



FEED THE FUTURE

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



Feed the Future Innovation Lab for Irrigation and Mechanization Systems

Semi Annual Report: October 1st, 2023 – March 31st, 2024

Submitted by the Robert B. Daugherty Water for Food Global Institute,
University of Nebraska System, 30 April 2024

This report was made possible through support provided by the U.S. Agency for International Development, under the Feed the Future Innovation Lab for Irrigation and Mechanization Systems and the terms of Cooperative Agreement No. 7200AA23LE00005. The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of the U.S. Agency for International Development.

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Acronyms

Abbreviation	Definition
AOI	Areas of Inquiry
AOR	Administrative Officer's Representative
CCR	Cross-cutting Results
CNA	Capacity Needs Assessment
DWFI	Daugherty Water for Food Global Institute
EAC	External Advisory Committee
FTF	Feed the Future
GFSS	Global Food Security Strategy
HICD	Human and Institutional Capacity Development
IFPRI	International Food Policy Research Institute
ILIMS	Innovation Lab for Irrigation and Mechanization Systems
IR	Intermediate Results
ME	Management Entity
MERC	University of Nebraska – Lincoln Methodology and Evaluation Research Core
MPI	Mechanization Propensity Index
PCC	Program Coordinating Committee
ToC	Theory of Change
UM	University of Missouri – Columbia
UNL	University of Nebraska – Lincoln
USAID	United States Agency for International Development

Executive Summary

The Innovation Lab for Irrigation and Mechanization Systems is led by the Robert B. Daugherty Water for Food Global Institute of the University of Nebraska System under Cooperative Agreement No. 7200AA23LE00005. ILIMS aims to mobilize research that catalyzes increased use of irrigation and mechanization technologies and practices in an inclusive, economically, and environmentally sustainable way in Feed the Future countries. Target countries proposed in 2023 include: Ghana, Rwanda, Ethiopia, Nepal, Guatemala and Honduras. This report describes progress toward objectives between 1 October 2023 and 31 March 2024.

In the first six months of the project, the Management Entity (ME) was established, including hiring a Project Manager, completing a search process for Deputy Director, establishing a Project Coordinating Committee of university faculty, and forming a communications team. Initial Activities outlined in the proposal were reviewed; six proposals were submitted to USAID and two project sub-awards approved and fully executed with University of Missouri – Columbia (UM) and the International Food Policy Research Institute (IFPRI). The ME developed a monitoring and evaluation (M & E) plan approved by USAID and set up the reporting platform for sub-awards. A communications plan was completed; website, newsletter, and social media presence were established. In addition, the Director participated in various outreach activities, which included participation in workshops, Webinar presentations, meetings with Missions (Ghana), and engagement with other potential partners and stakeholders in Latin America, Rwanda, Niger, and Ethiopia.

During the next reporting period, the primary focus will be on issuing Requests for Proposals for sub-awards, starting the additional Initial Activities, on-boarding the External Advisory Committee, and various global and national outreach activities relevant to the Innovation Lab Areas of Inquiry.

1. Introduction

The Innovation Lab for Irrigation and Mechanization Systems is led by the Robert B. Daugherty Water for Food Global Institute of the University of Nebraska System under Cooperative Agreement No. 7200AA23LE00005. This report describes progress toward objectives between 1 October 2023 and 31 March 2024.

ILIMS aims to mobilize research that catalyzes increased use of irrigation and mechanization technologies and practices in an inclusive, economically, and environmentally sustainable way in Feed the Future countries. Target countries proposed in 2023 include: Ghana, Rwanda, Ethiopia, Nepal, Guatemala and Honduras.

As of March 31, 2024, program partners included two USAID-approved sub-award organizations: University of Missouri – Columbia (UM) and the International Food Policy Research Institute (IFPRI). Additional sub-awards are anticipated in Fiscal Year 2024 (FY2024). The complete list of U.S. based awards is in Annex 1.

2. Key Accomplishments

DWFI achieved most of the required actions for the first six months of the project. The Management Entity (ME) was established, including hire of the Project Manager (Anthony Delaney) and managing a search process and identification of the Deputy Director (expected to join June 1, 2024). The ME established the Project Coordinating Committee of university faculty and began steps toward setting up the External Advisory Committee. Initial Activities outlined in the proposal were reviewed with the AOR and six proposals submitted to USAID for approval; two project sub-awards were fully executed and four others continued to be under review by USAID. An on-boarding process and package of information was developed for all sub-awardees. The ME developed a monitoring and evaluation (M & E) plan with the Methodology and Evaluation Research Core Facility (MERC), which was approved by USAID. Subsequently, the ME contracted with Piestar and set up the reporting platform for sub-awards. A communications group was constituted within the DWFI communications team; a communications plan was developed and the project website, social media, and newsletter established. The Director participated in various outreach activities. Toward strengthening relationships and ensuring research relevance, the Director made one visit to Ghana (February) to meet potential partners and engage stakeholders, while other meetings were held remotely with stakeholders in Latin America, Rwanda, Niger, and Ethiopia.

3. Research Program Overview and Structure

The technical lead for ILIMS is DWFI, while the project administration is supported by the University of Nebraska-Lincoln (UNL) Project Management Office (PMO) located in the Prem S. Paul Research Center. ILIMS is led by a Director (Nicole Lefore) and Deputy Director (identified during reporting period). To ensure accountability and scientific validity, two advisory committees provide scientific guidance, being the Project Coordinating Committee made up of University of Nebraska faculty and an External Advisory Committee comprised of experts in relevant subjects across the target regions. The project aims toward five development objectives (outcomes):

1. Context-suitable socio-economic, institutional, and technological interventions that effectively target and reduce risks for multiple producer types.
2. Strengthened, inclusive natural resource governance and improved climate adaptation, mitigation, and resilience capacities.
3. Strengthened and inclusive market and finance ecosystems for irrigation and mechanized technology systems with reduced inequalities in access to mechanization and irrigation technologies and services.
4. Strengthened stakeholder capacity throughout the market system to manage trade-offs and sustain natural resources.
5. Improved health, equity, and nutrition security through protected water and diets in mechanization and irrigation interventions.

4. Theory of Change and Impact Pathway

The initial Theory of Change indicates that: *If options of small-scale irrigation, Water Resource Management, and mechanization technologies can be targeted to match specific biophysical, climatic, and socio-economic conditions, including addressing the needs of women, youth and marginalized groups, and if the primary systems tradeoffs are identified and paired with technologies or approaches that overcome these barriers, then stakeholders will be able to better promote and adopt small-scale irrigation, WRM, and mechanization technologies that provide a pathway out of poverty and food insecurity,*"

The Theory of Change matrix showing the linkages between the project objectives and the Intermediate Results of the Global Food Security Strategy is in Annex 2. Impact pathways will be developed for each target country as sub-awards are developed.

5. Research Project Reports (by thematic area)

5.1. Objective 1. Context-suitable socio-economic, institutional, and technological interventions that effectively target and reduce risks for multiple producer types.

Project Name: Mechanization levels in Feed the Future (FTF) target geographies: Assessment and development of the Mechanization Propensity Index (MPI)

Project sub-awardee: International Food Policy Research Institute (IFPRI)

Location: Desk-based study (model) relevant to all countries

Collaborators: Local IFPRI offices in Feed the Future countries; CGIAR centers engaged in mechanization; Zamorano University

Description (summary): This activity analyses determinants of mechanization based on secondary household data in target geographies and develops a Mechanization Propensity Index (MPI) that supports identification of biophysically suitable locations for mechanization and irrigation; the MPI will incorporate some socioeconomic determinants of adoption.

Theory of Change and Impact Pathway/Logframe:

Inputs	Partners, Collaborators, Projects	Outputs	Assumptions	Outcomes (contribution to)
Secondary data Engagement of key actors	Agencies related to mechanized agriculture, including irrigation; universities, CG Centers, others in project countries	MPI Advice on variable selection, general information on mechanization policies	Access to suitable datasets for target countries. Key actors have interest to engage and incentive to apply the tool.	Context-suitable socio-economic, institutional, and technological interventions effectively target and reduce risks for multiple producer types

Achievements: Since the sub-award was approved on January 19th, 2024, IFPRI has reviewed secondary datasets relevant to Ethiopia, Nepal, Ghana, and Rwanda. Given the lack of data available in Central America on mechanization, IFPRI partnered with Zamorano University to collect data on Honduras and Guatemala. Over the reporting period, IFPRI made significant progress in data analysis and refinement of the MPI tool, using Ghana as a test case. A methodology for developing the MPI in Ghana has been finalized and implementation of the model is currently underway. Results from the secondary data regarding Ghana found that households with mechanization are richer and spend more money on food and household items (40%), are twice as likely to own livestock; households are largely male headed. Additionally, children in mechanized houses have better height compared to children their age in houses that are not mechanized. The data for Rwanda suggested that promoting private-sector innovations while focusing on the public good aspect of mechanization is the most promising way forward.

Capacity Building; Lessons Learned: Nothing to report.

Presentations and Publications: IFPRI is currently developing a paper on developing mechanization and adoption for areas in Feed the Future target countries.

5.2. Objective 2. Strengthened, inclusive natural resource governance and improved climate adaptation, mitigation, and resilience capacities.

Nothing to report.

5.3. Objective 3. Strengthened and inclusive market and finance ecosystems for irrigation and mechanized technology systems with reduced inequalities in access to mechanization and irrigation technologies and services.

Nothing to report.

5.4. Objective 4. Strengthened stakeholder capacity throughout the market system to manage trade-offs and sustain natural resources.

Project Name: Capacity needs assessment for Irrigation and mechanization adoption and sustainability

Project sub-awardee: University of Missouri - Columbia

Location: Ghana, Ethiopia, and Rwanda

Collaborators: XSyn (Ethiopia) [sub-subs include ISRD (Ghana); Kilimo Trust (Rwanda)]

Description (summary): Through surveys and interviews, the activity will conduct a comprehensive Capacity Needs Assessment (CNA) for sustainable irrigation and mechanization. This assessment will delve into the skills, capabilities, and capacities required by both public and private sectors within irrigation and mechanization market systems towards fostering sustainable agricultural practices and enhancing productivity.

Theory of Change and Impact Pathway/Logframe:

Inputs (e.g. data, stakeholder engagement)	Partners, Collaborators, Leveraged projects	Outputs	Assumptions	Outcomes (contribution to)
Primary and secondary data; Stakeholder engagement	<p>National agencies and departments with direct stake in irrigation and mechanization</p> <p>Development partners investing in mechanization</p> <p>Private companies expanding markets</p> <p>Natural resource management agencies or departments responsible for water and/or land (soils)</p>	<p>Policy and program analysis report and recommendations</p> <p>Capacity needs assessment reports and recommendations</p>	<p>Public sector actors have an incentive to invest in programs to address human resource gaps</p> <p>Private sector sees benefit from investing in skills development to increase market share</p> <p>Youth, women other groups are seeking jobs in development, fabrication, marketing, maintaining irrigation technologies and equipment</p> <p>Public sector has interest in science-based monitoring and planning of water and land</p>	<p>Strengthened and inclusive market and finance ecosystems for irrigation and mechanized technology systems with reduced inequalities in access.</p> <p>Youth and women actively participating in the use of irrigation technologies/equipment and provision of services along the irrigation value chain</p> <p>Strengthened stakeholder capacity throughout the market system to manage trade-offs.</p>

Achievements: UM-C contracted XSyn, a private firm in Ethiopia, to manage surveys and interviews across countries; key personnel were contracted by XSyn in Ghana (ISRD) and Rwanda (Kilimo Trust) to ensure deliverables. Data collection instruments were designed and tested, and data collection is underway.

Capacity Building; Lessons Learned; Presentations and Publications: Nothing to report.

University of Nebraska Semi-Annual Report FY2024:

Innovation Lab for Irrigation for Irrigation and Mechanization Systems

5.5. Objective 5. Improved health, equity, and nutrition security through protected water and diets in mechanization and irrigation interventions.

Nothing to report.

6. Associate Award Research Project Reports

Nothing to report.

7. Human and Institutional Capacity Development

DWFI began drafting an ILIMS specific student support and training program that will be aligned with the DWFI and Nebraska Water Center student support programs. No trainings were provide or students engaged during the reporting period.

8. Innovation Transfer and Scaling Partnerships

Nothing to report.

9. Environmental Management and Mitigation Plan

ILIMS received an exemption for the EMMP until field activities are introduced that may require such a plan.

10. Open Data Management Plan

No unique datasets were created in the reporting period.

11. Governance and Management Entity Activity

11.1. Project guidance and accountability

- Organized Program Coordinating Committee and scheduled first meeting (April 2024)
- Outlined and short-listed members for the External Advisory Committee, which is expected to be established in June/July 2024.
- Provided monthly updates to the DWFI executive for upward reporting to the University of Nebraska leadership.

11.2. Project management

11.2.1. Establish and maintain the project management system

- Hired professional project manager (start date December 1, 2023)
- Identified ILIMS Deputy Director (start date June 1, 2024)

- Established the Program Coordinating Committee (see list of members in Annex 3)
- Developed M & E plan with the Methodology and Evaluation Research Core Facility (MERC) at University of Nebraska-Lincoln.
- Contracted Piestar and established reporting system for sub-awardees.

11.2.2. Manage sub-awards and contracts to implement activities

- Fully executed sub-awards to IFPRI and U of M to undertake Initial Activities as outlined in the 2023 proposal.
- Commissioned consultant to identify recent and on-going irrigation projects and relevant datasets in Guatemala and Honduras.
- Commissioned consultant to provide desk study support on Irrigation as a Service in East and Southern Africa.

11.2.3. Report accurately and on time

- Established project and provided quarterly updates in FTF Activity Tracker.

11.2.4. Develop new funding proposals

- Submitted concept note to Niger USAID Mission for buy-in
- Submitted concept note to Bill and Melinda Gates Foundation for a project focused on Irrigation as a Service that will complement and leverage ILIMS

11.3. Communications and outreach

11.3.1. Communications

- ILIMS formalized and structured support from the DWF1 communications team; three team members are assigned partial FTE to undertake specific roles for ILIMS.
- Developed Strategic Communications Plan
- Developed project webpage: <https://waterforfood.nebraska.edu/irrigandmech>
- Developed newsletter template: <https://myemail-api.constantcontact.com/ILIMS-Quarterly-Update--April.html?soid=1115209281618&aid=SqGE4iVXzi0>
- Established social media presence:
 - LinkedIn - <https://www.linkedin.com/showcase/feed-the-future-irrigation-and-mechanization-lab/>
 - Facebook: <https://www.facebook.com/IrrigationAndMechanizationLab>
 - Twitter: @Irrig_MechLab
 - Followers: 123
 - Posts: 8
 - Impressions: 2,698
 - Clicks: 125
 - Reactions: 56
 - Reposts: 21

11.3.2. Outreach

- ILIMS Director presented during Agrilinks webinar for Water in Agriculture month (31 January 2024)
- ILIMS Director joined an IFC-IFAD webinar on the *Handbook for Scaling Irrigation Systems*, presenting her chapter on financing irrigation investments (8 February 2024).

11.3.3. Engagement

- U.S. Senator - Nebraska Pete Ricketts engaged with USAID Assistant to the Administrator Dina Esposito during a Senate hearing, noting ILIMS's ability to contribute to global food security by leveraging DWFI's expertise in irrigation and water management (March 6); this initiated discussion between USAID and the U.S./Nebraska irrigation industry. <https://www.foreign.senate.gov/hearings/global-food-security>
- ILIMS Director participated in two invited workshops on sustainable intensification and the bio-circular economy.

12. Issues

The process of generating the sub-awards through the Office of Sponsored Programs (OSP) was initially slow; a clear communication pipeline between the ME and OSP has been properly established for processing sub-awards. The resulting process reduced time to generate a draft subaward from an average of 40 days to about one business week. This has helped to ensure that once sub-award approval is received from USAID, University of Nebraska is able to execute the agreements in a timely manner.

13. Future Directions

The ME will continue to ensure effective project management. This includes on-boarding of the Deputy Director and establishment of the External Advisory Committee. In addition, the ME will submit the annual workplan and budget for fiscal year 2025.

The primary activity for the next reporting period is to publish Requests for Proposals. The ME has begun background research and stakeholder engagement related to content; the process is being supported by the PCC. The anticipated timeline is to release the RFPs beginning in/around July/August 2024, questions and informational meetings in August/September, and final submission deadlines by end of September 2024.

In addition, if approved, sub-awards for initial activities will begin, including:

- TetraTech: Carbon credits and innovative finance for irrigation
- Catholic Relief Services: Scoping study and capacity needs assessment, Honduras and Guatemala, with CIMMYT and CIAT.
- International Water Management Institute: Assess rainfed to supplemental and dry season water management practices and farmer incentives to change/adopt practices across three agro-ecological zones.

To ensure continuity in communications, two newsletters will be issued (April and July 2024) and podcasts and blogs published. Outreach will include the Director's leadership in the World Water Forum ("Agricultural water management: Technologies, practices, and outreach to support smallholder farmers in the Global South", 23 May 2024, Bali, Indonesia) and Stockholm World Water Week (Seminar Series: "Can Water for Food Help Peaceful Outcomes?", August 2024, Stockholm, Sweden). The Director and Deputy Director will also hold virtual and in-person meetings with USAID Missions and stakeholders in target project countries and attend the Africa Food Systems Forum in Rwanda (September 2024). (See Annex 4 Planned International Travel.)

Annex 1. List of awards given to U.S. partners

Organization	Project name	Dates	Funding (current: total)
International Food Policy Research Institute	Mechanization levels in Feed the Future (FTF) target geographies: Assessment and development of the Mechanization Propensity Index (MPI)	January 19, 2024 - September 30, 2024	\$250,712; \$250,712
University of Missouri – Columbia	Capacity needs assessment for Irrigation and mechanization adoption and sustainability	January 19, 2024 - September 30, 2024	\$146,530; \$146,530

Annex 2. ILIMS Theory of Change Matrix

Objective 1 Inclusive and sustainable agriculture-led economic growth,			Objective 2 Strengthened resilience among people and systems.			Objective 3 A well-nourished population especially among women and children			
IR 1 Strengthened inclusive agriculture systems that are productive and profitable	IR 2 Strengthened and expanded access to markets and trade	IR 3 Increased employment and entrepreneurship	IR 4 Increased sustainable productivity, particularly through climate-smart approaches	IR 5 Improved proactive risk reduction, mitigation, and management	IR 6 Improved adaptation to and recovery from shocks and stresses	IR 7 Increased consumption of safe and nutritious foods	IR 9 More hygienic household and community environments		
CC IR 2 Increased gender equality and female empowerment	CC IR 3 Increased youth empowerment and livelihoods	CC IR 4 Enhanced climate change adaptation and mitigation	CC IR 5 Improved natural resource management	CC IR 6 Improved water resources management	CC IR 7 More effective governance, policy, and institutions	CC IR 8 Improved human, organizational, and system performance	CC IR 9 Enhanced integration of conflict sensitivity, peace-building, and social cohesion	CC IR 10 Enhanced integration of digital technologies	
CR: Healthy ecosystems and biodiversity		CR: Economic growth in complementary sectors		CR: Stable, democratic societies		CR: Well-educated populations		CR: A reduced impact of disease	
Outcome 1: Context-suitable socio-economic, institutional and technological interventions that effectively target and reduce risks for multiple producer types		Outcome 2: Strengthened, inclusive natural resource governance and improved climate adaptation, mitigation and resilience capacities		Outcome 3: Strengthened and inclusive market and finance ecosystems for irrigation and mechanized technology systems with reduced inequalities in access.		Outcome 4: Strengthened stakeholder capacity throughout the market system to manage trade-offs and sustain natural resources		Outcome 5: Improved health, equity and nutrition security through protected water and diets in mechanization and irrigation interventions	

<p>EG.3.1-1: No. of households benefiting EG.3.2-7: Technologies & Management Practices EG.3.2-24: Applied Technologies, Practices & Approaches EG.3.2-x41: No. of water resources sustainability assessments YOUTH-3 GNDR-2 STIR 12: Publications</p>	<p>EG.3.1-12: No. of agriculture and nutrition policies EG.3.2-x41: No. of water resources sustainability assessments CBLD 9: No. of local organizations showing increased performance YOUTH-3 GNDR-2 STIR 12: Publications</p>	<p>EG.3.1-14: Value of new USG commitments and private sector investment leveraged EG.3.2-27: Value of agriculture-related financing accessed EG.3.1-1: No. of households benefiting EG.3.2-7: Technologies & Management Practices EG.3.2-24: Applied Technologies, Practices & Approaches YOUTH-3 GNDR-2 STIR 12: Publications</p>	<p>EG.3.2-1: Short-term Training Module EG.3.2-2: Degree-granting Training Module EG.3.2-7: Technologies & Management Practices EG.3.2-24: Applied Technologies, Practices & Approaches CBLD 9: No. of local organizations showing increased performance YOUTH-3 GNDR-2 STIR 12: Publications</p>	<p>EG.3.1-12: No. of agriculture and nutrition policies EG.3.2-1: Short-term Training Module EG.3.2-x41: No. of water resources sustainability assessments HL.9-4: Nutrition-related Training Module YOUTH-3 GNDR-2 STIR 12: Publications</p>
<p>Area of Inquiry 1 Develop suitable socio-technical innovation bundles that address the needs of specific producer types/segments, including women, youth and vulnerable people</p>	<p>Area of Inquiry 2 Establish and strengthen institutions for natural resource governance and climate resilience</p>	<p>Area of Inquiry 3 Support to more inclusive market systems that enable scaling of profitable use of irrigation and mechanization</p>	<p>Areas of Inquiry 4 Develop human resource capacity that supports mechanization and irrigation system resilience</p>	<p>Areas of Inquiry 5 Formulate strategies for nutrition-sensitive mechanization and irrigation that safeguard and enhance health and inclusivity</p>

Annex 3. Program Coordinating Committee

- Martha Mamo (mmamo3@unl.edu) - Department Head, John E. Weaver Professor of Agronomy and Horticulture, Agronomy
- Steve Shultz (sshultz@unomaha.edu) - Professor of Real Estate and Land Use Economics, College of Business Administration (Omaha)
- Tirthankar Roy (roy@unl.edu) - Assistant Professor, Civil & Environmental Engineering (Omaha)
- Erin Haacker (haacker@unl.edu) - Assistant Professor, Earth & Atmospheric Sciences
- Derek Heeren (derek.heeren@unl.edu) - Associate Professor and Irrigation Engineer, Biological Systems Engineering
- Santosh Pitla (spitla2@unl.edu) - Associate Professor, Advanced machinery systems , Biological Systems Engineering
- Laurie Miller (lmiller29@unl.edu) - Associate Dean, College of Business
- Lia Nogueira-Rodriguez (lia.nogueira@unl.edu) - Associate Professor, Ag Econ
- Tala Awada (tawada2@unl.edu) - Physiological Plant Ecologist; Agricultural Research Division Associate Dean, School Natural Resources
- Jesse Bell (jesse.bell@unmc.edu) - Professor of Health and Environment, UNMC

Annex 4. Planned international travel for 1 April to 30 September

Dates	Traveler	Location	Purpose
23 May 2024	Director	Bali, Indonesia	World Water Forum (“Agricultural water management: Technologies, practices, and outreach to support smallholder farmers in the Global South”
August 2024, Stockholm, Sweden).	Director Deputy Director		Stockholm World Water Week (Seminar Series: “Can Water for Food Help Peaceful Outcomes?”,
July 2024	Director	Rwanda	Country/field visit
2-6 September 2024	Director TBD		Africa Food Systems Forum in Rwanda