



USAID
FROM THE AMERICAN PEOPLE

USAID
**Higher Education
Solutions Network**

Higher Education Solutions Network FY 2017 Annual Report

Michigan State University
Global Center for Food Systems Innovation
Agreement No. AID-OAA-A-13-00006



Innovation Scholars Program participant Orpah Kabambe, Head of the Human Ecology Department at Lilongwe University of Agriculture and Natural Resources, discusses her research with about a dozen Malawian journalists at LUANAR's Natural Resource Campus as part of the Communicating for Impact Workshop in August 2017.

Photo courtesy of Bill Heinrich.

DRAFT Submitted: October 31, 2017 APPROVED: November 21, 2017

Reporting Period: FY 2012 through FY 2017

This publication was prepared by Michigan State University for review by the United States Agency for International Development.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS	iii
INTRODUCTION	1
1. BRIEF LAB OVERVIEW	1
2. EVALUATION FRAMEWORK	2
3. NUMBERS AT-A-GLANCE	3
4. KEY LAB PRODUCTS	4
5. PROGRAM AND POLICY CHANGES	6
6. KEY LEARNINGS IN IMPLEMENTING HESN LAB AT MICHIGAN STATE UNIVERSITY	7
7. FUTURE IMPACTS	9
8. FY17 MILESTONES / ACHIEVEMENTS	11
9. CLOSEOUT (CORE) ACTIVITIES, BUY-INS AND SUSTAINABILITY PLAN	19
9.1 Close-out of Ongoing Core Activities during Year 6	19
9.2 Buy-ins	20
9.3 Sustainability Plan	20
10. ENVIRONMENTAL MONITORING	21
Appendix 1: TOTAL GCFSI FOLLOW-ON FUNDING	22
Appendix 2: PUBLICATIONS	24
GCFSI Publications, by Type	24
External Publications, by Topic	26

ACRONYMS AND ABBREVIATIONS

AYL	Ag Youth Lab (MSU)
CIAT	International Center for Tropical Agriculture (Colombia)
CRM	Climate Resilient Maize
DAI	Development Alternatives, Inc.
DSI	Decision Support and Informatics
DSSAT	Decision Support Systems for Agrotechnology Transfer
FIP	Frugal Innovation Practicum
FSP	Food Security Policy (Feed the Future Innovation Lab for)
FY17	Fiscal Year 2017
GCFSI	Global Center for Food Systems Innovation
GRAIN	Grain Research and Innovation (Afghanistan)
HESN	Higher Education Solutions Network
HICD	Human and Institutional Capacity Development
IFPRI	International Food Policy Research Institute
ISP	Innovation Scholars Program
Lab	Global Development Lab
LUANAR	Lilongwe University of Agriculture and Natural Resources (Malawi)
M&E	Monitoring and Evaluation
MSU	Michigan State University
NAPAS	New Alliance Policy Acceleration Support: Malawi
NGO	Non-governmental Organization
OFSP	Orange-fleshed sweet potato
PI	Principal Investigator
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
Seed	Seed Systems Development
SMS	Short Message Service
US	United States
USAID	United States Agency for International Development
USD	United States Dollars
USIEF	United States-India Educational Foundation
WFD	Workforce Development
WUR	Wageningen University (The Netherlands)

INTRODUCTION

This report covers the full five-year period of the initial HESN cooperative agreement with GCFSI, from FY 2012 through FY 2017. Milestones and significant achievements for just FY 2017 are highlighted.

1. BRIEF LAB OVERVIEW

The goal of the Global Center for Food Systems Innovation (GCFSI) at Michigan State University (MSU) is to create, test and enable the scaling of innovations in the food system, using an approach that is multi-disciplinary (six colleges are involved), focused on the entire food system, and forward-looking, considering three major trends that will impact future food system performance: (1) population growth, climate change, and pressure on land, (2) rapid urbanization and income growth, and (3) workforce development (WFD) implications of changing food systems. GCFSI has three major objectives: Objective 1 – mobilize data and analytical tools to support development decision-making, Objective 2 – source, test, and scale up food systems innovations through \$3+ million in grants and GCFSI faculty-led projects, and Objective 3 – student engagement and partnerships to build a new generation of development innovators and practitioners.

The initial GCFSI work plan called for creating innovation hubs in West Africa, East Africa, and Asia. Soon after the launch of GCFSI, it was decided to begin with hubs in East Africa and Asia. After visits to several countries, a hub was established in July 2014 in Malawi, hosted by the Lilongwe University of Agriculture and Natural Resources (LUANAR). Efforts to establish a hub in Asia were not successful.

Reflecting on the years since GCFSI's formation in 2012, we can point to three phases through which the center progressed. During the first phase of GCFSI, from 2012 to early 2014, faculty teams focused on each of the three major trends ("megatrends"). White papers were developed to identify the state of the art in research related to food systems, and areas where innovation grants might be focused. A first phase of innovation grants for faculty (6 grants of \$100,000 each) and students were awarded.

The second phase, from early 2014 through mid-2015, emphasized applied research with a focus on Malawi, and a second, expanded round of innovation grants (10 grants totaling \$1.6m). GCFSI-funded teams of researchers from MSU and Wageningen University collaborated with faculty from LUANAR to implement an integrated set of nine research activities organized around a broad theme: "Where and how can multipurpose legumes be scaled for sustainable intensification of maize systems and what would the potential impacts be, in the medium term, across the food system in Malawi?"

In the third phase of GCFSI, from mid-2015 through September 2017, activities were reoriented in response to budget reductions and changes in the focus of the HESN program. For GCFSI, this meant cessation of major innovation grants, direct support for other USAID initiatives (especially the Climate Resilient Maize program), and increased focus on human and institutional capacity development in Malawi, especially in partnership with LUANAR, centered

on programming that would empower local communities of researchers, innovators and farmers/food vendors.

2. EVALUATION FRAMEWORK

In response to the changes in lab activities, the GCFSI evaluation framework has evolved over the course of the past five years. Our objectives have remained constant (see section 1 for objectives). What changed was how we evaluated our approach. The overall arc of change at GCFSI can be described as moving from Research to Apply and finally Empower.

Research

Originally, GCFSI was focused on understanding the major forces that are shaping food system change. GCFSI tapped into some of the best researchers at MSU to form interdisciplinary teams around three Megatrends:

Megatrend 1- *Population Growth, Climate Change and Pressure on the Land* tasked researchers to develop innovations that increase food availability and food system resilience in Africa and Asia in the face of global climate change.

Megatrend 2 - *Rapid Urbanization and Transformation of Food Systems* focused on understanding the transformations currently underway in developing country food systems and engaging farmers, business, communities and governments in the design of policies, programs, and targeted interventions to assure access to plentiful, safe, nutritious, and affordable food for all citizens.

Megatrend 3 - *Evolution in Skills Required by Food Systems* looked at upgrading skills in the food system in order to adapt the food system workforce to global trends.

In addition, Round 1 innovation grants funded researchers who were developing research that directly supported one of the megatrends.

During our initial *Research* phase, our impact was measured by research findings, publications and presentations. The research we produced was world class and generated quality reports. However, we wanted our research to have a larger impact, so we sought to inform food system change at the local level.

Apply

While our *Research* work never ended, GCFSI took a more targeted approach, asking “How can one specific country better adapt to the expected changes drive by the forces driving the megatrends?” Because of MSU’s long history of working in Malawi, it was decided to create a series of smaller research projects focused on better understanding how Malawi can adapt in response to the forces identified in the megatrends. To measure the impact of the *Apply* phase, GCFSI turned to the Malawi Working Paper series, webinars, and other measures focused on communicating research findings, including peer-reviewed publications.

During the *Apply* phase, we funded a second round of Innovation Grants, which focused on developing technologies, or applying research to scale solutions. In addition, we began to train our Innovation Grantees on how to use design thinking and the business model canvas to conceptualize how their research can reach the most beneficiaries.

Empower

GCFSI never lost its focus on either *Research* or *Apply*. However, at the start of our fourth fiscal year, we made our final shift to focus how *Empowered* individuals could *Apply* our *Research* to create local solutions to food system challenges. We wanted to provide a way for local people, working directly to address food system challenges, to harness tools and training that would improve research application. For the *Empower* phase, we continued to focus on Malawi because of the historically strong relationship between MSU and LUANAR.

The Frugal Innovation Practicum, while a student exchange program on the surface, was, at its core, a catalyst for LUANAR faculty and students to research local food system problems. The FIP's success is seen in the fact that LUANAR continues to work with the local government and market vendors to improve food access and sanitary conditions in the local/informal markets.

The Innovation Scholars Program (ISP), which is further explained in sections 4, 5, and 8, was developed as a Human and Institutional Capacity Development (HICD) initiative based on the premise that innovation could be learned. Twenty LUANAR faculty and administrators participated in a series of six workshops that utilized design thinking and systems thinking to build their capacity to create unique solutions to food system and institutional challenges. We know the ISP was successful based upon our assessment system, adapted from experiential education assessment methodologies, which shows participants have increased their conceptual understanding and application of both design and systems thinking.

3. NUMBERS AT-A-GLANCE

GCFSI has identified a few indicators that best represent the successes our lab has achieved during the five-year HESN cooperative agreement.

1. **Follow-on Funding:** GCFSI has leveraged follow-on funding for many core activities and innovation grants over the past few years. Appendix 1 shows the follow-on funding that GCFSI projects received, which totals \$4,415,491 USD.
2. **Cost Share:** GCFSI has exceeded its cost share goals during the last 5 years of the HESN cooperative agreement. GCFSI has received a total of \$5,107,912.28 USD in cost share.
3. **Publications:** GCFSI has self-published many papers, reports, and briefs on the various work that has been completed during the HESN cooperative agreement. Many of GCFSI researchers have also written and published their work in external sources and peer reviewed journals. To view a complete list of GCFSI supported publications, please see Appendix 2.
 - a. GCFSI produced 18 self-published papers, reports, and briefs.
 - b. Researchers have had their GCFSI-related research published in external sources on 42 occasions, with an additional 3 forthcoming.
4. **Grants Awarded:** GCFSI awarded a total of \$2,537,000 in grants to student and professional researchers. Over two rounds, \$2.2 million in Major Innovation Grants was

awarded to international researchers, with an additional \$127,000 awarded through 18 Student Innovation Grants. Another \$150,000 in Faculty Innovation Grants was awarded to LUANAR faculty. The center also provided \$60,000 to support the Big Ideas student competition, hosted by our sister lab, Development Impact Lab, at the University of California-Berkeley.

4. KEY LAB PRODUCTS

GCFSI has produced many knowledge products over the last five years that represent GCFSI's key learnings and impact. Highlights include the following:

- In 2016, GCFSI published the first paper in a series of *Malawi Reports* titled, “*Research on Multipurpose Legumes in Malawi: Synthesis Report.*” This paper summarizes results from ten research projects that were conducted in Malawi on multipurpose legumes in 2014/15 and written up in separate reports. The central question addressed by the research projects was: “Where and how can multipurpose legumes be scaled for sustainable intensification of maize systems and what would the potential impacts be, in the medium term, across the food system in Malawi?” *Citation:* White, Stephanie and Crawford, Eric. 2016. Research on Multipurpose Legumes in Malawi: Synthesis Report. Malawi Report No. 1. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA. http://gcfsi.isp.msu.edu/files/8614/6963/2320/Crawford_White.pdf.
- *Nature Plants* published a journal article from GCFSI researchers Joseph Messina, Brad Peter, and Sieglinde Snapp following their research conducted in support of USAID's Climate Resilient Maize program. The article reports findings that cast doubt on the “Malawi miracle” in which the government's large fertilizer and seed subsidy program in 2006 was said to have led to major increases in maize output. The authors' analysis shows that this contention is inconsistent with satellite data on agricultural productivity, and was partly a result of an error in published data on maize acreage. The article's findings suggest that the popular fertilizer subsidy program in Malawi may not be a sufficient or sustainable strategy for production gains. This peer-reviewed journal article is a culmination of the researchers work, and is just one example of the innovative work published by GCFSI researchers during the five years of the core HESN award. *Citation:* Messina, Joseph P., Peter, Brad G., and Snapp, Sieglinde S. 2017. Re-evaluating the Malawian Farm Input Subsidy Programme. *Nature Plants*. 3:17013. <https://www.nature.com/articles/nplants201713.pdf>.
- The Food Fix, a multi-media blog launched through GCFSI, covers issues related to food security and activities completed by GCFSI center-led projects and innovation grantees. The Food Fix refers both to the “fix” the world is in as it struggles to feed a growing population, and to the “fix” that innovators pursue to meet that challenge. This multi-media blog contains a collection of videos, podcasts, photos, and articles that communicate GCFSI research activities and outputs. The platform is one way that GCFSI engages MSU students in research storytelling. Students in GCFSI's Translational Scholars Corps contribute to content curation and production. The Food Fix can be found at <https://msufoodfix.wordpress.com/>.
- GCFSI designed and implemented the Innovation Scholars Program (ISP). Collaboratively created between MSU and LUANAR, the ISP is a 12-month capacity-building program for the Malawian university. Serving LUANAR faculty and administrators – collectively called Scholars – the ISP supports LUANAR's goal to equip graduates with the skills and mindset

to solve the region's development challenges. Through this program, faculty members learned techniques for bringing innovative thinking into the classroom and academic research. Administrative leaders – including deans, department heads, and the university registrar – developed ways to dismantle institutional constraints that inhibit innovation, and discuss new approaches to faculty assessment and other procedures. The program consisted of six workshops – co-designed by the participants and multiple partners. The workshops were facilitated by the ISP Lead Team in collaboration with various content experts in the region and from MSU. Scholars learned about design-thinking, community engagement, incorporating innovation to teaching and learning, leadership development, and skills for communicating for impact. The program itself is a knowledge product of GCFSI lab, and is represented by a few published products:

- a. Innovation Scholars Program Infographic: ISP Illustrated
<https://drive.google.com/file/d/0B7vUccuJH1sVRzllUmRnelRISXc/view>
 - b. Innovation Scholars Program Magazine: Showcase 2016-2017
<https://drive.google.com/file/d/0BzIKVUkbDFwRRUFDCG44WmxVOXM/view>
 - c. Innovation Scholars Program Slide Deck: A human-centered approach to innovating in African higher education
<https://drive.google.com/file/d/0BzIKVUkbDFwRZzNyV0VvOXI2eIE/view>
- Frugal Innovation Practicum reports, produced by GCFSI's City-Regional Food Systems Lead Dr. Stephanie White, document the first two years of the program's life. The reports cover the approach and activities, and discuss considerations for following years. The report for FIP 2015 can be found at:
http://gcfsi.isp.msu.edu/files/7515/0886/6937/Report_FIP_2015.pdf
The report for FIP 2016 can be found at:
http://gcfsi.isp.msu.edu/files/7515/0886/6937/Report_FIP_2015.pdf
 - GCFSI's Gender Strategy is a key development from the early years of the lab. Developed in 2015 by the lab's Gender Lead, Dr. Nathalie Me-Nsope, the document provides a rationale for use of a gender strategy, discusses gender issues with regard to the three megatrends GCFSI identified, and outlines how to implement the strategy. Gender inclusiveness is a significant focus of GCFSI's center-led research and Innovation Grants, as women play a central role in agriculture in most developing countries, yet numerous challenges hinder their full participation in and benefits from food system activities. The gender strategy outlines GCFSI's commitment to integrating gender in our projects. This was accomplished through training sessions and ongoing discussion with researchers, and incorporated to our monitoring and evaluation processes. *Citation:* Me-Nsope, Nathalie. 2015. Gender Strategy. Center Report Series, No. 6 Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA 23 pp.
<http://gcfsi.isp.msu.edu/files/2914/6229/3436/w6.pdf>
 - Stories from the Field is a GCFSI publication highlighting the progress and successes of many of the lab's food system innovation projects. This print and online piece shares the stories of GCFSI Innovation Grantees working in Kenya, Tanzania, Uganda, Zambia, India, Vietnam, and the Philippines. Featured projects cover a range of topics and innovations, including cell phone technologies to benefit farmers; harnessing anaerobic digestion for fertilization, refrigeration, and cooking; development of protein-rich baby formula made from wild-caught insects; and building low-carbon impact refrigeration units from locally sourced materials. *Citation:* Deska, K., Hussain, A., and LaFave, E. 2017. Stories from the

Field: Food System Innovation Projects. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
http://gcfsi.isp.msu.edu/files/9015/0887/1878/Stories_from_the_Field_Final_03.2017.pdf.

5. PROGRAM AND POLICY CHANGES

GCFSI's focus on the entire food system has allowed different GCFSI-funded projects to shape program and policy changes at the local, national and regional levels.

The FIP and LUANAR Innovation Hub combined are a major example of building innovative research for impact. The student practicum's focus on cooperative learning embedded within investigation of urban food markets rigorously strengthens cross-sector relationships, while the Hub sustains these relationships. Research efforts to introduce students to small-scale urban food-based livelihoods, connected to urban food exchange, provisioning, and environments, are coupled with intentional and consistent partnerships with provincial government. This engagement has helped catalyze key changes in provincial governance strategy. In October 2016, the local government made a commitment to reinvest at least 25% of collected market fees to benefit market infrastructure projects. This success was continued by embedding stakeholder input and student-powered, locally crowd-sourced funding into the research process. As a result, three out of four key maintenance and rehabilitation infrastructure projects have been completed, with the fourth moving towards completion. Additional market improvements will be made in the following year, as a result of the summer 2017 practicum innovation plans, which were co-created between students from MSU and LUANAR, and the local market committee. The provincial government partners said the management models emerging from these projects are exemplary. We believe the key finding from this success is the 'process innovation' embedded within the practicum, with a focus on collaboration between research faculty and students and diverse stakeholders within the local system.

The Innovation Scholars Program (ISP) is creating change in behaviors and approaches to teaching and learning at LUANAR. The program has two tracks of ISP Scholars: one for faculty researchers/instructors and one for academic leaders. The scholars have expressed strong interest in institutionalizing and continuing the application of design thinking to support innovation. LUANAR scholars, particularly in the leadership track, are working with GCFSI to learn how to implement desired changes at the institutional level. In June 2017, academic leaders attended a workshop to help them conceptualize pathways for their desired institutional changes. After the workshop, they worked together to prepare and present a proposal for a new Faculty Development Program to be implemented at LUANAR, and for an experiment to pilot-test increased budget control within one academic department.

GCFSI Innovation Grant projects are also harnessing the power of locally focused research and entrepreneurship. In the Philippines, GCFSI-funded grantees implemented FarmerLink, a mobile-phone based system that leverages scientific data and mobilizes field officers. The mobile tools and field officers monitor adopted practices and farm investments required to increase productivity. The findings are then communicated to smallholder coconut farmers via SMS and the officers. This project has led to changes in the policies and procedures of the Philippine Coconut Authority (a Philippine government agency tasked to develop and manage

the coconut industry in the Philippines). The Philippine Coconut Authority, using the tools and data developed within the FarmerLink program, developed the FarmerLink’s Early Warning System for coconut pest or disease attacks, and started to implement a standard operating procedure for actions that should be taken with the deployment of alerts. Having the FarmerLink program adopted by the Philippine Coconut Authority ensures that that program will be self-sustaining and that human resources will be dedicated to monitoring the new early warning system dashboard.

6. KEY LEARNINGS IN IMPLEMENTING HESN LAB AT MICHIGAN STATE UNIVERSITY

GCFSI was established at MSU to create, test and enable the scaling of innovations in the food system, using an approach that is multi-disciplinary, focused on the entire food system, and forward-looking. Throughout the five-year HESN cooperative agreement, GCFSI continued to advance, creating an impact at Michigan State University by changing conventional practices and learning from years of experiences, challenges and changes.

GCFSI changed conventional practices at Michigan State University during the implementation of the lab.

- The lab was explicitly intended to apply multi- or interdisciplinary approaches to seeking food systems innovations. This created a unique space at MSU where faculty could benefit from working on food system problems from within academically diverse groups. To be successful, interdisciplinary work must allow disciplinary-focused researchers to advance their careers in the eyes of their disciplinary peers, while weaving individual pieces of work into a collective body of research that draws on all disciplines. GCFSI created such a space for members of the core technical team and their collaborators at other institutions. Setting up an explicitly multidisciplinary and cross-college unit on campus, which is focused on finding solutions to global food problems, was an institutional innovation for MSU. GCFSI changed conventional practices at MSU by forming a “standing” core technical team drawn from multiple departments and colleges, unified by a common interest in research, outreach and capacity building oriented towards improving global food systems.
- The focus of GCFSI on innovation added a valuable dimension to the perspective and approach of faculty and students at Michigan State University, who learned what it means to be innovative. GCFSI found that there was a distinction between cutting-edge research and innovations that actually solve big development problems.
- Through the process of developing and implementing the Grain Research and Innovation Project (GRAIN) buy-in, GCFSI has established new procedures for implementing projects in high-risk, conflict environments, such as Afghanistan, that will have an impact on MSU procedures in similar projects taking place in high-risk, conflict environments – ranging from travel of personnel, export control and general implementation of the project.

GCFSI encountered many challenges during the five-year period of core activities, including:

- Developing RFAs for innovation grants that successfully call forth genuinely innovative proposals.

- Identifying good sites for innovation hubs, which requires support from a local USAID mission, support and capacity from a local host institution, and existing MSU experience/activities in the country concerned.
- Harmonizing the objectives or “agendas” of the two key USAID funding offices for GCFSI, namely LAB/HESN and Bureau for Food Security (which provided \$5m for Year 1). Initially, this made it difficult to define a mission and “value proposition” for GCFSI that was universally understood and supported.
- Challenges in communicating to specific USAID work groups the areas in which GCFSI faculty teams have expertise and on-going programs that are innovative and potentially relevant to USAID’s programs and priorities.
- Finding the best points of complementarity and synergy for GCFSI with ongoing programs and units at MSU.

During the five-year period of core activities, GCFSI experienced a few major changes, including:

- Midway in the project period, GCFSI’s budget was cut by 40%, partly as a result of a substantial cut in HESN’s budget. GCFSI was encouraged to (1) de-emphasize innovation grants, (2) focus on activities in Malawi, (3) focus on specific projects that supported major USAID initiatives (e.g., Climate Resilient Maize), and (4) to focus on capacity-building activities. This required an adjustment, but ultimately played to the strengths of MSU and the GCFSI core faculty.
- Community engagement became a major element of several GCFSI activities, including:
 - The FIP, which brought MSU and LUANAR students and faculty into contact and engaged with traders in urban food markets and city government officials in Lilongwe, Malawi, for a process of joint problem identification and design of solutions.
 - GCFSI collaborated with faculty and administrators of LUANAR to co-create the Innovation Hub at LUANAR and the ISP, with tracks for both researchers and academic administrators. This activity had a major focus on experiential learning, with a relatively small “instructional” component. Systematic assessment of the impacts of the experiential learning was built into the program.
 - Charles Steinfield and team’s work on “participatory video” enhanced the impact of extension messages by filming extension videos using local farmers as actors. The project’s success generated interest from other groups, and in response researchers hosted a skills-sharing workshop in Dar es Saalam, Tanzania in June 2017. Over 20 individuals from government agencies, non-governmental organizations, universities and donors attended “A Video Storytelling Method to Enhance Agricultural Extension Workshop.”
 - The ISP connected university researchers to members of the local community through the applied research projects. ISP participant Abel Sefasi had planned to conduct his research on indigenous vegetable cultivation at the LUANAR laboratory. However, working with ISP facilitators and his design team, Sefasi decided to host the experiment in a village south of LUANAR, and work collaboratively with the farmers to roll out the experiment. Prompted by Sefasi’s project, the village headman gifted farmers with a plot of land on which to work with Sefasi. The farmers plan to continue cultivating the vegetables on that land.

- Community engagement by GCFSI’s innovation grantees and participants in other center-led projects.
 - Rebecca Larson, a grantee working in Uganda, involved community members in her applied research on anaerobic digestion. Through Lweza Primary School, where Larson and her team installed the dual-fuel stove, Makerere University, and other sites, the researchers engaged students and stakeholders to teach them the science behind anaerobic digestion and the practical application of biogas to their households, schools, and businesses. Additionally, to facilitate peer-to-peer learning, Larson and the team of local researchers visited Rwanda to see another demonstration site that featured anaerobic digestion technologies.
 - Kate Scow and Abraham Salomon, grantees also working in Uganda, worked at six sites and helped to mobilize farmers to form farmer committees, who they worked with to develop locally-controlled irrigation systems.

GCFSI has had many key learnings from the experiences, challenges, and changes that occurred during the five-year HESN cooperative agreement. Some of these key learnings include:

- Setting up an explicitly multidisciplinary and cross-college unit on campus, focused on finding solutions to global food problems, was an institutional innovation for MSU.
- Using multi-media approaches to communicating activities and outputs of GCFSI is very important. GCFSI has found success in using videos, podcasts, photos, and social media to share stories and success of GCFSI researchers and events.
- GCFSI worked to move from conducting research on food system issues, to applying the research to come up with solutions to food system issues, to finally empowering people and communities to make a difference in food system issues using applied research. To empower people and communities, community engagement is an important part of GCFSI’s model. It is important to establish community engagement, continue to engage communities, and bring in new partners and stakeholders to have lasting impacts. GCFSI expanded its amount of community engagement in both core activities and innovation grants to genuinely empower local individuals to make changes in food system issues.
- GCFSI learned that students can bring tremendous enthusiasm and capacity for innovation to the search for solutions to big development problems!

7. FUTURE IMPACTS

GCFSI predicts a long-standing impact in the three to five years following our HESN cooperative agreement. We anticipate our work, both within MSU and beyond MSU, to have lasting impacts through the partnerships and stakeholders engaged, as well as the research scaled in food systems all around the world.

Future Impacts within Michigan State University

- GCFSI will continue to be an integral part of MSU’s International Studies and Programs unit; with a strategic plan to (a) serve as the hub for food-systems oriented innovation and entrepreneurship activities, especially those with an international dimension; (b) serve as the hub for design and implementation of projects with a multi-disciplinary

dimension involving agriculture, food systems, and related areas such as nutrition, health and the environment; and (c) focus on converting research into action around the food system.

- GCFSI is currently working with the MSU Department of Community Sustainability to design and introduce a minor in Food System Sustainability and Social Innovation, which provides undergraduate students the opportunity to learn about agriculture and food systems issues while considering biological, ecological, social, and economic contexts while fostering innovation.
- The FIP is an experiential, service-learning opportunity for students in diverse disciplines at MSU and LUANAR. This program provides students the opportunity to conduct active research at urban food markets and work with food retailers in Malawi to learn about challenges associated with food security, urban food systems, and food-based livelihoods. MSU acknowledged the value of this program in that it provides students with a forum to think critically and act creatively. Students work in cross-cultural teams to discover solutions that benefit the Malawians who work and shop at the urban markets. This program will be adopted as a study abroad option for undergraduate and graduate students at MSU, as either an independent or special topics course.
- The Food Fix, an online multimedia platform that spotlights issues related to food security, food systems, and innovative solutions spearheaded by GCFSI researchers and others, will continue to be maintained as a key element of MSU’s new university public awareness initiative, “Food @ MSU – Our Table.” Additionally, The Food Fix’s Global Partnership Series, which features radio spots and articles produced by Malawian reporters remains active. David Poulson, Director of GCFSI’s Translational Scholars Corps and leader of The Food Fix, initiated working relationships with various Lilongwe-area reporters during the August 2017 ISP Workshop: Communicating for Impact. The workshop brought together LUANAR researchers and journalists from the New Alliance Policy Acceleration Support (NAPAS), a USAID Feed the Future project.

Future Impacts beyond Michigan State University

- The Innovation Hub and the ISP in Malawi were first established through a partnership between GCFSI and LUANAR – and were developed to help support food system innovation and bolster food security, as well as develop the current and next generation of entrepreneurial scientists in Malawi and the region.
- The Innovation Hub and the ISP have been very successful and will continue to act as a sustainable model for generating innovations and putting them into practice, in various dimensions including teaching as well as research, and will serve to link faculty research with problems faced by local communities. The ISP was proposed to the African Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) during the 2017 Annual General Meeting as a model relevant to other universities and institutions wishing to strengthen



Figure: The Innovation Scholars Program used design thinking to bring a human-centered capacity development model to MSU and LUANAR as a way for generating innovation and putting them into practice in various dimensions of both teaching and research. This model will continue to be implemented through future ISP styled programs with other institutions.

their innovation capacity. GCFSI anticipates that there will be opportunities to implement similar programs as ISP within other African institutions. The ISP and GCFSI have strived to become known as an organization that specializes in building the capacity of people to apply research in new ways to solve local problems.

- Beyond work in human-centered capacity development, GCFSI recognizes the successes of many of the individual innovation grant projects, and anticipates many will continue to have lasting impacts within their target areas.
 - PhotosynQ (<https://photosynq.org/>), an innovative hand-held device developed by GCFSI Innovation Grantees David Kramer and Greg Austic is actively being used by researchers, educators, farmers and citizen scientists around the globe. The device catalyzes a network of users who collect, analyze, discuss and share plant photosynthesis-related data. Plant researchers from over 18 countries and 6 continents are using PhotosynQ.
 - FarmerLink, led by GCFSI Innovation Grantee Ana Herrera, is proving to be very successful in the eyes of farmers, which increases the likelihood that the Philippine Coconut Authority will continue to adopt the technology and work with researchers expand its reach within the Philippines. A farmer satisfaction indicates that 93% of farmers who used FarmerLink said they will gain skills if FarmerLink is continued, and 80% of farmers reported to be very or extremely satisfied with the project. To measure partner outcomes focused on operational efficiency gains using the mobile tools, the project team also conducted an activity-based costing methodology for Franklin Baker, the coconut buyer. The results showed a 62% efficiency gain in the digital farm inspection process compared to manual processes, that field officers doubled their farmer outreach for farm inspection using the mobile tools, and that the value of the efficiency gain is \$3,676 per field officer per year or \$47,788 per year if the tools are used by all current field officers.

8. FY17 MILESTONES / ACHIEVEMENTS

During FY17 (October 2016 – September 2017), GCFSI continued to implement a strong portfolio of programs in the field.

- GCFSI Innovation Grantees acquired an additional \$934,908 in follow-on funding in FY17, for total of \$4.4 million over the life of the project.
- The ISP at LUANAR is starting to produce change agents as both faculty and administrators began to apply design thinking and systems thinking to their research projects and internal LUANAR institutional challenges that restrict their capacity to respond to the needs of the private sector and students.
- Joseph Messina and colleagues from the CRM-4 team published an article in the prestigious journal, *Nature Plants*, on their GCFSI-funded work in Malawi.
- GCFSI Innovation Grantees continue to produce strong field-level impact as their innovations move from research into testing and adoption in the field.
- GCFSI-funded research has produced a large number of peer-reviewed and invited research papers.

GCFSI Management

GCFSI management realized that we cannot expect our colleagues and partners to be innovative if we are not innovative in how we assist them in their design and implementation. We made a decision to change how we implemented the ISP. Now the program is implemented, as well as designed, via a process rooted in design thinking. In addition, we worked with the Innovation Grantees to define the focus of the FY17 Grantee Workshop.

GCFSI has found design thinking to be a framework that places beneficiary needs at the center of our work. This change in approach creates the possibility for collaborating, learning and adapting to local conditions. GCFSI learned that it was necessary to build *our* capacity to engage with partners in new ways *before* we built the capacity of our partners to engage with *their* colleagues or local environment in new ways.

Innovation Scholars Program serves faculty and administrators at LUANAR:

Over the last fiscal year, the ISP implemented four additional workshops, making seven successful workshops hosted since the launch of the program.

In December 2016, workshop 3 took place at LUANAR focusing on Teaching and Learning for Innovation in African Food Systems. During the workshop facilitators further emphasized to scholars the principles, techniques and methods of design thinking and systems thinking. To help bridge the gap between research and application, an interactive forum was held for stakeholders and the university community to discuss the need for innovation and partnerships. Individuals from the private sector, including a LUANAR graduate who now works in the landscape architecture business, were in attendance with the director of national education assessment for Malawi; the director of assessment at LUANAR; the president of the student body; and officials from the government, including a member of Malawi's Ministry of Agriculture.

In March, the ISP scholars attended a learning excursion to Nairobi, Kenya for a three-day, interactive Field Study for Innovation in African Food Systems. During this excursion, scholars visited regional innovation centers where they were able to contextualize lessons from other African institutions. Sites included the University of Nairobi, Jomo Kenyatta University of Agriculture and Technology, Catholic University of Eastern Africa, United States International University, International Potato Center, International Livestock Research Institute, and local tech incubators Nailab and iHub. Part of the 15-month capacity building program, the field study allowed scholars to see innovation systems in action, gain understanding of how the centers functioned, and brainstorm how they might incorporate novel ideas into the context of LUANAR and the broader Malawian food system.

ISP Facilitators also organized a Leadership Development workshop, hosted in June 2017, which brought together the ISP academic leadership track to discuss how to leverage leadership within LUANAR to make organizational change. Though not initially planned, scholars and facilitators agreed that an intensive workshop focused on organizational change would be beneficial. Facilitators from MSU and Wageningen University & Research (WUR) discussed principles and practices of strategic change. Through the workshop, members of the leadership track planned

the next steps they would take to advance their group project: the creation of a LUANAR-specific leadership development pilot.

In August, workshop 5 tasked the scholars with learning, developing, and practicing telling their science and research to diverse audiences. This final workshop provided the scholars with the tools and preparation to present their ISP work at the ISP Close of Project Research and Innovation Symposium in October 2017. Because ISP workshop 5, titled “Communicating for Impact,” ran parallel to another workshop on LUANAR’s campus, which involved journalists from the New Alliance Policy Acceleration Support (NAPAS), journalists and reporters were face-to-face and discussed the challenges they each face. After hours of training, practice, and conversation researchers were interviewed by local reporters, who followed up with articles in various Malawian news outlets. To view some of the articles, visit the ISP webpage at <http://gcfsi.isp.msu.edu/gcfsi-activities/innovation-scholars-program/>.

Each of these workshops continued the ISP tradition of hosting a stakeholder forum around the theme of the workshop. These forums brought together external stakeholders including government officials, producers, alumni, and media into the LUANAR community for an exchange in information, ideas, and solutions.

Outside of the workshops, members of the ISP leadership track continued to develop their proposal for a leadership development program specifically tailored to LUANAR faculty. While they first worked on creating a curriculum that would teach leadership skills, the focus later changed to establishing a pilot program that would give a particular department increased budgetary control. The rationale behind this is that much of the innovative programming that faculty would like to implement is prevented because they are not allotted the funds necessary to do so. The premise behind the leadership track’s proposal is that with ability to make decisions about their department’s budget, faculty can better work together to roll out innovative academic opportunities for students. At the time of the ISP wrap up, members of the leadership cohort of ISP were initiating a dialogue with university administrators about this possibility.

Frugal Innovation Practicum supports innovation in Malawi’s urban food markets:

The third cohort of FIP students continued activities in Lilongwe. Throughout all three years, the students took a systems perspective and considered the various functions that impact an innovation system. In 2015 the first cohort mapped the markets, which helped students quickly get acquainted and also served as a foundation for future FIP activities. During 2016, FIP Leader Dr. Stephanie White introduced design thinking to the students, who then hosted design charrettes with market vendors in Lilongwe. The students presented what they saw as the markets’ challenges, and received feedback from the vendors. Solutions were then established from that vantage point. In 2017, again the students worked with vendors to develop plans that would lead to improved market conditions. While in 2016, the solutions focused mainly on making tangible infrastructure improvements, the 2017 cohort working in Waka Waka market had to think beyond infrastructure.

Waka Waka market is on private land, not endorsed by the city and could be shut down at any time. As a result, the students had to think of solutions that would serve vendors even if they were forced to move locations. In response, students worked with vendors to establish a list of skills they like to learn. Students proposed that LUANAR faculty host the skills trainings for

vendors, and shared this recommendation during their meeting with the Lilongwe City Council, LUANAR officials and other local stakeholders.

In terms of the FIP student curriculum, 2017 was the first time that specific communications skills were taught. During FIP classes, students were taught about the importance of clear communication and telling relatable stories in order to build empathy and support for the market vendors. Students were taught how to shoot and edit video with their phone, took photos and wrote vendor profiles that described the challenges faced by various vendors. The communication skills are important not only for the students' future success, but also affect the impact they have when talking to the Lilongwe City Council and decision makers.

A crowdfunding campaign led by GCFSI/FIP, raised \$2,550 in summer of 2017. Inspired by the success of MSU's CrowdPower campaign, FIP faculty and students from LUANAR launched a fundraising campaign of their own, raising an additional \$1,358 for improvements in local food markets. Of that total, \$500 came from a pledge from LUANAR university management. Other donors included LUANAR staff and students from various departments, friends from the community, and one insurance company (AON Malawi).

This year, the money will go to committees that help organize the vendors in Lilongwe's Mitundu market and Waka Waka market. The committees will work with LUANAR faculty members throughout the school year to take steps and follow through on the innovation plans previously established with student teams. The FIP is structured so that it is ongoing and cyclical. After the students leave, the funding keeps the market committee engaged with the plans and gives them the financial ability to make the concrete changes they helped to outline. Waka Waka market, located in Lilongwe's Area 36, is looking to start a series of skill-building workshops for vendors on sanitation, hygiene and economics. Mitundu market plans to use the funds to repair the central water tap. Market committees are working out the logistics and budgeting of how the money raised in 2017 will be applied to the student innovation plans.

In addition to providing students with a profound learning experience, three years of carrying out the FIP have generated a deep knowledge base about urban food markets, food security, and food economy planning. In FY18, in addition to finding ways to continue the student experiential and service learning activities, LUANAR and MSU will explore ways to expand the program so that local governments, market retailers, and other relevant actors are engaged over the entire year. Probable focus areas will include developing training programs to be implemented by LUANAR that will respond to retailers' expressed needs, supporting the municipality to invest strategically in markets based on a combination of demographic projections and problems specific to market locales, and providing research opportunities for MSU and LUANAR faculty and students.

Translating research into impact serves innovators and the development community:
GCFSI's capacity and emphasis on effectively translating scientific research into impact continues to be integrated into all aspects of the Center's projects, as well as other initiatives at MSU.

The 2017 Grantee Workshop, hosted in March, focused on capacity-building in Communicating Science. Translating research into impact was also the focus for the August ISP workshop titled

“Communicating for Impact”. During this ISP workshop, ISP Scholars learned to use the tools of engagement: using brevity, focus, and clarity.

The Food Fix, a multimedia blog launched through the HICD-3 project, has been selected by MSU’s AgBioResearch unit to tell their research stories to diverse audiences, and to provide content for “Food @ MSU. Our Table,” a communication initiative launched in the second half of March 2017 by MSU’s President Lou Anna K. Simon. The main components of the initiative include community engagement and social dialogue around the topics of agriculture and science. The lead organizer for the initiative is especially interested in the podcast platform hosted by the Food Fix.

Additionally, the PI on HICD-3 is associated with a new partnership, announced in March 2017, between MSU and Ramoji Film City, an Indian media business within the Ramoji Media Group, which reaches 620 million Indians through television and print/online media. The Food Fix will serve as a multimedia venue that amplifies Ramoji’s future features on agricultural innovations, a new content focus for the media giant.

City-regional food systems research

The goals for the project were achieved. Data collection was carried out, with data analysis ongoing. A research brief discussing findings was produced and distributed. The research team, spearheaded by Stephanie White, has a large data set that can be drawn on for center-produced reports and journal publications, provided to Lilongwe decision makers, and used while seeking additional funding. It can be found at http://gcfsi.isp.msu.edu/files/5615/0842/7543/Regional-Supply-Chain-Malawi-Food-Economy_Oct2017_GCFSIRResearch-Brief.pdf.

Workforce development in Malawi

Domenico Dentoni, of WUR, completed and produced the final report and executive summary for the project. The team also developed case studies and hosted a dissemination workshop.

- The executive summary can be viewed at:
<https://www.dropbox.com/sh/35v2t0y41jc7ruu/AABKyJ1NXG5CgWhkxxj hazv0a?dl=0&preview=ACE+Executive+Summary+FINAL.docx>
- The final report can be found at:
https://www.dropbox.com/sh/e1rmh970g3id0ke/AABQfJcGOTe-Uf77ahg8_nkja?dl=0
- A description of the case study of Malawian Agricultural Exchange can be found at:
<https://drive.google.com/file/d/1BDtHiErBNnTWQCJTZ9QGt2QW7EhAtMb/view?usp=sharing>.

Participatory video for CRM extension in Kenya, Uganda, and Tanzania (CRM-1)

Principal investigators Charles Steinfield and Jennifer Olson, and the project’s Ph.D. student Tian Cai hosted a full-day workshop, “A Video Storytelling Method to Enhance Agricultural Extension,” in June of 2017 in Dar es Salaam, Tanzania. The workshop shared insights from the participatory video research conducted over the years. In attendance were 21 individuals including representatives from the Tanzanian government, donor organizations like USAID, universities and other educational institutions, NGOs providing agricultural extension services, and international research centers. The team prepared a handbook, “A Video Storytelling Method to Enhance Agricultural Extension,” which was distributed at the workshop and will continue to

be distributed as appropriate. The handbook provides a detailed, step-by-step, guide to the use of the participatory video approach.

In another milestone, the three-member team wrote and presented, “Keeping Top-of-Mind: The Impact of Audio Phone Reminders on Kenya Farmers’ Knowledge and Uptake of Drought Tolerant (DT) Maize.” The paper highlights key results from our research over the past year and was presented to the Agricultural and Applied Economics Association annual meeting in Chicago, July 29-August, 1, 2017. This paper can be found at https://www.researchgate.net/publication/320172914_Keeping_Top-of-Mind_The_Impact_of_Audio_Phone_Reminders_on_Kenya_Farmers'_Knowledge_and_Uptake_of_Drought_Tolerant_DT_Maize.

The following month, the team resubmitted a revised paper, “Understanding Malawian Farmers’ Slow Adoption of Composting: Revealing Stories About Composting Using a Participatory Video Approach,” to the *Journal of Land Degradation and Development*. The team had previously received an invitation for a second round of review. The paper provides lessons from the earlier work in Malawi focused on using a participatory video approach to encourage greater use of compost manure to improve soil fertility.

Currently, PIs are completing a comprehensive report documenting findings from the efforts to improve awareness and adoption of climate resilient maize in Kenya. Ph.D student Cai defended her dissertation in August of 2017 and has accepted a job with the Food and Agricultural Organization.

Assessing drivers of fertilizer response in maize in Tanzania and Malawi: Implications for CRM scaling programs (CRM-5)

Led by Sieg Snapp, the research team continued the maize response panel survey, which was jointly developed with CIMMYT researchers and Tanzanian crop and soil scientists, under the TAMASA grant. First implemented in 2016, the team carried out the second wave of the panel in May, June and July of 2017 with improved training and logistic setup for efficient, effective survey implementation. Survey topics included soil sampling, plant sampling, field management practices, detailed documentation and socio-economic household information. The team has implemented the survey twice with 630 households, and data analysis continues. The team also carried out soil analyses at the Nelson Mandela African Institution of Science and Technology lab and at MSU. The team completed soil analyses for wave 1 of the panel survey and is progressing on data cleaning.

Seed Entrepreneurship in Malawi (Seed-2)

Led by Gareth Borman, the research team trained 700 farmers/vendors as seed entrepreneurs. The team also focused on developing networks by hosting farmers’ field days at sites of technology demonstrations and hosting farmer visits to trading centers, such as Nkhamenya market in Kaluluma EPA where many agrodealers and service providers can be found.

To share experiences and findings, the team disseminated agronomic and market information on promoted legumes via local radio broadcasts and led a workshop on “Strengthening seed systems for legumes in Malawi.” Held in Lilongwe in August, the workshop facilitated the sharing of

experiences by members of this project and others, including the Malawi Improved Seed Systems and Technologies, USAID Feed the Future-funded project.

GCFSI Innovation Grantees:

During the reporting period, many innovation grantees reached significant milestones, a selection of which are highlighted below.

- Significantly, the cassava simulation modeling team, spearheaded by Julian Ramirez and Tin Maung-Aye completed more than 90% of model development activities and is ready to officially release the model, although one more update will take place. The team also attended DSSAT Sprint, with very positive feedback from modeling community; established two field trials; and produced a first analysis of the 2016 field trial data. Furthermore, the team secured an additional \$500,000 in funding from the Bill and Melinda Gates Foundation in FY17, which will be used to continue improving the process-based crop model that simulates cassava growth and development.
- PIs on the zero-waste cassava flour-processing project presented the newly developed system to leaders at Ukaya, a major cassava-processing business.
- The anaerobic digestion system project installed over 50 innovative solid/liquid separation systems, and 15 absorption chillers modified to run on biogas. Margaret Atele, of Kumi, Uganda saw her milk losses drop by 10 liters after she installed one of the absorption chillers. With Margaret's increased revenue, she expects to have the chiller paid off within a year-and-a-half. In addition to ongoing data collection and evaluation, the team is completing training videos for extended outreach and education.
- The human-powered bean thresher project team secured additional funding from the International Fund for Agriculture Development to continue developing improved prototypes for the bean thresher and expand implementation of the project in Zambia. A qualitative research study, consisting of 48 farmer interviews with 24 farmers, was completed in two districts in Northern Zambia. The PI also met with HESN-affiliated potential future project partners in Tanzania and, while in country, visited neighboring project sites to benchmark the implementation of a multi-crop thresher.
- The beekeeping research project results indicate that beehives produce the same amount of honey regardless of their height placement in a tree. With this new finding, hives can be kept lower in trees, opening the beekeeping industry to women. During the reporting period, the team completed construction of the solar wax melter and delivered one to all beekeepers. A beekeeper reported a harvest of 70 kg wax.
- In the grasshopper and locust farming project the assessment of nutritional value and the microbial safety of reared locusts and grasshoppers has been completed. The team applied for registration of locust-based baby weaning meal with the Kenya regulatory bodies, which would allow for the commercialization of the product. During the reporting period, researchers conducted mass production of locusts and grasshoppers, shared experimental results with all stakeholders, presented at a conference, and held a forum discussion with farmers. As a result of the media outreach assistance through DAI, a company contracted with USAID, the project was featured in three press outlets, including *People Daily*, *Africa.com*, and *The Standard*. Two additional articles are pending. Furthermore, the team is conducting data analysis and continuing to work on journal manuscripts.

- Researchers on the cool storage project in India successfully met the objectives of the project—to build inexpensive cool and cold storage structures running with a low carbon footprint. The team built a pair of two-ton fabric structures, one that’s evaporatively cooled and another that’s solar refrigerated and evaporatively cooled. Both the structures are operational and were tested by introducing one ton of hot water in each structure and observing the cooling of water over several days. Storage studies of Amaranth leaves were also conducted, and data for the internal, external mesh, and fabric temperature were measured every 15 minutes daily.
- The SoilDoc team reached significant milestones in FY17. Formal SoilDoc climate trials and farmer and extension surveys were completed, and field days and demonstrations were hosted. Field days for farmers and extension agents included training on SoilDoc, SoilDoc climate app, and discussion of SoilDoc climate trials. After SoilDoc climate trials were harvested, the SoilDoc climate app was piloted and tested with extension agents at national, regional and local levels. The SoilDoc climate tool app was then refined to incorporate survey feedback. An important milestone that was reached is that 100% of those surveyed reported that the app was useful. A second major milestone that was reached was hosting field days and demonstrations of SoilDoc+. Subsequently, 36 extension agents have requested SoilDoc training and kits. Prior to reaching those milestones, researchers continued to conduct soil sampling climate trials, and interview farmer and extension agents on climate perceptions and soil quality.
- PIs working on small-scale irrigation technology in Uganda reached several milestones with farmers at the project’s irrigation sites. The team completed the first assessment rubric from farmers and developed innovations in irrigation using with farmers at all of the project innovation sites. The rubric was completed from experience with farmers at the innovation sites. It will serve as the basis for the mobile phone-based assessment, which is scheduled to be piloted in the near future. The best platform to host this tool has been identified, and its functionality is being set up. The development of innovations at the irrigation sites was completed through an iterative design cycle. This has involved a number of undergraduate students in irrigation engineering from Busitema University in Uganda. Additionally, farmers and students have been trained on irrigation and production management. Data collection on irrigation techniques is continuing, and includes establishing research plans with communities as well as collecting plot background and management data. The irrigation assessment tool for small farmer-managed systems is also being developed. It’s now in the process of being put into a mobile data collection system for piloting in the field.
- In the orange-fleshed sweet potato (OFSP) project, researchers established a network of female producers, processors, entrepreneurs, and retailers of orange-fleshed sweet potato through email and cell phone communication. This network strengthened behavior change, communication, and social marketing of OFSP-based products and allowed for improved village-wide consumption of these products. Three women groups were officially registered by the district registrar of companies and associations and permitted to operate as microfinance groups. Village Community Banks (VICOBA) were officially established with seed money provided by the project and loan schemes were established.
- A research team in Tanzania continued further development of a zero-waste cassava processing system. The team is testing biogas burners in a hybrid biogas-solar dryer. They also fabricated a fermenter and distillation column to be used in bioethanol production, which will use the waste water generated by cassava processing. Significantly, Cassava SME FJS

African Starch Development Limited, located in Bungu, visited the site and discussed the possibility of using the team's innovation.

- As of September 2017, FarmerLink reached 27,548 coconut smallholder farmers with SMS-based agriculture extension promoting coconut good agricultural practices, financial literacy and pest and disease management. A farmer satisfaction survey was embedded in the endline survey to measure farmers' perception of the program. 93% of farmers in the treatment groups agreed or strongly agreed that they will gain skills if FarmerLink is continued and 80% of farmers reported to be very or extremely satisfied with the project. To measure farmer outcomes particularly focused on the adoption of good agricultural practices the project team completed evaluation activities which compared control and treatment groups. Additionally, the project team conducted an activity-based costing methodology for Franklin Baker, the coconut buyer with which the team previously developed an operational model. The overall results showed that the company would save costs by using the mobile tools. Key activities for this reporting period include the deployment of the Early Warning System which reached 10,471 coconut farmers, the final training of field agents training, the completion of evaluation activities and program sustainability discussions with the Philippine Coconut Authority

To provide support to grantees as they move onto the next stage of their project, GCFSI hosted the second Innovation Grantee Workshop, March 3-5, 2017, on the campus of MSU. Composed of five informative sessions, the capacity-building workshop provided the 16 attending grantees with skills to sustain their research project beyond the close of the innovation grant. Targeted sessions included design thinking, communicating research, working across disciplines, innovative assessment and evaluation, and the importance of considering gender and cultural norms when designing and implementing projects.

To move from theory to practice, grantees worked in small groups throughout the weekend, culminating with a presentation to a panel of mock funders in which grantees pitched an innovation, developed during the days prior. Grantees benefitted equally from the opportunity to build relationships with one another by working as a team, and from the feedback provided by the panel.

Additionally, reporters from GCFSI's project, the Food Fix, interviewed each grantee on film. Asked about the impact of their projects, this activity built upon a communication activity in the first workshop hosted in 2016, in which each grantee gave a brief "ignite" talk discussing the plans and goals of their innovation project.

9. CLOSEOUT (CORE) ACTIVITIES, BUY-INS AND SUSTAINABILITY PLAN

9.1 Close-out of Ongoing Core Activities during Year 6

GCFSI will continue to implement our activities as presented in our FY18 work plan. We anticipate the majority of our Center-led projects will finalize data analysis and report writing during the first six months of FY18. GCFSI management will work with the remaining operating activities to move them to closeout, including collection of final project reports, success stories and other documents relevant to measuring GCFSI's impact. A major activity for the GCFSI

Management team will be the collection, organization and registration of the datasets created with GCFSI funding to assure our compliance with USAID's open access data policy. In addition, GCFSI will work with USAID/LAB/HESN staff to assure proper financial closeout of activities funded under the initial five-year core award.

9.2 Buy-ins

On March 29, 2017, GCFSI was awarded the Grain Research and Innovation (GRAIN) project from the USAID Mission in Afghanistan (USAID/Afghanistan). The total amount of the award is \$19.5 million, and the project is scheduled to run for five and a half years, ending on September 30, 2022. The period from March 29 through September 30, 2017, was designated as a "flex period" during which a detailed needs assessment was conducted, the project team was staffed up, and a detailed life-of-project work plan and budget were prepared.

9.3 Sustainability Plan

In spring 2017, GCFSI completed the center's Strategic Plan, an activity that involved systematic discussions within GCFSI's Core Technical Team, as well as discussions with other partners inside and outside MSU. GCFSI's Strategic Plan feeds into a broader strategic planning initiative launched by MSU's International Studies and Programs unit, the administrative home of GCFSI. Future roles for GCFSI that are being discussed include: (a) serving as the hub for food-systems oriented innovation and entrepreneurship activities, especially those with an international dimension; (b) serving as the hub for design and implementation of projects with a multi-disciplinary dimension involving agriculture, food systems, and related areas such as nutrition, health and the environment; and (c) collaboration on food systems or innovation-related applied research or action programs with MSU's new Alliance for African Partnership. Major future activities will include:

- GRAIN: The first full year of implementation started on October 1, 2017. The implementation teams in Kabul and at MSU are expected to be fully staffed by the end of October. Additional needs assessment information gathering is underway, along with start-up of the project's major activities, including short-term and long-term training, wheat trials, strengthening of national agricultural research facilities, and support for the government's implementation of the national Wheat Sector Development Plan.
- Youth Workforce Development: GCFSI will provide financial and administrative support the MasterCard Foundation-funded Agrifood Youth Opportunity Lab (AYL), which focuses on entrepreneurship and youth workforce development activities in Nigeria and Tanzania. The AYL is located administratively within MSU's International Studies and Programs Office.
- Expanded Role at MSU: GCFSI is collaborating with the Entrepreneurship and Innovation program at MSU. We are in conversations with two academic departments to create a Food Systems Innovation minor for MSU undergraduates.
- Capacity Development for Agricultural Innovation Systems (CDAIS): USAID/BFS has allocated \$700,000 through a buy-in to MSU's Feed the Future Innovation Lab for Food Security Policy (FSP) to support preparation of a toolkit for use by USAID personnel and their development partners. This activity will be led by the International Food Policy Research Institute (IFPRI), MSU's major partner in the FSP project. However, lessons

learned from GCFSI's experience with the ISP in Malawi will be fed into the toolkit. Kurt Richter and Bill Heinrich will receive some funding to support their work on this.

10. ENVIRONMENTAL MONITORING

The GCFSI FY17 work plan was reviewed by the U.S. Global Development Lab's Bureau Environmental Officer (BEO) for potential environmental impacts and received a categorical exclusion for all but one included activity pursuant to 22 CFR 216.2(c)(2).

The GCFSI-funded *Grasshopper and Locust Farming as a Sustainable Source of Protein for Non-Ruminant Livestock and Humans in Kenya* innovation grant was determined to require an Environmental Monitoring and Mitigation Plan (EMMP). In summary, Dr. Nduko and his team are following the EMMP protocols and fulling implementing the EMMP. To date, there have been no monitoring measures that raised any form of alarm. The project is on track to be successfully implemented. The detailed EMMP document for this project can be found at <https://drive.google.com/open?id=0BzIKVUkbDFwRMkxaRm95SVVtLUE>.

The buy-in supported GRAIN project submitted an Environmental Manual to USAID/Afghanistan in September 2017. The Chief of Party for the project, Dr. Michael R. Whiteman, provided GCFSI with a written EMMP report. In summary, Dr. Whiteman and his team are following the EMMP protocols and fulling implementing the EMMP. To date, there have been no monitoring measures that raised any form of alarm. The project is on track to be successfully implemented. The detailed EMMP can be found at <https://drive.google.com/file/d/0B7vUccuJH1sVR2xNZWtTNGFPS0k/view?usp=sharing>.

Appendix 1: TOTAL GCFSI FOLLOW-ON FUNDING

This is a table showing the total follow-on funding that GCFSI projects have received. With an initial investment of \$1.4 million, GCFSI attracted an additional \$4.4 million in follow-on funding.

Innovation	GCFSI Funds (USD)	Follow-on Funding (USD)	Donor
FY17			
Implementation of a Human-powered Bean Thresher for Small-scale Legume Production in Zambia	125,000	50,000	International Fund for Agricultural Development
Climate Resilient Maize in Ethiopia	150,000	156,000	International Center for Tropical Agriculture (CIAT)
Low-Carbon Footprint Cool Storage Structures to Empower Farmers: Improving Storage and Enabling Processing of Perishable Produce	250,000	20,000	United States-India Educational Foundation (USIEF)
		25,000	Fulbright Nehru Academic and Professional Excellence Fellowship
Towards an improved cassava simulation model to aid management decisions in the tropics	250,000	500,000	Bill and Melinda Gates Foundation
		100,000	Philippines Department of Agriculture
		50,000	CGIAR Roots, Tubers and Bananas CRP
Linking Climate Services and Soil Diagnostics for Climate-smart Decisions for Small-scale Farmers and Service Providers	250,000	30,000	Columbia University Cross-Cutting Initiative
Frugal Innovation Practicum	70,000	2,550	CrowdPower
		1,358	Lilongwe University of Agriculture and Natural Resources Student Fundraising
Total FY17		934,908	
FY16			
PhotoSyncQ	100,000	600,000	McKnight Foundation
EWareHousing	100,000	695,834	BASIS AMA
		360,000	Agricultural Technology Adoption Initiative - Abdul Latif Jameel Poverty Action Lab (ATAI-JPAL)
		780,000	Wellspring
Towards an improved cassava simulation model to aid management decisions in the tropics	250,000	420,000	International Institute for Tropical Agriculture, through a grant from the Bill and Melinda Gates Foundation
Core Team / Wageningen University	150,000	372,000	Polish Ministry of Science and Higher Education
		110,000	Australia Center for International Agricultural Research (ACIAR)

		110,000	Embassy of The Netherlands in Nairobi (Kenya)
Linking climate services and soil diagnostics for climate-smart decisions for small-scale farmers and service providers	250,000	29,774	Columbia University
Frugal Innovation Practicum	70,000	1,575	CrowdPower
		1,200	Schoenl Grant
		200	Kiwassee Kiwanis
Total FY16		3,480,583	
TOTAL	1,445,000	4,415,491	

Appendix 2: PUBLICATIONS

The following pages provide a list of citations for all publications that have been produced as a result of GCFSI work. The first section provides the articles and papers published by GCFSI. The second section, arranged by topic, includes citations for published journal articles written by GCFSI researchers, about their GCFSI work.

GCFSI Publications, by Type

White Papers

Me-Nsope, Nathalie and Michelle Larkins. 2015. *Gender Analysis of the Pigeon Pea Value Chain: Case Study of Malawi*. Center Report Series, No. 4. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.

Messina, J., Adhikari, U., Carroll, J., Chikowo, R., DeVisser, M., Dodge, L., Fan, P., Langley, S., Lin, S., Me-nsope, N., Moore, N., Murray, S., Nawyn, S., Nejadhashemi, A. Olson, J., Smith, A., Snapp, S. 2014. *Population Growth, Climate Change and Pressure on the Land – Eastern and Southern Africa*. 99 pp. ISBN 978-0-9903005-0-2

Steinfeld, Charles and Wyche, Susan. 2013. *Assessing the Role of Information and Communication Technologies to Enhance Food Systems in Developing Countries*. Global Center for Food Systems Innovation, White Paper Series, Michigan State University, East Lansing, Michigan, USA 39 pp.

Tschirley, D., Haggblade, S., Reardon, T., eds. 2014. *Population Growth, Climate Change and Pressure on the Land – Eastern and Southern Africa*. 99 pp. ISBN 978-0-9903005-2-6

White, Stephanie A. and Hamm, Michael W. 2014. *Urban Agriculture and a Planning Approach to Urban Food Systems*. Center Report Series, No. 4. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA 23 pp.

Malawi Working Papers

Dentoni, D., Krussmann, F., Degnet, M., & Noor, A. (2016). *Institutional and Policy Constraints to Innovation in the Malawian Legume Value Chains: Current Status and Business Actors' Coordination for Institutional Change*. (Malawi Report No. 007). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA. http://gcfsi.isp.msu.edu/index.php/download_file/view/351/251/

Dzanja, J., Matita, M., Kankwamba, H., Dolislager, M., & Tschirley, D. (2016). *Mapping Market Prospects for Grain Legumes in Malawi*. (Malawi Report No. 005). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA. http://gcfsi.isp.msu.edu/index.php/download_file/view/353/251

Me-Nsope, Nathalie and Michelle Larkins. 2016. *Gender Analysis of the Pigeon Pea Value Chain: Case Study of Malawi*. (Malawi Report No. 008). Global Center for Food Systems

Innovation, Michigan State University, East Lansing, Michigan, USA.
http://gcfsi.isp.msu.edu/index.php/download_file/view/363/251/

Moore, N., Breeze, V., Deindorfer, H., Nejadhashemi, A., Umesh., A., Herman, M., & Devisser, M. (2016). *Climate Trends, Hydrologic Modeling, and Land Use Analysis in Malawi*. (Malawi Report No. 006). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA. http://gcfsi.isp.msu.edu/index.php/download_file/view/352/251/

Olson, Jennifer, Gopal Alagarswamy, Jenni Gronseth, and Nathan Moore. 2017. *Impacts of Climate Change on Rice and Maize, and Opportunities to Increase Productivity and Resilience in Malawi*. Malawi Report No. 9. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
[http://gcfsi.isp.msu.edu/index.php/download_file/view/377/251.](http://gcfsi.isp.msu.edu/index.php/download_file/view/377/251/)

Steinfeld, Charles, Susan Wyche, Hastings Chiwasa, Tian Cai, Japhet Mchakulu. April 2015. *Using Participatory Video for Smallholder Farmer Training in Malawi*. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
[http://gcfsi.isp.msu.edu/index.php/download_file/view/355/251.](http://gcfsi.isp.msu.edu/index.php/download_file/view/355/251/)

White, S., & Crawford, E. (2016). *Research on Multipurpose Legumes in Malawi: Synthesis Report*. (Malawi Report No. 001.). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
http://gcfsi.isp.msu.edu/index.php/download_file/view/350/251/

White, S., Hamm, M., Mwangwela, A., Kamoto, J., Kampanje-Phiri, J., Chigwa, F., & Thondolo, M. (2016). *Small- to Medium-Scale Urban Legume Exchange in Lilongwe, with a Focus on Pigeon Pea: Identifying Opportunities and Constraints to the Scaling of Multipurpose Legume Innovations in Maize-based Farming Systems* (Malawi Report No. 002). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
http://gcfsi.isp.msu.edu/index.php/download_file/view/343/251/

Zulu, Leo. 2017. *Existing Research and Knowledge on Impacts of Climate Variability and Change on Agriculture and Communities in Malawi*. (Malawi Report No. 009). Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.
http://gcfsi.isp.msu.edu/index.php/download_file/view/376/251

Zambia Reports

Vroegindewey, R., & Crawford, E. *Crop Budgets for Maize Production Costs and Returns: Zambia, 2010/11 to 2013/14*. (Zambia Report No. 001). East Lansing, Michigan: Global Center for Food Systems Innovation, Michigan State University.
http://gcfsi.isp.msu.edu/index.php/download_file/view/366/251/

Supplementary Materials

Me-Nsope, Nathalie. 2015. *Gender Strategy*. Center Report Series, No. 6 Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA 23 pp.

Mock, T, Cai, T, Steinfield, C., and Olson, J., 2017. *A Video Storytelling Method to Enhance Agricultural Extension: Workshop Handbook*, Dar es Salaam, Tanzania, June 13, 2017, Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA. 24 pp.

White, S., Kampanje-Phiri, J., Hamm, M., Richter, K., and Phiri, C., 2017. *Regional Supply Chains and the Food Economy of Malawi: Expanding Livelihood Opportunities and Enhancing Food Security*. Global Center for Food Systems Innovation, Michigan State University, East Lansing, Michigan, USA.

External Publications, by Topic

City and Regional Food Systems

Hamm, M. W. (2015, March 11). U.S. Dietary Guidelines Report – What’s the Fuss Over Sustainability? *Knowledge for better food systems*.

Hamm, M. W. (2015, March 30). Feeding Cities - with Indoor Vertical Farms? *Knowledge for better food systems*.

Hamm, M. W. (2015, May 20). City Region Food Systems – Part I – Conceptualization. *Knowledge for better food systems*.

Hamm, M. W. (2015, June 5). City Region Food Systems – Part II – Who Will Farm? *Knowledge for better food systems*.

Hamm, M. W. (2015, June 5). City Region Food Systems - Part IIIA – Scale and Production Strategy. *Knowledge for better food systems*.

Hamm, M. W. (2015, July 3). City Region Food Systems - Part IIIB - Scale and Production Strategy. *Knowledge for better food systems*.

Climate Change and Pressure on Land

Chikowo, R., Zingore, S., Nyamangara, J., Bekunda, M., Messina, J., & Snapp, S. (2015). Approaches to Reinforce Crop Productivity Under Rain-fed Conditions in Sub-humid Environments in Sub-Saharan Africa. *Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa* (pp. 235-253). Springer International Publishing.

Li, G., Messina, J., Peter, B., and Snapp, S. (2017). Mapping Land Suitability for Agriculture in Malawi. *Land Degradation and Management*. doi:10.1002/ldr.2723.

Lin, S., DeVisser, MH., Messina, JP. (2015.) An agent-based model to simulate tsetse fly distribution and control techniques: A case study in Nguruman, Kenya. *Ecological Modelling* 314, 80-89; doi:10.1016/j.ecolmodel.2015.07.015.

Lin S., Messina, J.P., Snapp, S. (2017) Mapping Marginal Land Distribution in Malawi Through Assessment of Agricultural Land Suitability. *Land Degradation and Development*.

Magliocca, N.M., Vliet, J. van., Brown, C., Evans, T.P., Houet, T., Messerli, P., Messina, J.P., Nicholas, K.A., Ornetmüller, C., Sagebiel, J., Schweizer, V., Verburg, P.H., Yu, O. (2015). From meta-studies to modeling: Using synthesis knowledge to build broadly applicable process-based land change models. *Environmental Modelling & Software* 72:10-20.

McCann, R. S., Messina, J. P., MacFarlane, D. W., Bayoh, M. N., Vulule, J. M., Gimnig, J. E., & Walker, E. D. (2014). Modeling larval malaria vector habitat locations using landscape features and cumulative precipitation measures. *International Journal of Health Geographics*, 13(1), 17.

McCord, A. I., Stefanos, S. A., Tumwesige, V., Lsoto, D., Meding, A. H., Adong, A., Schauer, J. J. and Larson, R. A. (2017). The impact of biogas and fuelwood use on institutional kitchen air quality in Kampala, Uganda. *Indoor Air*, 27(6). doi:10.1111/ina.12390

Messina, J.P., Peter, B.G., & Snapp, S.S. (2017). Re-evaluating the Malawian Farm Input Subsidy Programme. *Nature Plants* 3, 17013. doi:10.1038/nplants.2017.13

Messina, J., Snapp, S., and Peter, B. Malawi Weather Station Data for the 2014–2015 Growing Season. *Mendeley Data*, v1. <http://dx.doi.org/10.17632/xczc64xw46.1>.

Ortega, D. L., & Tschirley, D. L. (2017). Demand for food safety in emerging and developing countries: a research agenda for Asia and sub-Saharan Africa. *Journal of Agribusiness in Developing and Emerging Economies*, 7(1).

Peter, B. and Messina, J. [in review]. A case of error propagation, detection, and mitigation in MODIS time-series data over Malawi. *Frontiers in Environmental Science*.

Peter, B., Messina, J., Frake, A., and Snapp, S. Scaling Agricultural Innovations: Pigeonpea in Malawi. *Professional Geographer*. (2017) 1:12. <http://dx.doi.org/10.1080/00330124.2017.1347798>

Peter, B. Messina, J., and Snapp, S. [in press]. A Multi-Scalar Approach to Mapping Marginal Land: Smallholder Agriculture in Malawi. *Annals of the American Association of Geographers*.

Peter, B., Mungai, L., Messina, J., and Snapp, S. (2017). Nature-Based Agricultural Solutions: Scaling perennial Grains Across Africa. *Environmental Research*, 159, 283-290. <https://doi.org/10.1016/j.envres.2017.08.011>

Decision Support & Informatics

Adhikari, U., & Nejadhashemi, A. P. (2016). Impacts of climate change on water resources in Malawi. *Journal of Hydrologic Engineering*, 21(11), 05016026.

Adhikari, U., Nejadhashemi, A. P., & Herman, M. R. (2015). A review of climate change impacts on water resources in East Africa. *Transactions of the ASABE*, 56(6).

Adhikari, U., Nejadhashemi, A. P., Herman, M. R., & Messina, J. P. (2016). Multiscale Assessment of the Impacts of Climate Change on Water Resources in Tanzania. *Journal of Hydrologic Engineering*, 05016034.

Adhikari, U., Nejadhashemi, A. P., & Woznicki, S. A. (2015). Climate change and eastern Africa: a review of impact on major crops. *Food and Energy Security*, 4(2), 110-132.

Mutenyo, I., Nejadhashemi, A. P., Woznicki, S. A., & Giri, S. (2015). Evaluation of SWAT performance on a mountainous watershed in tropical Africa. *Hydrology: Current Research*, (S3), 1.

Gender

Me-Nsope, N., & Larkins, M. (2016). Beyond crop production: Gender relations along the pigeon pea value chain and implications for income and food security in Malawi. *Journal of Gender, Agriculture and Food Security*, 1(3).

Me-Nsope, N., & Larkins, M. (2016). Empowering Women for Food and Income Security: The Case of Pigeon Pea in Malawi. *Gendered Perspectives on International Development: Working Papers*, (308), 0_1.

Food Safety and Consumer Demand Analysis

Ortega, D.L., David Tschirley, (2015) "Demand for Food Safety in Emerging and Developing Countries: A Research Agenda for Asia and Sub-Saharan Africa." *Journal of Agribusiness in Developing and Emerging Economies*. (7)1, 21-34. doi.org/10.1108/JADEE-12-2014-0045

Ortega, D. L., Wang, H. H., Wu, L., & Hong, S. J. (2015). Retail channel and consumer demand for food quality in China. *China Economic Review*, 36, 359-366.

Information and Communication Technology for Development

Cai, T., Chiwasa, H., Steinfield, C., & Wyche, S. (2015, May). Participatory video for nutrition training for farmers in Malawi: an analysis of knowledge gain and adoption. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (p. 29). ACM.

Ninsiima, D. (2015, May). Buuzza Omulimisa (ask the extension officer): text messaging for low literate farming communities in rural Uganda. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (p. 54). ACM.

Steinfield, C., & Cai, T. (July 30-August 1, 2017). *Using a multichannel training strategy to stimulate farmers' knowledge and willingness to test drought tolerant maize varieties*. Paper accepted at the Conference of Agricultural & Applied Economics Association, Chicago, IL.

Steinfield, C., Wyche, S., Cai, T., & Chiwasa, H. (2015, May). The mobile divide revisited: mobile phone use by smallholder farmers in Malawi. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (p. 8). ACM.

Wyche, S. P., Densmore, M., & Geyer, B. S. (2015, May). Real mobiles: Kenyan and Zambian smallholder farmers' current attitudes towards mobile phones. In *Proceedings of the Seventh International Conference on Information and Communication Technologies and Development* (p. 9). ACM.

Wyche, S., & Steinfield, C. (2016). Why don't farmers use cell phones to access market prices? Technology affordances and barriers to market information services adoption in rural Kenya. *Information Technology for Development*, 22(2), 320-333.

Wyche, S., Steinfield, C., Cai, T., Simiyu, N., & Othieno, M. E. (2016, June). Reflecting on video: exploring the efficacy of video for teaching device literacy in rural Kenya. In *Proceedings of the Eighth International Conference on Information and Communication Technologies and Development* (p. 8). ACM.

Rapid Urbanization and Transformation of Food Systems

Reardon, T. (2015). The hidden middle: the quiet revolution in the midstream of agrifood value chains in developing countries. *Oxford Review of Economic Policy*, 31(1), 45-63.

Reardon, T., Tschirley, D., Minten, B., Haggblade, S., Liverpool-Tasie, S., Dolislager, M., & Ijumba, C. (2015, September). Transformation of African Agrifood Systems in the New Era of Rapid Urbanization and the Emergence of a Middle Class. In *Chapter in the Proceedings Volume of the ReSAKSS Annual Conference "Beyond a Middle Income Africa," Trends and Outlook Report Conference Held in Addis Ababa, September* (pp. 1-3).

Tschirley, D., Reardon, T., Dolislager, M., & Snyder, J. (2015). The rise of a middle class in East and Southern Africa: Implications for food system transformation. *Journal of International Development*, 27(5), 628-646.

Tschirley, D. L., Snyder, J., Dolislager, M., Reardon, T., Haggblade, S., Goeb, J., & Meyer, F. (2015). Africa's unfolding diet transformation: implications for agrifood system employment. *Journal of Agribusiness in Developing and Emerging Economies*, 5(2), 102-136.

Sustainable Intensification

Fisher, M. and S.S. Snapp. 2014. Can adoption of modern maize help smallholder farmers manage drought risk? Evidence from southern Malawi. *Experimental Agriculture*, 50:533-548.

Messina, J.P. Suepa, T., Snapp, S., Olson, J.M., Nejadhashemi, A.P., Murray, S., Moore, N., Frake, A.N., Fan, P., and U. Adhikari. 2017. Food system resilience and sustainability in Cambodia. *International Journal of Applied Geospatial Research*, 8:3 Note 4 (accepted pending revisions)

Petersen, B. and S.S. Snapp. 2015. What is sustainable intensification: Views from experts. *Land Use Policy*, 46:1-10 doi:10.1016/j.landusepol.2015.02.002.

Rogé, P., S.S. Snapp, M.K. Kakwera, L. Mungai, I. Jambo and B. Peter. (2016). Ratooning and perennial food crops in Malawi: A review. *Agronomy and Sustainable Development*. 36:50. <https://doi.org/10.1007/s13593-016-0384-8>

Smith, A., Snapp, S., Dimes, J., Gwenambira, C., & Chikowo, R. (2016). Doubled-up legume rotations improve soil fertility and maintain productivity under variable conditions in maize-based cropping systems in Malawi. *Agricultural Systems*, 145, 139-1