide a baseline and again later to evaluate the impact of the small scale irrigation interventions. These surveys assess the impact of irrigation on household income, nutrition and factors affecting the access to use of the technology by women and men farmers. Baseline household surveys of farm households have provided data on nutrition, economic status, adoption factors and gender.

Integrated Decision Support System (IDSS): IDSS is formed by a suite of models - SWAT, FARMSIM and APEX. IDSS is assessing the consequences of small scale irrigation interventions on production, environmental and economic outcomes. IDSS is used to evaluate the set of interventions in field studies, plus other options that expand the vision of the project. IDSS can either be used as a total system or a component part may be used separately to address specific questions.
Initial model results, from the ex-ante analysis looked at potential availability of water and other natural resource inputs. Primary data from field studies and the survey data informs calibration and validation for **IDSS ex-post analysis** and are the basis for developing suitable country as well as site specific scenarios. The results from the scenario analysis contribute to the constraints and gaps analysis, in term highlighting opportunities for outscaling and adoption.

Capacity development and stakeholder engagement: Capacity development and stakeholder engagement is continuous throughout the ILSSI project. At farm level, ILSSI provides training and learning support to farmers, and local stakeholders, such as extension and microfinance cooperatives. At research and planning level, ILSSI trains stakeholders in universities and institutions in the use of household survey instruments and IDSS. In addition, graduate students and faculty are involved in field studies, mentored in research methods, and trained to use IDSS. Based on the capacity developed in each country and databases created, stakeholders will be enabled to use IDSS to address specific development scenarios or questions related to individual elements of the natural resource environment and the production system after the project.

Constraints analysis to identify small scale irrigation solutions to scale

Smallholder farmers are typically constrained by a range of factors to realize SSI opportunities. Under ILSSI, project components have identified factors at different scales - from agro-hydrological, technical to social-institutional. Using an integrated analysis, IDSS provides a method for assessing these constraints and evaluating potential mitigation strategies. IDSS can be used to identify the combinations of inputs (e.g. fertilizer, seeds), SSI technologies and practices (e.g. water storage, water lifting, irrigation scheduling), farming practices (e.g. crop and pest management) to optimize production and the economic return to the farmer. At the same time, IDSS also provides an assessment of environmental consequences, including sustainability of the intervention.

Different constraints might dominate depending on the scale from farm/household, to landscape and even national level. IDSS uses the constraints observed during field pilots and assesses whether it remains a constraint at larger scale, and if, so how that could be mitigated. Depending on the type of constraint, one part of the IDSS model suite or the entire IDSS will be used. While IDSS is suited to evaluate biophysical (e.g. hydrological, agro-ecological etc.) and some socio-economic (e.g. market access, labor etc.) constraints, IDSS is less well suited to other issues, such as policy and regulatory context.

Selecting and prioritizing: Candidate constraints

The preliminary list of constraints below is proposed based on results obtained during pilots, household surveys, as well as local and national level consultations in each country. Stakeholders are being consulted to provide expertise on the ILSS identified constraints. The aim is to assess their relevance and

relative importance in line with national and institutional priorities and goals. In addition, stakeholders may identify other constraints to the application of SSI interventions at multiple levels of scale.
The result of the consultation on constraints will be a short list of the most important constraints that will contextualize and guide further analysis using IDSS. The analysis is intended to suggest how constraints can be overcome to create new SSI opportunities.

Preliminary constraints identified

- Water availability, storage, delivery and accessibility for individual farm
- Water availability, storage, delivery and accessibility at larger scales
- Costs related to water access: example drilling or hand dug wells (for groundwater), building on-farm water storage, and/or water fees (surface and ground water)
- Access to seeds for agricultural intensification
- Access to fertilizer for agricultural intensification in the irrigation season
- Water lifting technology access (market, prices, export, tax, interest/discount rates)
- Labor requirements/costs
- Micro-finance access for investments in irrigation technologies and other inputs (fertilizer, seeds)
- Access to market for products (vegetables, fodder, livestock (including byproducts e.g. milk)
- Energy costs (related to pumping): diesel and petrol access (fuel price variations), electric power access
- High numbers of low producing livestock (as relates to access to fodder)
- Low levels of mechanization
- Lack of access to land /land availability
- Climate and rainfall variability
- Skills throughout the irrigation value chain
- Land tenure policies and practices
- Access to input and output markets, including market and transportation infrastructure
- Social and cultural practices
- Gendered dimensions of various constraints above

IDSS analysis outcomes

The IDSS reports will provide insight into potential trends based on quantitative and stochastic estimates of the consequences of introduction of a variety of small scale irrigation interventions. These analyses are scheduled for completion in October 2016 and will be shared with stakeholders for their assessment and expert input under further consultation.

By the end of the project in 2018, ILSSI aims to share with stakeholders a comparison of the potential of SSI systems in each country. Based on the capacity developed to use the IDSS in each country, as well as databases created, stakeholders will be enabled to apply IDSS to specific development scenarios or questions related to individual elements of the natural resource environment and the production system.

14. Video Summarizing ILSSI Accomplishments

A video summarizing key ILSSI accomplishments is currently under production and should be made available in June 2017. A link to the video will be provided to the External Review Committee as soon as it's available.

Data Entry Status Report as of 07-Jul-2017 10:52:04 AM,Washington DC Time

Current Selection

Prime Partner : Texas A&M University
Implementing Mechanism : ARP- FTFIL for Small-scale Irrigation
Data Status : Data Approved by OU
Indicator Type : All

Indicator / Disaggregation	Deviation Narrative	Commment	Baseline Year	Baseline Value	2011		2012		2013		2014		2015		2016		2017	2018	2019
					Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Actual	Target	Target	Target
ARP- FTFIL for Small-scale Irrigation																			
EG.3.1-x24: (4.5.1-24) (OLD) Numbers of Policies/Regulations/Administrative Procedures in each of the following stages of development as a result of USG assistance in each case: (Stage 1/2/3/4/5)	1			2							2	2				2	2	2	
Sector				2							2	2				2	2	2	
Inputs											1	1							
Outputs											1	1							
Macroeconomic																			
Agricultural sector-wide																			
Research, extension, information, and other public service																			
Food security/vulnerable																			
Climate change adaptation or natural resource management (NRM) (ag-related)			2013	1												1	2	2	
Disaggregates Not Available			2013	1												1			
Stages of development				2							2	2				2	2	2	
Stage 1 of 5 Number of policies / regulations / administrative procedures analyzed			2013	1							2	2				1	2	2	
Stage 2 of 5 Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation																			
Stage 3 of 5 Number of policies / regulations / administrative procedures presented for legislation/decree																			
Stage 4 of 5 Number of policies / regulations / administrative procedures prepared with USG assistance passed/approved																			
Stage 5 of 5 Number of policies / regulations / administrative procedures passed for which implementation has begun																			
Disaggregates Not Available			2013	1												1			
EG.3.1-2: (4.5.1-28) Hectares under new or improved/rehabilitated irrigation and drainage services as a result of USG assistance																			
EG.3.1-12: (4.5.1-24) Number of agricultural and nutritional enabling environment policies analyzed, consulted on, drafted or revised, approved and implemented with USG assistance	2	3		1									3	3		1	1	2	
Policy Area				1									3	3		1	1	2	
Institutional architecture for improved policy formulation																			
Enabling environment for private sector investment																			
Agricultural trade policy																			
Agricultural input policy (e.g. seed, fertilizer)																		1	
Land and natural resources tenure, rights, and policy				1									2	1		1	1	1	
Resilience and agricultural risk management policy																			
Nutrition (e.g. fortification, food safety)																			
Other													1	2					
Disaggregates Not Available				0												0	0	0	
Process/Step				1									3	3		1	1	2	
Analysis													3	3					
Stakeholder consultation/public debate				1												1	1	1	
Drafting or revision																			
Approval (legislative or regulatory)																			
Full and effective implementation																			
Disaggregates Not Available				1												1	1	2	
Total policies passing through one of more processes/steps of policy change													3	3					
EG.3.2-x41: (4.5.2-41) Number of water resources sustainability assessments undertaken	4	5		0									12	12	24	24	24	24	
Transboundary vs. national basins				0									12	12	24	24	24	24	
Transboundary basins			2013	0									0	0	0	0	0	0	
National basins			2013	0									12	12	24	24	24	24	
Disaggregates Not Available														0					
Scale				0									12	12	24	24	24	24	
Basin-level			2013	0									4	4	8	6	8	8	
Sub-basin level			2013	0									4	4	8	9	8	8	
Field level			2013	0									4	4	8	9	8	8	
Disaggregates Not Available														0					

EG.3.2-1: (4.5.2-7) Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training	6			0							50	82	150	594	185	797	185	185	
Type of Individual				0							50	82	150	594	185	797	185	185	
Producers				0								14	50	382	50	317	50	50	
Male																238			
Female																79			
Disaggregates Not Available			2013	0								14	50	382	50		50	50	
People in government				0							25	5	10	43	15	96	15	15	
Male																72			
Female																24			
Disaggregates Not Available			2013	0							25	5	10	43	15		15	15	
People in private sector firms				0							5	1	10	9	20	10	20	20	
Male																7			
Female																3			
Disaggregates Not Available			2013	0							5	1	10	9	20		20	20	
People in civil society				0							20	42	80	160	100	374	100	100	
Male																280			
Female																94			
Disaggregates Not Available			2013	0							20	42	80	160	100		100	100	
Disaggregates Not Available												20		0		0			
Male																0			
Female																0			
Disaggregates Not Available												20		0		0			
Sex				0							50	82	150	594	185		185	185	
Male			2013	0							30	63	100	419	130		130	130	
Female			2013	0							20	19	50	175	55		55	55	
Disaggregates Not Available														0					
EG.3.2-2: (4.5.2-6) Number of individuals who have received USG supported degree-granting agricultural sector productivity or food security training	7			0							9	4	8	8	8	52	8	8	
Sex				0							9	4	8	8	8	52	8	8	
Male			2013	0							5	2	4	4	4	43	4	4	
Female			2013	0							4	2	4	4	4	9	4	4	
Disaggregates Not Available														0					
New/Continuing				0							9	4	8	8	8	52	8	8	
New												4	5	5		44			
Continuing													3	3	8	8	8	8	
Disaggregates Not Available			2013	0							9			0					
EG.3.2-7: (4.5.2-39) Number of technologies or management practices under research, under field testing, or made available for transfer as a result of USG assistance	8																		
Number of new technologies or management practices under research as a result of USG assistance			2013	0							4	4	7	13	7	10	7	7	
Number of new technologies or management practices under field testing as a result of USG assistance			2013	0							6	1	2	9	2	8	2	2	
Number of new technologies or management practices made available for transfer as a result of USG assistance			2013	0							11	14	12	14	12	15	12	12	
Disaggregates Not Available														0					

Index	Comments and Deviation Narratives
1	EG.3.2-x41: (4.5.2-41) Number of water resources sustainability assessments undertaken
2	The project has had higher than anticipated demand and need for repeated training of farmers and local subject matter specialists, such as extension agents and sub-national agricultural information offices. The high demand for capacity development has emerged as the project has been implemented. In addition, the project has trained a number of local civil servants, students and others in methods for data collection and basic concepts on water resources and smallholder irrigation. This is because of the intense requirement for data to
3	The demand for students to join the project as field researchers is higher than anticipated. In Ethiopia, one of the national partner universities is beginning a new program related to irrigation and water resources, so that has increased the demand of students to participate in ILSSI to get training, mentoring and field experience in the subject. In addition, the project had initially expected to take on mostly PhD students for the duration of the project. However, there are very few PhD students in the subject field. Therefore, the project has taken
4	(Phase I/II/III) (S) The increase in number of new technologies under under Stage I represents emerging opportunities (and local demand) for certain technologies based on the existing interventions and research. For example, testing more and varied types of fodder under various irrigation technologies and practices. The higher number of technologies in Stage II is due to continuation of technologies and practices under field testing, as drought in Ethiopia and floods in Ghana affected the field trials, resulting in the need for additional