



**USAID**  
FROM THE AMERICAN PEOPLE

USAID  
**Higher Education  
Solutions Network**

# Higher Education Solutions Network FY 2017 Mid-year Report

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



*Farmers and community members in Atari, Uganda discuss plans for an irrigation system.  
Photo courtesy of Abraham Salomon.*

DRAFT Submitted: April 28, 2017

Reporting Period: FY 2017, Mid-year Report

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

# TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS.....	iv
<b>1. EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>2. MAJOR MILESTONES / ACHIEVEMENTS .....</b>	<b>1</b>
<b>2.1 Program and Policy Changes .....</b>	<b>5</b>
<b>3. SUMMARY OF KEY ACTIVITIES .....</b>	<b>7</b>
<b>3.1 Objective 1: Mobilizing data and analytical tools to support development decision-making .....</b>	<b>7</b>
<b>3.2 Objective 2: Source, test and scale up food systems innovations.....</b>	<b>7</b>
3.2.1 GCFSI Management Team.....	7
3.2.2 Activities in Support of USAID’s Climate Resilient Maize Program.....	7
3.2.3 Human and Institutional Capacity Development (HICD) .....	8
3.2.4 Workforce development assessment .....	9
3.2.5 Seed systems development.....	9
<b>3.3 Objective 3: Student engagement and partnerships to build a new generation of development innovators and practitioners .....</b>	<b>10</b>
3.3.1 Major Innovation Grants .....	10
3.3.2 GCFSI Follow-on Funding.....	13
3.3.3 Student Engagement.....	13
<b>4. FUTURE CORE ACTIVITIES.....</b>	<b>14</b>
<b>4.1 Future Core Activities for Year 5 .....</b>	<b>14</b>
<b>4.2 No-Cost Extension Requested for Core Activities.....</b>	<b>14</b>
<b>4.3 Closeout Activities and Sustainability Plan .....</b>	<b>15</b>
<b>5. ENGAGEMENT OF PARTNERS AND OTHER ACTORS .....</b>	<b>15</b>
<b>5.1 Interdisciplinary Collaboration and Partner Engagement .....</b>	<b>15</b>
5.1.1 Interdisciplinary Collaboration.....	15
5.1.2 Partner Engagement.....	16
<b>5.2 Summary of collaboration across HESN .....</b>	<b>16</b>
5.2.1 Data.....	17
5.2.2 Solutions: Creation, Testing, Scaling .....	17
5.2.3 Student Engagement.....	17
<b>6. USAID ENGAGEMENT .....</b>	<b>17</b>
<b>6.1 USAID Buy-ins .....</b>	<b>17</b>
<b>6.2 USAID/Lab Interactions.....</b>	<b>17</b>
<b>6.3 Other Non-Lab USAID/Washington Interactions .....</b>	<b>18</b>
<b>6.4 USAID Mission Interactions.....</b>	<b>18</b>
<b>7. SUMMARY OF MONITORING AND EVALUATING (M&amp;E) ISSUES .....</b>	<b>19</b>
<b>7.1 M&amp;E Updates .....</b>	<b>19</b>
<b>7.2 Deviance from M&amp;E Targets.....</b>	<b>19</b>

<b>8. LESSONS LEARNED / BEST PRACTICES .....</b>	<b>19</b>
<b>8.1 Partnership Enhancement.....</b>	<b>19</b>
<b>8.2 Adaptive Management.....</b>	<b>21</b>
<b>8.3 Keys for Moving from Research to Impact .....</b>	<b>22</b>
<b>9. ENVIRONMENTAL MONITORING.....</b>	<b>23</b>
<b>Appendix 1: TOTAL FOR GCFSI FOLLOW-ON FUNDING.....</b>	<b>24</b>
<b>Appendix 2: PUBLICATIONS .....</b>	<b>24</b>
<b>GCFSI Publications .....</b>	<b>25</b>
<b>External Publications.....</b>	<b>27</b>
<b>Appendix 3: GCFSI GRANTEE WORKSHOP AGENDA .....</b>	<b>32</b>
<b>Appendix 4: INNOVATION SCHOLARS PROGRAM NAIROBI EXCURSION AGENDA .....</b>	<b>34</b>
<b>Appendix 5: INNOVATION SCHOLARS PROGRAM NAIROBI EXCURSION WORKBOOK .....</b>	<b>36</b>
<b>Appendix 6: STORIES FROM THE FIELD .....</b>	<b>578</b>
<b>Appendix 7: SELECT GCFSI COMMUNICATIONS PRODUCTS .....</b>	<b>856</b>

## ACRONYMS AND ABBREVIATIONS

CGC	Center for Global Connections in Food, Agriculture and Natural Resources
CIAT	International Center for Tropical Agriculture (Colombia)
CRM	Climate Resilient Maize
DAI	Development Alternatives, Inc.
DFID	Department for International Development
DSI	Decision Support and Informatics
DSSAT	Decision Support Systems for Agrotechnology Transfer
FAO	Food and Agriculture Organization of the United Nations
FIP	Frugal Innovation Practicum
FIPS Africa	Farm Input Promotions Africa Ltd.
FY17	Fiscal Year 2017
GCFSI	Global Center for Food Systems Innovation
GRAIN	Grain Research and Innovation
HESN	Higher Education Solutions Network
HICD	Human and Institutional Capacity Development
IDIN	International Development Innovation Network
ISP	Innovation Scholars Program
Lab	Global Development Lab
LUANAR	Lilongwe University of Agriculture and Natural Resources
MIT	Massachusetts Institute of Technology
M&E	Monitoring and Evaluation
MSU	Michigan State University
NGO	Non-governmental Organization
PEPFAR	President's Emergency Plan for Aids Relief
PI	Principal Investigator
PPC	Program and Policy Changes
RAN	Resilient Africa Network
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
Seed	Seed Systems Development
SIG	Student Innovation Grants
SIIL	Sustainable Intensification Innovation Lab
SMS	Short Message Service
TechCon	Technical Convening
US	United States
USAID	United States Agency for International Development
USD	United States Dollars
USIEF	United States-India Educational Foundation
WASH	Water and Sustainability Habits
WFD	Work Force Development
WUR	Wageningen University (The Netherlands)
YSiG	Youth Spark Innovation Grant

## 1. EXECUTIVE SUMMARY

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.

In the first half of Year 5 (October 2016 – March 2017), GCFSI continued to implement a strong portfolio of programs in the field.

- GCFSI Innovation Grantees acquired an addition \$726,000 in follow-on funding in the first half of FY17.
- The Innovation Scholars Program (ISP) at Lilongwe University of Agriculture & Natural Resources (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.
- GCFSI Grantees and Center-led Projects led to 11 program and policy changes.
- 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.

## 2. MAJOR MILESTONES / ACHIEVEMENTS

### ***GCFSI Management***

GCFSI management realized that we cannot expect our colleagues and partners to be innovative if we are not adaptive in how we assist them in their design and implementation. We made a decision to change how we implemented the Innovation Scholars Program (ISP). The ISP is now 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 collaboration, learning and adaption to local conditions. GCFSI learned that it was necessary to build our capacity to engage with our 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:***

During the reporting period, GCFSI leaders of the ISP hosted a third workshop and a three-day excursion. In December 2016, the workshop at LUANAR focused on Teaching and Learning for Innovation in African Food Systems. In March, ISP leaders took the scholars to Nairobi, Kenya for a three-day, interactive Field Study for Innovation in African Food Systems.

Moreover, the significant value of program prompted Scholars to request an additional workshop. Scheduled for June 2017, the workshop will cover how to implement some of the desired institutional changes, which have been discovered throughout the year-long reflective process facilitated by the ISP.

The ripple effect of the ISP has also led to collaboration between Wageningen University (WUR) and LUANAR. Faculty from WUR, who serve as GCFSI primary investigators (PIs) for other Center-led projects, are exploring how to envelope their capacity-building work within the needs of LUANAR. This will be a significant component of the June 2017 workshop.

***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.

A capacity-building workshop on Communicating Science was hosted during the weekend Grantee Workshop, and is scheduled to be the focus of an upcoming workshop for the ISP.

The Food Fix, a multimedia blog launched through the HICD-3 project, has been selected by MSU's AgBioResearch department 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<sup>12</sup>. 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. Due to the initiative's recent launch, the Food Fix had not provided any content by the end of the reporting period.

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<sup>3</sup>. 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.

***GCFSI Innovation Grantees:***

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

---

<sup>1</sup> Food @ MSU homepage: <http://www.food.msu.edu>

<sup>2</sup> Food @ MSU Facebook page: [www.facebook.com/FoodAtMSU](http://www.facebook.com/FoodAtMSU)

<sup>3</sup> MSU Today Article on Ramoji partnership: <http://msutoday.msu.edu/news/2017/msu-to-partner-with-indian-media-giant-helping-local-farmers/>

- The project focused on harnessing the power of anaerobic digestion installed over 50 innovative solid liquid separation system. The team installed 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 year-and-a-half.
- In the orange-fleshed sweet potato project, the researchers established a network of female orange sweet potato producers, processors, entrepreneurs, and retailers through email and cell phone communication. This network strengthened behavior change, communication, and social marketing of orange sweet potato-based products and allowed for improved village-wide consumption of these products.
- The cassava modeling project team secured an additional \$500,000 in funding from the Bill and Melinda Gates Foundation to continue improving the process-based crop model simulating cassava growth and development.
- 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.
- 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.
- In the grasshopper and locust farming project, collection and rearing of the insects was completed during the reporting period. This project is quickly being implemented, and will soon have an impact on the community's protein consumption. The team was also selected to receive three months of media outreach assistance through DAI, a company contracted with USAID.
- Farmerlink, the project serving coconut farmers in the Philippines, reached 15,916 farmers with texts messages on good agricultural practices, cash flow and pest and disease management. The team also drafted an operational model with Franklin Baker Company of the Philippines, a coconut product manufacturer and exporter. The FarmerLink mobile tool kit would serve to streamline business processes between the company's organic certification, nut buying teams, and farmers.
- PIs on the zero-waste cassava flour-processing project presented the newly developed system to leaders at Ukaya, a major cassava-processing business.
- In a draft report from January 2017, student researchers on the gravity goods ropeway (GGR) project noted that prior to the intervention of GGR, households had to skip meals but found that post-GGR every household where the project was present could consume at least three meals per day throughout the year. The project reported increased market access, reduced post-harvest loss and reduced transaction cost.

To provide support to grantees as they move onto the next stage of their project, GCFSI hosted the second Innovation Grantee Workshop <sup>4</sup>, 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,

---

<sup>4</sup> GCFSI Innovation Grantee Workshop: <http://gcfsi.isp.msu.edu/grant-projects/grantee-workshop1>

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.

***GCFSI Strategic Plan:***

For GCFSI to be sustainable beyond the end of the current USAID grant (September 30, 2017), it must be able to articulate an institutional role that is unique, have a mission that is aligned with the objectives of audiences both inside and outside MSU, and have a capacity to deliver outputs that are regarded as valuable by those audiences. These are prerequisites for attracting continued funding.

What makes GCFSI unique is its focus on the entire food system, its experience with fostering and scaling of innovations, its proven strategy of bringing together the expertise needed to address multiple dimensions of the food system from a research and program implementation perspective, and its emphasis on understanding long-run global trends that will influence future food system problems and needed solutions.

Team-based approaches that draw on and integrate multiple disciplines are therefore a core part of GCFSI's approach to research, outreach, and capacity-building activities. A particular strength of GCFSI is our recognition that challenges have to be addressed at multiple points and from multiple perspectives across any food system. In this way, we hope to promote innovative solutions that have a strong likelihood of being adopted at scale, that rely on resources that are readily available in a particular context, and that avoid creating new problems at other points along the food value system.

Other units at MSU, including the USAID-supported Feed the Future Innovation Labs for Collaborative Research on Grain Legumes and for Food Security Policy, the Center for Global Connections in Agriculture and Natural Resources, and the Food Security Group (all within the College of Agriculture and Natural Resources), share some of the features of GCFSI, but not all. GCFSI therefore gives MSU a unique platform for developing new international activities and attracting new funding. GCFSI activities already involve collaboration with these other important MSU units and programs, in ways that promise to open up new opportunities. Specifically, GCFSI's human resources and collective experience to date equip it to serve as a leader, partner or convener on projects that have the following characteristics, especially those focused on food and agriculture:

1. Multidisciplinary or cross-unit.
2. Emphasize innovation and entrepreneurship.
3. Emphasize education, training, and institutional capacity building.
4. Support scientific research areas that address problems within global food systems, and ways in which food system transformation can help alleviate other large, complex problems such as those related to water and energy use, and climate change.

## 2.1 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. We observe change at the intersection of locally-focused research and entrepreneurship, to embolden the processes and relationships at the heart of transforming systems.

The Frugal Innovation Practicum (FIP)<sup>5</sup> and LUANAR Innovation Hub combined are a major example of building towards the coexistence of research and impact. The practicum's focus on cooperative learning embedded within investigation of urban 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, specifically a commitment in October 2016 to reinvest at least 25% of collected market fees towards market infrastructure projects. This success was continued by embedding stakeholder input and student-powered, crowdsourced funding into the research process. As a result, three out of four key maintenance and rehabilitation infrastructure projects have been completed to date, with the fourth moving towards completion. The provincial government partners have said the management models emerging from these projects are exemplar. We believe the key finding from this success is the 'process innovation' embedded within the research process, with a focus on diverse stakeholders within the local system.

GCFSI Innovation Grant Projects are also harnessing the power of embedded locally focused research and entrepreneurship with significant university partnership. PIs building capacity for irrigation innovations in East Africa are focused on small-scale irrigation designs and framework for evaluating and improving irrigation sites. The PIs approach is unique as they first consider the realities of Ugandan land tenure, gender relations, and operating constraints facing farmers before creating a design. The project's main university partner is responding in significant ways by building capacity for students to engage in practical work focused on agriculture engineering and irrigation. The university has also taken on agriculture and irrigation as one of their major activities in which to promote women's economic empowerment, namely through improved access to business and decision-making. The project's overall success is supported by PIs discussions with the USAID/Uganda regarding the potential for collaboration with existing Mission projects and future engagements.

Another change is underway through the Center-led project, Participatory Video for Support of Climate Resilient Maize (CRM-1), in which the team focused on innovative agriculture

---

<sup>5</sup> GCFSI Frugal Innovation Practicum webpage: <http://gcfsi.isp.msu.edu/gcfsi-activities/frugal-innovation-practicum/>

extension. The team's local partner in Kenya, Farm Input Promotions, Africa (FIPS-Africa) is exploring potential use of the project's innovative extension method. FIPS-Africa is considering showing farmers short video clips via smartphones and notepads carried by their village-based advisors. Additionally, significant data analyses and findings that explore themes explaining farmers' attitudes and behavior relevant to maize production continue to be disseminated to several stakeholders.

We found that some projects that reported current changes also noted anticipated change. The innovation grant project on developing an improved cassava simulation model in Vietnam is seeing success through the adoption of their proposed non-destructive cassava sampling strategy by local partners at the Hung Loc Research Center and Khon Kaen University. The project's success is corroborated by a recent \$500,000 grant from the Bill and Melinda Gates Foundation to continue their work. In the Philippines, the grant project working on an early warning system for coconut farmers has seen their main implementing partner, the commercial enterprise Franklin Baker Company, change farmer outreach processes due to efficiency gains using the mobile tools developed. Their field officers can now provide different types of value-added services, and build stronger relationships with farmers, because the tools allow them to provide coaching on very specific agronomic practices.

We anticipate that the following projects may catalyze program and policy change at different levels with continued support. The women's groups in the project using orange-fleshed sweet potatoes continued to develop innovative food products and recently received a small grant from their district government in Tanzania. This comes from their successful establishment of a village community bank, focused on producing sweet potato products. The project is anticipated to be exemplar of securing microfinance through combination of research on value-added products and intentional capacity building. As well, the innovation grantees working with a combination of mobile and spatial technology found that placement of beehives yields no difference in honey production. As it is currently culturally unacceptable for women to climb trees, this finding could open the bee-based value chain to women. PIs also introduced a solar wax melter to women increasing bee-based income generated opportunities.

The Innovation Scholars Program (ISP) is creating change in behaviors and approaches to teaching and learning at LUANAR. The scholars have expressed sincere interest to institutionalize and continue application of design thinking to support innovation. Scholars are working with GCFSI to learn how to implement desired changes as a cohesive institution. A new workshop scheduled in June will train Scholars to conceptualize pathways for their desired institutional changes. After the workshop, the Scholars will present a proposal for change to LUANAR's Vice Chancellor.

Additionally, the research conducted by CRM-4 has the potential to provoke change. PI Joseph Messina and fellow GCFSI researchers recently published "Re-Evaluating the Malawian Farm Input Subsidy Programme," in *Nature Plants*. The article asserts that the popular fertilizer subsidy program in Malawi may not be a sufficient or sustainable strategy for production gains. Messina illuminates potential flaws due to confirmation bias in science, and subsequently, potential re-evaluations for how to invest in international aid.

## 3. SUMMARY OF KEY ACTIVITIES

### 3.1 Objective 1: Mobilizing data and analytical tools to support development decision-making

#### Decision Support and Informatics (DSI)

The DSI team, which continues to work on a “fee for service” basis, added a new tool to the website, allowing for further knowledge discovery. Called K-Mean Multi-Field Point Clustering, the tool enables the user to find clusters in geospatial data using multiple fields at the same time. DSI also developed stronger security for the DSI servers and applications. The security actions on the part of the DSI team were a proactive response to a mass data breach, resulting from a hacking incident that affected some of the MSU databases in November 2016.

### 3.2 Objective 2: Source, test and scale up food systems innovations

#### *3.2.1 GCFSI Management Team*

The GCFSI management team took the lead in implementing a suite of new Human and Institutional Capacity Development (HICD) activities designed to support the work of the LUANAR Innovation Hub.

#### *3.2.2 Activities in Support of USAID’s Climate Resilient Maize Program*

In FY16, GCFSI designed a set of five two-year projects to meet the needs established through USAID’s Climate Resilient Maize (CRM) program. During the reporting period, the five CRM teams continued their work into the first half of FY17. Results to date have contributed to the global scientific communities in their fields, as well as to the CRM program itself.

#### Participatory Video for CRM Extension in Kenya, Uganda, and Tanzania (CRM-1)

During the reporting period, the team analyzed data and transcripts collected from focus groups in September 2016 to assess the impact of the video on farmers’ difference in knowledge, behavior, and future intentions. The team explored themes that may help to explain farmers’ attitudes and behavior relevant to their maize production during the piloted interventions in spring 2016. A preliminary set of findings was shared with several stakeholders.

#### Post-harvest Storage and Marketing Program Factors Affecting Demand for CRM Varieties (CRM-2)

During the reporting period, GCFSI experience in Africa helped to advance the use of value network analysis for systemic change. This was applied during the Nudge Global Leadership Challenge, a conference in the Netherlands, at which PI Domenico Dentoni hosted a workshop on systems interventions for preventing climate change. Dentoni applied the work of CRM-2 within a participatory setting of 95 young managers from the public and private sector. In response to the unfortunate departure of one of the PhD students on CRM-2, the PIs recruited a postdoctoral scholar, as well as one student in Ethiopia, to replace the former team member.

#### Using Geophysical “Big Data” to Improve Targeting of CRM Variety Adoption (CRM-4)

The CRM-4 team has been listening to farmers. Producers tell researchers that the rainy season in some areas is starting later, whereas in others, it is ending earlier. During the reporting period, CRM-4 used time series spatial rainfall data to identify spatial patterns of many types of rainfall change across Malawi and diagnosed historical climate change. Almost all of Malawi saw

statistically significant changes in at least one of the following: length of growing season, onset of rainy season, cessation of rainy season, 95th percentile rainfall events (>20mm/day), rainfall variance. Looking towards making a greater impact, the goal of the team is to scale up the process of extrapolating trends from satellite imagery for all of Sub-Saharan Africa.

In March, a PI for the project published a captivating journal article in *Nature Plants*, entitled “Re-evaluating the Malawian Farm Input Subsidy Programme.” (See appendix 2 for the full citation.) The article revealed inconsistencies between data from national and international organizations on maize area cultivated, yields, and total national production, and climate, land use, and vegetative productivity trends reflected in satellite data. These results call into question the efficacy of the “Malawi Miracle” farm input support program implemented in 2005/06. They also suggest “big data” methods that can be a useful complement to other methods of analyzing and forecasting national crop production when reliable field-level survey data are not available.

#### Assessing Drivers of Fertilizer Response in Maize in Tanzania and Malawi: Implications for CRM Scaling Programs (CRM-5)

CRM-5 is focused on diversification with multipurpose legumes for soil rehabilitation and integrated nutrient management in maize-based farming systems. The team implemented a socio-economic survey in Tanzania, and completed analyses of soil samples taken during the first panel survey, which began in April 2016. The team also worked on designing a second panel survey, to be administered mid-year. It will provide insight to Tanzania’s maize practices, plant characteristics and bean yields. Additionally, CRM-5 continues to work on modeling the maize yield response for Malawi.

#### 3.2.3 Human and Institutional Capacity Development (HICD)

GCFSI continued to build on the major HICD efforts in FY17. The focus of GCFSI’s HICD work is twofold: (1) build the capacity of LUANAR to produce innovative research and teaching and, (2) build the capacity of GCFSI to utilize design thinking and agile project implementation.

#### Innovation Scholars Program (HICD-1)

The team created and delivered its third workshop and a field study visit to Nairobi, Kenya, where a range of new public and private partners engaged with LUANAR faculty. The workshop focused on teaching and learning, and highlighted the use of design thinking to shape classroom experience, and create in scholars a habit of principles and practice built on design thinking. A public forum including stakeholders from the academic, public, and private sectors surfaced chronic challenges within the university system and defined several pathways to transformative change in university teaching and learning.

A carefully planned field study visit for LUANAR faculty and administrators to Nairobi, Kenya, served as an introduction to one of Africa’s most advanced innovation ecosystems. Scholars and leaders were able to experience first-hand the various components of a thriving innovation system and to grapple with how the system synergies allow innovations to succeed in a university environment. Throughout this excursion, participants were encouraged to reflect on how these systems work and how they might be contextualized in the institutional environment of LUANAR, as well as in the broader Malawian food system.

### Skill Development for Research Translation and Communication (HICD-3)

The HICD-3 team continued to sharpen capacity of researchers and scientists to share their impact, and provide innovators from around the world with a multimedia forum to do so. During the reporting period, the Food Fix produced ten podcasts, seven print stories, and three training videos on how to communicate research<sup>6</sup>. The team was significantly involved in the March 2017 Innovation Grantee Workshop, and recorded interviews with each grantee about his/her project. At the time of reporting, three podcasts were produced with content gathered during workshop interviews. A Mastercard Fellow at MSU, originally from Cameroon, has assumed a leadership role in the Food Fix and is working to build capacity among Food Fix reporters.

### LUANAR Innovation Hub (HICD-5)

The Hub organized an ISP workshop in December 2016, as well as the field study to Nairobi in March 2017. Innovation Hub Coordinator continues to facilitate program administration on behalf of both LUANAR and GCFSI. The Hub recently facilitated LUANAR's participation in the Resilient Africa Network's Youth Spark Innovation Grant (YSiG), with mentorship support provided by GCFSI for nine student teams.

#### *3.2.4 Workforce development assessment*

##### Oilseed Sector (Food Safety) (WFD-1)

During the reporting period, PIs consulted with stakeholders based in Malawi regarding the design of the food safety capacity building program. These meetings led to a potential partnership between the workforce development project and the Department for International Development (DFID) Malawi.

##### Employment Trends and WFD Priorities for Food Traders and Processors in Tanzania and Mozambique (WFD-2)

Currently the team is finalizing the data analysis phase of the projects. The reports and final analysis will become available in the second half of FY17.

#### *3.2.5 Seed systems development*

##### Community-based Legume Seed System Development in Malawi Small-scale Pigeon Pea Processing (Seed-1)

The Seed-1 project proved to be an opportunity for GCFSI to practice adaptive management. During this reporting period, the Seed-1 team, comprised of both MSU and LUANAR faculty, worked together to design the research plan and trained a set of enumerators who were to collect the data in the field. After a successful start, a lack of oversight while the enumerators were in the field resulted in a very weak dataset. GCFSI Assistant Director Kurt Richter, the LUANAR Acting Vice Chancellor, and the LUANAR Hub Coordinator, met to discuss the situation in December. During this meeting, it was decided to reprogram these funds to support research on the role informal food markets play in providing food to the urban population in Lilongwe. This new research path is a result of how the FIP has increased interest at LUANAR in better understanding local food markets.

---

<sup>6</sup> MSU Food Fix website: <https://msufoodfix.wordpress.com/>

### Promoting Entrepreneurship in Informal Seed Systems for Legumes in Malawi (Seed-2)

The aim of Seed-2 is to increase the local availability of quality seed of selected legumes at selected sites in Malawi. In October 2016, interviews were conducted with 604 participants in the districts of Dowa, Kasungu, Mchinji and Mzimba. Each site received three informative and practical guides which were developed by the project team. Topics include (1) quality seed management, (2) seed marketing and (3) financial literacy. Two participants from each site were then selected to become local trainers who provide practical information on the three focus areas (quality seed management, seed marketing and financial literacy). By the close of the reporting period, trainers at Kasungu and Mzimba districts trained 300 local seed entrepreneurs, including farmers and traders. Additionally, partners have been brokering linkages between farmers/traders, and innovative inputs/services. For example, demonstration activities were held at project sites for farmers to showcase improved varieties from the International Center for Tropical Agriculture.

### Workforce Skills Needs for CRM Seed Systems (Seed-3)

Seed-3 PIs visited Lilongwe, Malawi with the leaders of the ISP (HICD-1) to initiate a collaboration with LUANAR. The group is working to develop a new way forward to continue the efforts of Seed-3 with ISP, and to help LUANAR faculty conduct a systems analysis of the institution. Also during the reporting period, the Seed-3 team focused on data collection and analysis of the emerging business models around the Agricultural Commodity Exchange in Malawi.

## 3.3 Objective 3: Student engagement and partnerships to build a new generation of development innovators and practitioners

### 3.3.1 Major Innovation Grants

Specific milestones of the selected Round 1 Major Innovation Grants

1. *Use of Orange Fleshed Sweet Potatoes in Enhancing Vitamin A-Nutrition in Tanzania:*  
The small loans scheme for the woman's group established in year 4 was converted into a Village Community Bank. The production and sales of the orange-fleshed sweet potato based products in the communities expanded to include bakery products, fried products, supplementary foods, and preserves. Email and cell phone communication was used to connect orange sweet potato producers, processors, entrepreneurs, retailers, and researchers. This network was used to increase village level consumption of orange-fleshed sweet potato products.
2. *Building Capacity for Assessing and Developing Irrigation Technology Innovations:*  
Evaluation data on the irrigation innovations was collected. This data collection has been finished for the first two site seasons, and data collection will continue. This new information is being used to better inform site design modifications and innovations for irrigation systems. The irrigation designs for three new innovations were completed.

Specific milestones of selected Round 2 Major Innovation Grants

1. *FarmerLink: Mobile Enabling the Coconut Value Chain in the Philippines:* During the reporting period, the team deployed the full suite of FarmerLink mobile tools including, farm management plans, harvest monitoring tools, organic inspection forms, and pest incident forms for the early warning system. The team also drafted an operational model

with Franklin Baker Company of the Philippines, a coconut product manufacturer and exporter. The tool would streamline activities between the company's organic certification and nut buying teams. FarmerLink PIs also strengthened the relationship with the Philippine Coconut Authority and established regular performance reviews with provincial and regional offices.

2. *Linking Climate Services and Soil Diagnostics for Climate-Smart Decisions for Small-Scale Farmers and Service Providers in Tanzania:* In an effort to improve the Soil Doc tool, this project set up and is currently managing 12 different field experiments in three districts in Tanzania. The field experiments in two districts (Njombe and Mbeya) are at the grain filling stage, and the experiments in the last district (Mvomero) are at the active vegetative stage. These field experiments will provide expansive field-testing of the Soil Doc tool.
3. *Towards an Improved Cassava Simulation Model to Aid Management Decisions in the Tropics:* The first batch of cassava field trial data was finalized and analyzed to further calibrate the cassava simulation model. The current version of the model combines the new field trial and water limitation data. The team secured an additional \$500,000 in funding from the Bill and Melinda Gates Foundation to continue the project.
4. *Implementation of a Human-Powered Bean Thresher for Small-Scale Legume Production in Zambia:* The development of two all-new prototypes, for the human-powered bean thresher were finalized. Future funding has been secured from the International Fund for Agriculture Development.
5. *Low Carbon Footprint Cool Storage Structures: Improving Storage and Enabling Processing of Perishable Produce:* A fourth 1/10th-scale and the first of two full-scale evaporative cooled structures for the storage of perishable produce were constructed on the Indian Agricultural Research Institute campus. The structures were designed to be inexpensive so that smallholder farmers could construct them. The full sized storage room (cooled via evaporative cooling), is capable of holding two tons of produce. A second full-sized structure is in the process of being constructed and will have a solar-powered refrigeration system installed. This refrigeration system is to be used in conjunction with evaporative cooling system to achieve lower target temperatures for better storage outcomes.
6. *Greener Cassava Processing System Leading to Zero Waste for Enhanced Market Access by Small and Medium Entrepreneurs:* Construction of the anaerobic digestion and hybrid drying system was completed. The system was optimized to produce maximum biogas production when digesting cassava peels. A training program was designed and implemented for select cassava female processor leaders to train other women in preparation of cassava tubers; grating, pressing and loading tubers into the dryer; and preparing the cassava peels for biogas production.
7. *Cell Phones as a Lifeline for African Beekeepers:* Data collected demonstrates that reliable information can be collected from farmers via cell phones. This data helped

confirm that the generated computer model can predict landscape impacts on honey production, thus making it possible to predict the best locations for honey production. In addition, this project can be used to make best practice recommendations to beekeepers. A significant finding from the reporting period is that there is no difference in honey production when beekeepers placed the hives high, intermediate, or low in the trees. This is socially significant, because it is culturally unacceptable for women to climb trees making beekeeping off-limits to them. The knowledge that hives can be kept closer to the ground without loss of honey production also makes beekeeping far safer for all farmers keeping bees.

8. *Improving Performance of Anaerobic Digestion Systems in Uganda*: This project has multiple innovation components that each involve the process of anaerobic digestion. First, 20 absorption chillers were purchased. At the time of reporting, 75% were installed and functioning properly. Second, the dual fuel stove was updated. Third, 50 solid liquid separation systems were installed. The system achieved the team's goal for water reduction. Fourth, plot trials, which tested the impact of field application of separated solids, were completed, and farmer trials began. Lastly, the team evaluated the model digester heater and is currently designing and installing the first heating system.
9. *Grasshopper and Locust Farming as a Sustainable Source of Protein for Non-Ruminant Livestock and Humans in Kenya*: Field collection of the grasshoppers and locusts was completed, and all insect species were identified. Optimal breeding conditions were investigated and insects were bred and reared. Forums were held to engage stakeholders, including poultry farmers, and mothers with babies. This project was selected in March 2017 to receive professional media outreach assistance from DAI, contracted with USAID through the U.S. Global Development Lab.
10. *Bringing Farmville to the Tropics: App-based Simulations to Build Farmers' Understanding of Customized Fertilizer Recommendations*: The functional mobile phone application was completed after a draft version was piloted in Western Kenya. The final version was built on the Decision Support System for Agrotechnology Transfer (DSSAT) crop model, and the project included a series of soil samples and tests from sample farmers to improve the app's accuracy. With the phone app, the project also supported a survey to gather additional user feedback for continual improvements. A project website was developed for wider engagement <sup>7</sup>.

#### Specific milestones of selected Round 2 Student Innovation Grants<sup>5</sup>

1. *Testing Capacity of Maize Soil Ripper and Seed Planter in Tanzania*: During the last reporting period, this project saw many mechanical improvements to the Soil Ripper and Seed Planter tool. The changes to the functionality of the equipment included improvements to the seed dropper by switching from metal stoppers to plastic brushes to decrease broken seeds. The equipment was adjusted to include temporary joints, making it easy to disassemble and repair, as necessary. The seed holes in the seeder shaft were expanded to accommodate larger maize seeds.

---

<sup>7</sup> Project website for the bringing Farmville to the tropics phone app: <http://www.mahindimaster.org/>

2. *Enhancing Food Security through Gravity Goods Ropeway in Nepal*: A highlight for this project was the recognitions of being selected to participate in the November 2016 TechCon Student Innovation Competition. The team developed a poster for the event and fully participated in the TechCon activities. The team completed their GCFSI-funded work during this first half of FY17.
3. *Use SMS to Document Maize Trader Participation in Government Reporting Protocols in Zambia*: The team has finalized their experimental protocol, and will complete project activities in the latter half of FY17.
4. *Concentrated Solar Drying of Fresh Agriculture Produce in Uganda*: Prototype is currently being piloted with local farming communities, and being optimized to different scales to suit different farmer group needs. The team has sold 15 prototypes to farmer communities, and is pursuing scaling and start-up of Fast Agro-produce Hybrid Solar Dryer production units.
5. *An Innovative Approach to Producing, Distributing, and Marketing Food in Ghana*: The group has finished project activities, having recruited and trained 55 women participants for a dry season garden project, with emphasis on making fresh vegetables available to women during dry season.

### 3.3.2 GCFSI Follow-on Funding

The investments GCFSI made in our innovation grantees are starting to produce returns. We report over \$726,000 in follow-on funding for this period. The details of follow-on funding are presented in the table below:

<b>Innovation</b>	<b>GCFSI Funds (USD)</b>	<b>Follow-on Funding (USD)</b>	<b>Donor</b>
<i>Implementation of a Human-powered Bean Thresher for Small-scale Legume Production in Zambia</i>	125,000	50,000	International Fund for Agricultural Development
<i>Climate Resilient Maize in Ethiopia</i>	150,00	156,000	International Center for Tropical Agriculture (CIAT)
<i>Low-Carbon Footprint Cool Storage Structures to Empower Farmers: Improving Storage and Enabling Processing of Perishable Produce</i>	250,000	20,000	United States-India Educational Foundation (USIEF)
<i>Towards an improved cassava simulation model to aid management decisions in the tropics</i>	250,000	500,000	Bill and Melinda Gates Foundation

### 3.3.3 Student Engagement

During the reporting period, the PI for the FIP program developed next steps for the program, and planned the third action-research practicum to take place in summer 2017. After, a crowdfunding campaign launched by a former FIP participant, a total of \$3,000 USD was disbursed to four markets in Lilongwe in November. Managed by a market committee and kept

in a village community bank, this money has been used to fund specific water, sanitation, and hygiene (WASH), infrastructure, and security improvement projects designed by market vendors. Significantly, prior to the work of students in FIP, market vendors struggled with accountability, transparency and communicating with local governance. However, with the strengthening of market committees, local vendors and retailers are improving relations with local governance and are working together to make market improvements.

## 4. FUTURE CORE ACTIVITIES

### 4.1 Future Core Activities for Year 5

GCFSI will continue to implement our activities as presented in our FY17 workplan. We anticipate the majority of our Center-led projects will finalize data analysis and report writing during the last six months of FY17. GCFSI management will work the remaining operating activities to move them to closeout. 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.

GCFSI will not add any new core-funded activities to our workplan during the last half of FY17.

### 4.2 No-Cost Extension Requested for Core Activities

GCFSI would like to formally request a no-cost extension from October 1, 2017 through March 31, 2018 in order to complete a small number of previously planned "core" activities and to complete project closeout. We anticipate we will be working to finalize implementation of the following FY17 core activities:

- HICD-1: Innovation Scholars Program. This program will host an end-of-project convening as part of the RUFOUM Annual Meeting, which will be held in Lilongwe, October 26 - 28, 2017.
- Innovation Grantees: A few of the GCFSI Innovation Grantees have asked if no-cost extensions would be available for them. Upon receiving our official approval for our no-cost extension for core activities, we will work with each Innovation Grantee to finalize their plan for the no-cost extension period.

#### ***Estimated Budget for the No-Cost Extension Period***

GCFSI estimates at least \$400,000 will be available to complete our core activities during the no-cost extension period. We will be able to provide a more accurate budget number after the end of our busy summer implementation season.

#### ***FY18 Core Activities***

GCFSI Management

- Program closeout activities
- USAID Open Access Data compliance

## Center Led Projects

- HICD-1: Innovation Scholars Program. ISP project staff and participants will finalize their activities on the ground in Malawi with the final project presentation during the RUFORUM Annual Meetings in Lilongwe, Malawi from October 26 - 28, 2017.

## 4.3 Closeout Activities and Sustainability Plan

### *Closeout Activities*

GCFSI will focus on achieving and documenting project impact during the closeout period. During this period, we will complete collection of final project reports, success stories and other documents relevant to measuring GCFSI's impact.

### *Sustainability Plan*

GCFSI will remain part of MSU after the completion of core HESN-funded activities. GCFSI is currently in conversation with several groups around campus on ways we can collaborate and build upon the success of GCFSI from our first five years. Major future activities will include:

- GRAIN: 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 end in November 2021.
- Youth Workforce Development: GCFSI will support the African Youth Workforce Development activities being led through MSU's International Studies and Programs Office.
- Expanded Role at MSU: GCFSI is working to establish support for 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.

## 5. ENGAGEMENT OF PARTNERS AND OTHER ACTORS

### 5.1 Interdisciplinary Collaboration and Partner Engagement

#### *5.1.1 Interdisciplinary Collaboration*

GCFSI continues to maintain an interdisciplinary collaboration with emphasis on HICD activities in Malawi. To date, faculty from six MSU colleges or departments are involved in coordinating the HICD activities with LUANAR. A few of the key partners for the GCFSI at MSU are the Food Security Group (FSG), the Center for Global Connections in Food, Agriculture, and Natural Resources (CGC), Legume Innovation Lab, International Studies and Programs, Alliance for African Partnership, and the Center for Regional Food Systems.

A specific HICD activity that involved interdisciplinary collaborations was the field study tour conducted for the ISP, which brought Scholars on an excursion to Nairobi, Kenya. This trip was designed to help LUANAR faculty and administrators envision more concretely how a robust innovation ecosystem might be generated in the Malawian context, and open new doors of regional collaboration. GCFSI worked with faculty from the Catholic University of East Africa, MSU Hub for Innovation in Learning and Teaching, and the MSU CGC to design and facilitate the excursion.

GCFSI tapped experts from across MSU to host the second GCFSI Innovation Grantee Workshop in March 2017 including, faculty from the MSU Hub for Innovation in Learning and

Teaching, the CGC, the Department of Community Sustainability, and the Knight Center for Environmental Journalism. The workshop provided grantees with skills to successfully sustain their research projects beyond the close of the GCFSI 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.

### *5.1.2 Partner Engagement*

The expansion of the ISP program and increased local engagement of our innovation grantees expanded GCFSI's list of partners by 20 in the first half of FY17.

Each partner requires a different approach to engagement. GCFSI paid particular attention to our engagement with the Innovation Grantees via the Grantee Workshop and the production of a collection of Innovation Grantee's implementation stories <sup>8</sup>. GCFSI continued to work with MSU's Hub for Innovation and Teaching and the Entrepreneurship and Innovation program. Our work with Hub for Innovation and Teaching is focused on how best to measure the impact of our ISP work beyond the number of people trained. We are working towards developing metrics that capture changes in behavior. The Entrepreneurship and Innovation team is collaborating with our efforts to develop plans for a Food Systems Innovation Minor at MSU.

GCFSI has been working actively within the International Studies and Programs unit of MSU to strategize on how to increase student engagement in international opportunities and to better utilize the skills and partners of our peer International Studies Program units.

During the ISP Excursion to Nairobi, Kenya, GCFSI and LUANAR faculty networked and created new partnerships within the public and private sector. An emphasis was placed on Kenyan universities who have developed innovation ecosystems in differing capacities, ranging from student innovation hubs to research-for-development institutions.

## *5.2 Summary of collaboration across HESN*

During the first half of FY17, GCFSI and the Resilient Africa Network (RAN) collaborated at HESN TechCon to share best practices for working collaboratively to build innovation hubs. The importance of harnessing local capacity to implement activities was emphasized. Collaboration with RAN continued with the RAN Youth Spark Innovation Grants (YSiG) Competition, where GCFSI supported the LUANAR Innovation Hub in submitting nine student team proposals. This marks the first time that LUANAR Innovation Hub led a student innovation competition on the Bunda campus. GCFSI Assistant Director Kurt Richter also served as a judge for the food systems category of this year's Big Ideas Berkeley competition. Also, GCFSI grantees are connected across International Development Innovation Network (IDIN) projects, including the GCFSI-funded student innovation project, Ripper and Seed Planter, which involves collaboration with Twende, an IDIN innovation center in Tanzania; and secondly, a major innovation grant project, whose co-PI is a member of the IDIN.

---

<sup>8</sup> GCFSI Stories from the Field: <http://gcfsi.isp.msu.edu/field-stories/>

### *5.2.1 Data*

The majority of GCFSI-funded projects spent the first half of FY17 finalizing data collected from the field. We will be making the data available in accordance to the USAID Open Access Data policies in FY17.

### *5.2.2 Solutions: Creation, Testing, Scaling*

GCFSI-funded projects are moving through the testing and scale-up planning phases of implementation. Testing and scaling will continue throughout FY17.

### *5.2.3 Student Engagement*

In the first part of FY17, GCFSI's cross-HESN student engagement focused on supporting nine LUANAR student teams in submitting proposals to the RAN Youth Spark Innovation Grant (YSiG) competition. The Frugal Innovation Practicum to be implemented in August 2017 will provide learning opportunities for nine students. GCFSI supported seven MSU graduate students, in the departments of Biosystems and Agricultural Engineering; Geography; Media and Information Studies; Plant, Soil and Microbial Sciences; and Agriculture, Food and Resource Economics.

## 6. USAID ENGAGEMENT

### 6.1 USAID Buy-ins

On March 29, 2017, GCFSI was awarded the Grain Research and Innovation (GRAIN) project from USAID/Afghanistan. The total amount of the award is \$19.5 million, and the project is scheduled to end in November 2021.

The goal of GRAIN will be to enhance the productivity, profitability and climate resilience of wheat based systems through improved agronomic practices, better access to high-yielding seed varieties and appropriate inputs, improved wheat genetics, post-harvest management, and better linkages to private seed sector and other actors along the wheat value chain. In order to achieve these gains Afghanistan must develop a system such that government, universities, and the private sector come together to support research in all of the above areas. GRAIN will work to strengthen the capacity for grain research, particularly wheat research, of the Ministry of Agriculture, Irrigation and Livestock (MAIL) and the Directorates of Agriculture, Irrigation and Livestock (DAILS), so that the national government can develop and improve locally adapted grain varieties and cultivation practices. The GRAIN activity will also strengthen the capacity of MAIL's research branch, the Agricultural Research Institute of Afghanistan (ARIA), to identify, obtain, screen, and characterize potentially HYVs from outside the country for release in Afghanistan in collaboration with CIMMYT and/or ICARDA. Moreover, GRAIN will assist MAIL/ARIA in its production of high-quality breeder and foundation seed.

### 6.2 USAID/Lab Interactions

1. At this year's HESN TechCon, GCFSI Assistant Director Kurt Richter collaborated with RAN Deputy Chief of Party, Rob William Mayega to lead a panel discussion to discuss best practices for building innovation hubs.
2. Charles Steinfield and Jennifer Olson, PIs on CRM-1, presented preliminary findings of the participatory video research to Emmanuella Delva (GCFSI AOR) in February 2017.

3. Adam Lyman, lead researcher for the bean thresher project in Zambia, made a project presentation to a group representing MIT's IDIN network in Zambia, where IDIN hosts an innovation center and a business incubator in Lusaka, Zambia. The presentation was to managers within the business incubator.

### 6.3 Other Non-Lab USAID/Washington Interactions

1. Maryann Frazier, lead researcher for the Kenyan beekeeping project: Communicated with Emmanuella Delva (USAID HESN) to get assistance with setting up a meeting with the USAID/Kenya.
2. John Masani Nduko, lead researcher for the grasshopper and locust innovation grant: Communicated with Althea Lyness-Fernandez (USAID), Samantha Majerus (DAI), and Amanda Horowitz (DAI) regarding the progress of the project, short-term goals, and a five-year projection for the project. Project publicity and new avenues for communication through the USAID and Food and Agriculture Organization platforms were discussed.
3. Charles Steinfield, lead researcher on the CRM-1 project provided Emmanuella Delva (USAID HESN) a presentation of the project's preliminary findings during a conference call.
4. Nathan Moore, lead researcher on the CRM-4 project met with several USAID people at the Sustainability Indicators Conference in December, where he described the progress of the CRM-4 project.
5. Joseph Messina, lead researcher on the CRM-4 project, visited with Brian King (USAID) and Pete Richards (USAID) and presented the results and progress of the CRM-4 project to the USAID Bureau of Food Security and the Global Development Lab.

### 6.4 USAID Mission Interactions

1. USAID/India
  - a. David Poulson and Amol Pavangadkar met with Chuck Hope and Sadama Ali Gorghum of USAID/India to discuss the adaption of Food Fix and other GCFSI research translation activities to an Indian context. The meeting resulted in the submission of a concept note to USAID/India.
2. USAID/Malawi
  - a. Kurt Richter met with Fenton Sands, USAID/Feed the Future Team Lead in December 2016 to provide an update of GCFSI activities at LUANAR.
  - b. Kurt Richter participated in a conference call in March 2016, arranged by Emmanuella Delva (USAID/HESN) with Chrispin Magombo (USAID/Malawi) to provide Chrispin with an update on the ISP and the LUANAR Student Innovation Competition.
3. USAID/Afghanistan
  - a. Eric Crawford and Kurt Richter had multiple conversations with members of USAID/Afghanistan to discuss the Mission's interest in working with GCFSI via the Grain Research and Innovation (GRAIN) program. The Mission personnel communicated with included:
    - i. Adam Silagyi
    - ii. Gary Robbins
    - iii. Bill Benjamin
    - iv. Mohammad Junaid Sahibzada

4. USAID/Tanzania
  - a. Sieg Snapp, PI for CRM-5 team met with USAID/Tanzania officer, David Charles, and presented an update on activities supported by GCFSI and the Sustainable Intensification Innovation Lab.
5. USAID/Uganda
  - a. Abraham Salomon, Innovation Grantee, Building Capacity for Assessing and Deploying Irrigation Technology Innovations in East Africa met with the Uganda Mission's Agriculture Advisor to discuss potential for collaborating with existing Mission projects and future engagements as priorities change.
6. USAID/Kenya
  - a. Maryann Frazier, Innovation Grantee, Focusing Global Technology to Magnify Honey Bee Impacts on the Food System initiated contact with the USAID/Kenya in January 2017, but did not receive response.

## 7. SUMMARY OF MONITORING AND EVALUATING (M&E) ISSUES

### 7.1 M&E Updates

GCFSI is on track towards meeting its M&E targets for FY17. The Center-led Projects, Major Innovation Grants, and Student Innovation Grants continued to generate a host of new activities that are quickly moving the Center towards our M&E targets.

### 7.2 Deviance from M&E Targets

GCFSI made significant progress towards hitting our FY17 M&E targets during the first half of FY17. A small subset of our Innovation Grantees underestimated their number of beneficiaries. We learned that in one case, community groups involved more individuals than originally estimated. Another grantee shifted the focus of their work to deliberately involve more beneficiaries than originally planned. In addition, the research previously funded by GCFSI has begun to produce a large volume of peer reviewed publications, articles and information dissemination via other media<sup>9</sup>.

## 8. LESSONS LEARNED / BEST PRACTICES

GCFSI identified three common themes when reflecting on the lessons learned and the best practices. The thematic areas are partnership enhancement, adaptive management, and keys for moving from research to impact.

### 8.1 Partnership Enhancement

#### **GCFSI Management**

- GCFSI management continues to build its skills in fostering partnerships that go beyond good communication. As GCFSI improved its skills in teaching design thinking, we found ourselves empathizing more with our partners. An example of this is when GCFSI designed the FY17 Innovation Grantee Workshop by first listening to the needs of our grantees and then designing a workshop based on the skill enhancement requests for our grantees.

---

<sup>9</sup> GCFSI Publications: <http://gcfsi.isp.msu.edu/publications/>

GCFSI management has also been taking steps to identify and catalyze potential partnerships among the university community, across fellow HESN development labs, and with USAID/Malawi. As a result, the Innovation Hub at LUANAR hosted the first campus wide student innovation competition via the RAN Y-SIG program. The idea for a student focused innovation competition was first discussed during a FY16 conversation with a representative of USAID/Malawi.

### **Center Led Projects**

- CRM-1 team found that the message in the participatory videos is best reinforced through a coordinated, multichannel communication strategy, with mobile based reminders and group discussions led by extension officers. Coordination with input suppliers and partners was vital to ensure that the resources discussed in the video would be available to farmers. The team collaborated with Farm Input Promotions, Africa and village-based advisors to identify screening locations and mobilize farmers to attend.
- The CRM-5 team noted that due to variance among organizational culture and objectives, working with a variety of partners requires strong communication facilitated by sharing agendas, taking minutes, and following up on action items.
- Seed-2 researchers found that while it can be challenging to establish commitments among partners due to resource constraints and other factors, multi-stakeholder collaborations are vital to the sustainability of a project. Seed-2 learned that aligning and integrating different groups' activities at specific sites of intervention can be beneficial to success.
- The excursion to Nairobi's innovation ecosystem enabled Scholars in the ISP to see innovation systems that could be replicated or adapted at LUANAR and in Malawi. The introduction of LUANAR representatives to active innovation projects elsewhere builds regional networks. Also, the leaders found that it is best practice to involve local partners early in the planning process.

### **Innovation Grants**

- The FarmerLink project serving coconut farmers via mobile technology discovered that while working with the Philippine Coconut Authority (PCA), a government institution, it was best practice to assign project staff members to manage each key relationship identified within the PCA. The team reported the effectiveness of this approach, noting it resulted in the highest performance of PCA field officers within the duration of the grant period.
- Implementers for the cassava modeling project, and the innovators developing a protein product from grasshoppers and locusts, found that successful project implementation is dependent on regular communication with project partners and requires information sharing, follow-up, and face-to-face meetings. Also, PIs on the beekeeping research project relied on steady communication between beekeepers, the project manager, and investigators who analyze findings, in order to have effective and impactful data collection.
- The team focused on building capacity for irrigation technology discovered that it's best practice to build trust and nurture cooperation between all stakeholders. Lack of cooperation among irrigation committee members, coupled with over-reliance on some key members, led to challenges associated with efficient data collection.

- PIs on the cassava flour processing project in Tanzania found that effective partnership between the research team and the administrative/finance team is instrumental to maintaining momentum. Furthermore, they discovered that while involvement of stakeholders cannot be overlooked, it is crucial to engage policymakers and politicians, as their involvement can have a quick and wide impact on the dissemination of project outputs.
- The student researcher developing the 2-in-1 soil ripper/seed planter, found that to increase awareness of an innovation project and encourage adoption of new agronomic practices, it is beneficial to partner with in-country institutions that can provide additional training to local farmers.

## 8.2 Adaptive Management

### GCFSI Management

- GCFSI management has been working to “practice what we preach” in terms of modeling design thinking-based behavior in how we implement our work. During this reporting period, GCFSI reprogramed some activities after receiving feedback from partners regarding other priorities and pressing needs. The management is pleased to have the support of HESN in making the required work plan adjustments.

### Center Led Projects

- PIs on CRM-1, the participatory video project, found barriers to completing mobile phone calls, including poor battery charge and inconvenient timing, making it difficult to reach farmers. Therefore, further study is needed to establish a successful way to reach farmers via multiple channels.

### Innovation Grants

- Due to shifting social and environmental conditions, including changing partners and uncharacteristic drought, the PIs on the Ugandan irrigation technology project needed to continually innovate appropriate responses during implementation to meet the needs of the project sites’ communities.
- The cool storage project in India learned the advantages of taking recommendations from local institutions, which can provide important context. The project benefitted when PIs responded to local insight and practiced flexibility during project implementation.
- PIs on the grasshopper and locust protein development project harnessed adaptive management in various phases of the project, from harvesting insects from the wild to establishing optimal rearing conditions.
- The cassava modeling team experienced the necessity to adapt the project’s research approach and methods to suit the changing needs of project partners.
- Being adaptive regarding funding amounts and sources is important to the sustainability of a project. The team working on the bean thresher in Zambia faced a gap in funding, during which researchers continued to work and plan project activities. Although follow-on funding was ultimately awarded, the team did not know the fate of funding at the time.
- PIs on the anaerobic digestion innovations reported that making incremental adjustments to a community’s existing practices and designs proved to be more successful than developing a completely novel design.

- An operational problem arose for the student researcher working on the affordable 2-in-1 soil ripper/seed planter. To address the issue of improper seed metering, the project team is, again, adapting the design to respond to farmers' needs.

### 8.3 Keys for Moving from Research to Impact

#### **GCFSI Management**

- While working with our Innovation Grantees, GCFSI learned converting research to impact is possible for our grantees but the process from research to impact is different for each grantee. Successful research translation requires adapting translational process so the both the scientist and target beneficiary group are comfortable with the outcome.

#### **Center Led Projects**

- The CRM-1 program found that when using participatory video for agricultural extension, the greatest impact occurs when the videos are highly localized. By having local actors and video technicians present the videos to local farmers, all in the area's local language and environmental context, there was greater knowledge enhancement, and encouraged behavior change.
- FIP researchers learned that changing policy was not enough to impact the markets. Rather, additional on-the-ground activities, via collaborative engagement and sufficient resources, must occur for the new policy to influence the experiences within a local community.
- The Seed-2 team found that there must be greater recognition placed on the importance of informal seed systems. Further, these seed systems work best when capacity is built at multiple nodes of the system, including the areas of business operation, planning, and financial management.
- Design thinking improves innovation, and can have a strong impact on research and development. PI's of the ISP (HICD-1) found that constant iteration of design thinking fundamentals is crucial for adoption of the process and principles. As the process becomes increasing intuitive for program participants it impacts their research teams, classroom design and teaching practices. The Seed-3 team also found that design thinking appeals to people across disciplinary and cultural boundaries when introduced with the appropriate user-centered approach.

#### **Innovation Grants**

- The team that is implementing the innovations utilizing the power of anaerobic digestion found that grain and biomass yields increased when farmer trials were initiated.
- The research in the grasshopper and locust project conducted research that identified optimal breeding conditions for the insects, and now this research will have a substantial impact on the community by providing a new source of affordable and sustainable protein to relieve malnourishment.
- The beekeeping research project found results during this reporting period that can be used to make best practice recommendations to beekeepers. Through the translation of this research into practice, this project can promote local economic growth and sustainable, long-term development impacts.
- When provided with the opportunity, the women participating in the orange-flesh sweet potato project were empowered through education and finances with small loans and

were able to generate income, while providing good nutrition, food security, and improved health and living conditions for their families.

## 9. ENVIRONMENTAL MONITORING

The GCFSI FY 2017 workplan 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 grasshopper and locust project's environmental monitoring report will be submitted as part of the FY17 annual report.

## Appendix 1: TOTAL FOR GCFSI FOLLOW-ON FUNDING

This is a table showing the total follow-on funding that GCFSI projects have received. With an initial investment of \$1.5 million, GCFSI attracted an additional \$4.1 million in follow-on funding.

<b>Innovation</b>	<b>GCFSI Funds (USD)</b>	<b>Follow-on Funding (USD)</b>	<b>Donor</b>
<b>FY17</b>			
<b>Implementation of a Human-powered Bean Thresher for Small-scale Legume Production in Zambia</b>	125,000	50,000	International Fund for Agricultural Development
<b>Climate Resilient Maize in Ethiopia</b>	150,00	156,000	International Center for Tropical Agriculture (CIAT)
<b>Low-Carbon Footprint Cool Storage Structures to Empower Farmers: Improving Storage and Enabling Processing of Perishable Produce</b>	250,000	20,000	United States-India Educational Foundation (USIEF)
<b>Towards an improved cassava simulation model to aid management decisions in the tropics</b>	250,000	500,000	Bill and Melinda Gates Foundation
<b>Total FY17</b>	<b>625,000</b>	<b>726,000</b>	
<b>FY16</b>			
<b>PhotoSyncQ</b>	100,000	600,000	McKnight Foundation
<b>EWareHousing</b>	100,000	695,834	BASIS AMA
		360,000	Agricultural Technology Adoption Initiative - Abdul Latif Jameel Poverty Action Lab (ATAI-JPAL)
		780,000	Wellspring
<b>Towards an improved cassava simulation model to aid management decisions in the tropics</b>	250,000	420,000	International Institute for Tropical Agriculture, through a grant from the Bill and Melinda Gates Foundation
<b>Core Team / Wageningen University</b>	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)
<b>Linking climate services and soil diagnostics for climate-smart decisions for small-scale farmers and service providers</b>	250,000	29,774	Columbia University
<b>Frugal Innovation Practicum</b>	70,000	1,575	CrowdPower
		1,200	Schoenl Grant
		200	Kiwassee Kiwanis
<b>Total FY16</b>	<b>920,000</b>	<b>624,749</b>	
<b>TOTAL</b>	<b>1,545,000</b>	<b>4,150,583</b>	

## 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

### 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/](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](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*. Center Report Series, No. 8. 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/](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/](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/](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/](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. 9. East Lansing, Michigan: Global Center for Food Systems Innovation, Michigan State University, January. [http://gcfsi.isp.msu.edu/index.php/download\\_file/view/376/251](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). Retrieved from East Lansing, Michigan: [http://gcfsi.isp.msu.edu/index.php/download\\_file/view/366/251/](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.

## External Publications

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. In *Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa* (pp. 235-253). Springer International Publishing.

Jayne, Thomas (2017). Africa Agriculture Status Report (2016) Chapters 1 and 11. Poster presentation. <http://agra.org/aasr2016/>

Li, G., Messina, J., Peter, B., and Snapp, S. *Mapping Land Suitability for Agriculture in Malawi*. Land Degradation and Management.

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, JP., Snapp, S. (in press) Mapping Marginal Land Distribution in Malawi Through Assessment of Agricultural Land Suitability. *Land Degradation and Development*.

Magliocca, NM., Vliet, J van., Brown, C., Evans, TP., Houet, T., Messerli, P., Messina, JP., Nicholas, KA., Ornetmüller, C., Sagebiel, J., Schweizer, V., Verburg, PH., 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. Accepted Author Manuscript. doi:10.1111/ina.12390
- Messina, J. P. and Peter, B. *From Big Data to the Farm: Scaling Agricultural Innovations. Meeting on Indicators for the Sustainable Intensification of Agriculture*. East Lansing, MI.
- Messina, J.P., Peter, B.G., & Snapp, S.S. (2017). Re-evaluating the Malawian Farm Input Subsidy Programme. *Nat. Plants* 3, 17013.
- Messina, J., Peter, B., Snapp, S., Jayne, T., Carroll, J. *From Top Down to Bottom Up: Tackling Agricultural Challenges in Small Holder Systems with Precision*. USAID. Presentation.
- 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, Brad G. *Marginal Agricultural Land and Development Opportunities in Malawi* (2016). *Environmental Science & Policy Program*. Climate, Food, Energy, and Water Colloquium Series. East Lansing, MI. Presentation.
- 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. [in review]. *Scaling Agricultural Innovations: Pigeonpea in Malawi*. Professional Geographer.
- Peter, B. Messina, J., and Snapp, S. [in review]. *A Multi-Scalar Approach to Mapping Marginal Land: Smallholder Agriculture in Malawi*. *Annals of the American Association of Geographers*.
- Peter, B., Messina, J. P., Snapp, S. S, and Frake, A. N (2017). *Transforming Maize Marginality into Pigeonpea Opportunity*. American Association of Geographers. Boston, MA. Presentation.
- Peter, B., Mungai, L., Messina, J., and Snapp, S. [in review]. *Nature-Based Agricultural Solutions: Scaling perennial Grains Across Africa*. *Environmental Research*.
- Shortridge, AM., Messina, JP., Kravchenko, S., Finley, A. (eds.). 2014. Accuracy 2014: Proceedings of the 11th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences : July 8-11, 2014, Michigan State University, East Lansing, Michigan, USA. ISARA, International Spatial Accuracy Research Association.

Steinfeld, C. and Olson, J. *Using a multichannel training strategy to stimulate farmers' knowledge and willingness to test drought tolerant maize varieties*. Paper accepted for poster presentation at the Agricultural & Applied Economics Association, Chicago, IL, July 30-August 1, 2017.

### **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. *Trans. ASABE In Review*.

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 (forthcoming) "Demand for Food Safety in Emerging and Developing Countries: A Research Agenda." *Journal of Agribusiness in Developing and Emerging Economies*.

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. Opportunities for perennial food crops in Malawi: A review. *Agronomy and Sustainable Development*, In press.

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, 139-149.

## Appendix 3: GCFSI GRANTEE WORKSHOP AGENDA

The following pages include the agenda for the GCFSI Grantee Workshop.

### **GCFSI Grantee Workshop Schedule**

**Michigan State University, Kellogg Hotel & Conference Center**

**Friday-Sunday, March 3-5, 2017**

#### **Friday, March 3**

- 12:30 – 6:00 p.m. Food Fix Interviews with Amol Pavangadkar and Dave Poulson. Previously scheduled timeslots. (Room 102 and Heritage Room, Kellogg Center)
- 2:00 – 5:00 p.m. Arrive and hotel check-in at Kellogg Hotel & Conference Center
- 6:00 p.m. Reception with hors d'oeuvres and cash bar (Red Cedar Room, Kellogg Center)
- 6:40 – 7:00 p.m. Welcome and Opening Remarks
- 7:00 – 7:40 p.m. Orientation: Coached Speed Pitching
- 7:40 – 8:00 p.m. Formal Remarks

#### **Saturday, March 4**

- 7:30 – 8:15 a.m. Continental Breakfast (Room 105, Kellogg Center)
- 8:15 – 8:30 a.m. Welcome Remarks
- 8:30 – 9:15 a.m. Team Formation
- 9:15 – 10:00 a.m. Session: Interdisciplinary Teams/Multidisciplinary Research
- 10:00 – 10:45 a.m. Session: Systems Thinking for your Intervention
- 10:45 – 11:00 a.m. Coffee Break
- 11:00 – 12:00 p.m. Facilitated Team Brainstorming
- 12:15 – 1:15 p.m. Lunch (Red Cedar Room, Kellogg Center)
- 1:30 – 1:50 p.m. Session: Impact Assessment, Beyond Counting (Room 105, Kellogg Center)
- 1:50 – 3:00 p.m. Team Pitch Development

3:00 – 3:15 p.m.	Break
3:15 – 4:00 p.m.	Session: Regional/Cultural/Gender-Sensitive Communication
4:00 – 4:55 p.m.	Session: Storytelling/Translating Research
4:55 – 5:00 p.m.	End Comments
5:00 – 5:40 p.m.	Break / Personal Time
5:45 – 7:00 p.m.	Dinner (Brody Cafe, across the road from Kellogg Center)
Evening	Final Team Pitch Development (Optional)

**Sunday, March 5**

7:30 – 8:15 a.m.	Continental Breakfast (Room 105, Kellogg Center)
8:30 – 9:00 a.m.	Final Team Pitch Development
9:00 – 10:00 a.m.	Final Team Pitch Presentations, with Feedback
10:00 – 10:10 a.m.	Coffee Break
10:15 – 12:00 p.m.	Final Team Pitch Presentations, with Feedback
12:15 – 1:30 p.m.	Lunch, Workshop Close and Farewell (Riverside Room, Kellogg Center)



## Appendix 4: INNOVATION SCHOLARS PROGRAM NAIROBI EXCURSION AGENDA

The ISP visited several private and public sector sites in Nairobi, Kenya in order to gain exposure to the Nairobi innovation ecosystem, especially institutions of higher education. The following pages include the agenda for the Excursion.



### **Innovation Scholars Program Nairobi Excursion Agenda March 19-23, 2017**

#### **Sunday, March 19**

1800 Flights Arrive in Nairobi  
2030 Light Dinner, Amani Gardens  
2130 Group Briefing

#### **Monday, March 20**

0630 Breakfast, Amani Gardens  
0745 Bus Loading  
0800 Bus Departs from Amani Gardens  
0930 Site Visit to Jomo Kenyatta University of Agriculture and Technology (JKUAT)  
1100 Lunch, JKUAT  
1200 Bus Loading  
1215 Bus Departs from JKUAT  
1330 Site Visit to Kenyatta University  
1515 Bus Loading  
1530 Bus Departs from Kenyatta University  
1600 Site Visit to United States International University (USIU)  
1700 Reflection Session  
1800 Bus Loading  
1810 Bus Departs from USIU  
1830 Dinner & Shopping, Garden City Mall  
2030 Bus Departs from Garden City Mall for Amani Gardens

#### **Tuesday, March 21**

0630 Breakfast, Amani Gardens

0800 Group Briefing  
 0830 Bus Loading  
 0840 Bus Departs from Amani Gardens  
 0930 Site Visit to University of Nairobi, College of Agriculture  
 1300 Lunch, University of Nairobi Golf Club  
 1400 Site Visit to International Potato Center (CIP) and International Livestock  
 Research Institute (ILRI)  
 1600 Reflection Session  
 1730 Dinner & Shopping, The Junction  
 1930 Bus Loading  
 1940 Bus Departs from The Junction

**Wednesday, March 22**

0630 Breakfast, Amani Gardens  
 0800 Group Briefing  
 0830 Bus Loading  
 0840 Bus Departs from Amani Gardens  
 0930 Site Visit to iHub  
 1230 Lunch, Yaya Center  
 1330 Bus Departs from Yaya Center  
 1400 Site Visit to Catholic University of East Africa (CUEA)  
 1630 Final Reflection Session  
 1730 Bus Loading  
 1740 Bus Departs from CUEA  
 1750 Shopping at Galleria Mall  
 1930 Dinner, The Carnivore

**Thursday, March 23**

0800 Bus Group Transport to Airport  
 1105 Flight to Lilongwe



**USAID**  
 FROM THE AMERICAN PEOPLE



Global Center for  
 Food Systems Innovation  
 MICHIGAN STATE UNIVERSITY



## Appendix 5: INNOVATION SCHOLARS PROGRAM NAIROBI EXCURSION WORKBOOK

An important key to success to the ISP excursion was the workbook, which combines programmatic focus for the scholars and evaluative evidence for learning for the facilitation team. The workbook focuses participant thinking for observation, reflection, and visioning throughout the learning process. The following pages include the workbook for the ISP Nairobi Excursion.

Name:

Project:



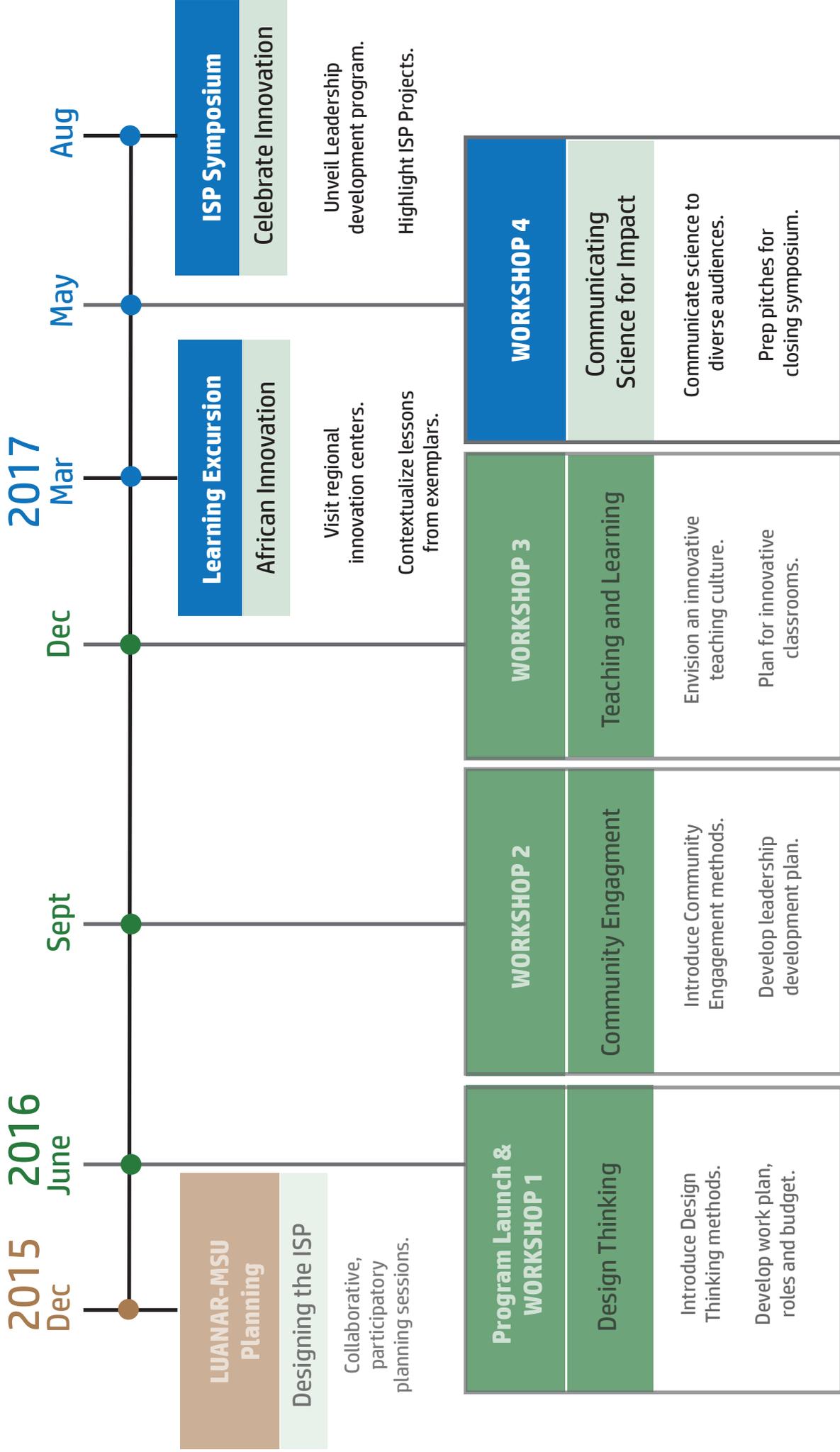
# Learning Excursion

**INNOVATION SCHOLARS PROGRAM**



# Innovation Scholars Program

## Project Timeline

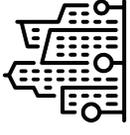




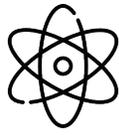


## Excursion Overview

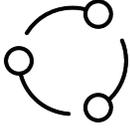
Partners specializing in different areas on the innovation spectrum:



University-Community Partnerships



Teaching and Learning



Business Incubators

### Day 1

### Day 2

### Day 3

Briefing

Site Visits

● Site 1: JKUAT

● Site 4: University of Nairobi

● Site 6: Nailab

● Site 2: Kenyatta

● Site 5: ILRI: International Livestock Research Institute

● Site 6: Brck

● Site 3: ISIU

● Site 5: Potato Center

● Site 6: mHub

● Site 6: iHub

● Site 7: CUEA

Understand



Contextualize



Apply



Reflection



## Day 1 Briefing : Design Thinking Review

### INNOVATION SPECTRUM

*Problem Finding*



In past workshops, we have spent time on **empathy** as a primary tool for understanding problems. In this workshop, we will introduce **systems thinking** as another form of problem finding.



In past workshops, we have used **testing** as our tool for evaluating our solutions. In this workshop, we will introduce double loop learning as another form of reflecting on and developing our solutions.

*Solution Developing*

Understand

Design

Sustain

Today's Site Visits:

- o JKUAT
- o Kenyatta
- o ISIU



## Day 1 Briefing: Community Engagement Review

### Outcomes

- Comments relating to producing good employees.
- Comments that relate to producing employers

- Comments that relate to changing the way we teach and learn in the classroom.

- Comments that relate to changing the way LUANAR can support good teaching and learning.

### Inputs

# JKUAT

## Day 1-Site 1

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



*clients*



*resources*



**CONNECTIONS TO  
PAST WORKSHOPS**



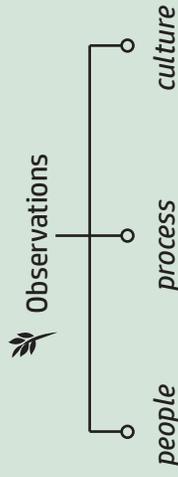
**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**



# Kenyatta

## Day 1-Site 2

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



*clients*



*resources*



**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**

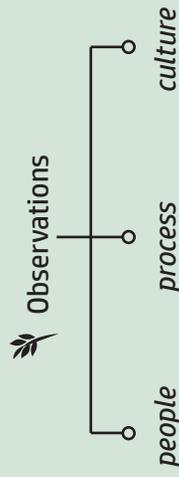


7

# ISIU

## Day 1-Site 3

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



*clients*



*resources*



**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**





## Day 1 Reflection: Making Connections

## UNDERSTAND

Look through your 3 site visit notes pages. Consider your observations about both the sites and yourself.

What's a story you would tell someone about today?

What did you see, feel, hear, touch?

*How did our visits today connect to our past workshops?*

Design Thinking

Community Engagement

Teaching and Learning



## Day 2 Briefing: Community Engagement Review



### Community Actors

What are the categories of actors/ stakeholders in the community that we envisage to engage with?



### Principles and Values

What are the underlying principles and values that should guide our engagement with community to achieve our shared goal?



### Competencies & Values

As scholars, what do we need to be able to do/do differently to engage better with the community in a mutually beneficial manner?

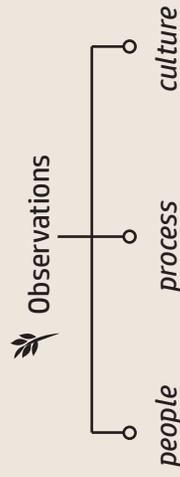
### Today's Site Visits:

- University of Nairobi
- ILRI: International Livestock Research Institute
- Potato Center

# University of Nairobi

## Day 2-Site 4

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



*clients*



*resources*



**CONNECTIONS TO  
PAST WORKSHOPS**

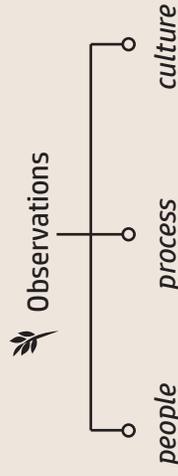


**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**



- International Livestock Research Institute (IRLI)
  - International Potato Center (CIP)
- Day 2-Site 5*

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**





## Day 2 Reflection: System Mapping

## CONTEXTUALIZE

- map a system you saw today
- map a system back home

*How did our visits today connect to our past workshops?*

Design Thinking

Community Engagement

Teaching and Learning



## Day 3 Briefing

# THE ICEBERG MODEL

Use this tool to help you think more systematically!



## EVENTS

What is happening?

## PATTERNS OF BEHAVIOR

What trends are there over time?

## SYSTEMS STRUCTURE

How are the parts related?

What influences the patterns?

## MENTAL MODELS

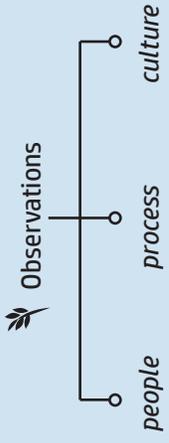
What values, assumptions, + beliefs shape the system?

Increasing Leverage

## Today's Site Visits:

- o Nailab
- o iHub
- o Brck
- o CUEA
- o mHub

# Nailab Day 3-Site 6.1

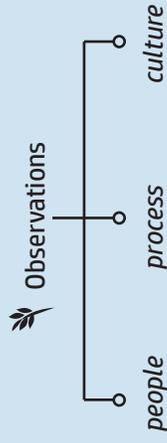


clients



resources

# Brck Day 3-Site 6.1



clients



resources

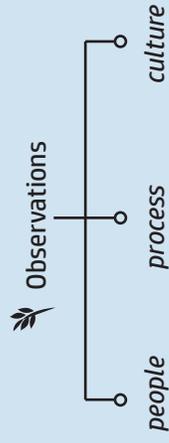
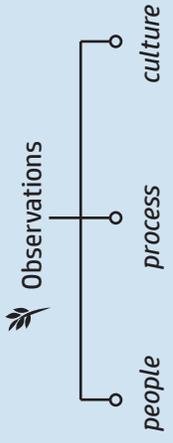


**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**





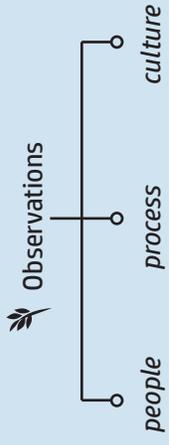
**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**



# iHub Day 3-Site 6.2

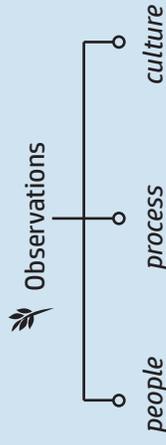


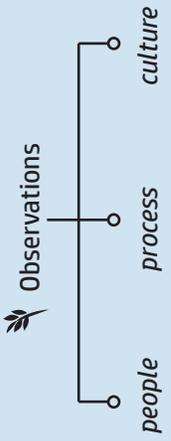
**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**

# mHub Day 3-Site 6.2





**CONNECTIONS TO  
PAST WORKSHOPS**



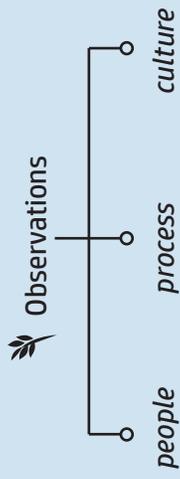
**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**



# CUEA

## Day 3-Site 7

- What did you observe, experience and discuss at this site?



- Who does this serve and how do they do it?



*clients*



*resources*



**CONNECTIONS TO  
PAST WORKSHOPS**



**POTENTIAL FOR  
FUTURE  
PARTNERSHIPS**

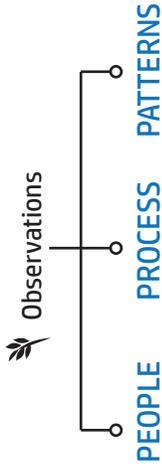




## Day 3 Reflection: System Visioning

## APPLY

Map the system you want to create:



**Incorporate:**

- EVENTS ◦ What do you want to happen?
- PATTERNS ◦ What trends do you want to see over time?
- STRUCTURES ◦ What are the parts? How are they related?
- MENTAL MODELS ◦ What values, assumptions & beliefs shape the system?

*How did our visits today connect to our past workshops?*

Design Thinking

Community Engagement

Teaching and Learning

## Appendix 6: STORIES FROM THE FIELD

Stories from the Field is a compilation of innovation project success stories and updates. GCFSI staff generated the content of Stories from the Field during the reporting period, after interviewing grantees and reviewing monitoring and evaluation submissions. The compilation was shared with grantees and other attendees during the Grantee Workshop in March 2017. Stories from the Field prepared the Food Fix reporting team to conduct PI interviews during the workshop. Photos were provided by project PIs.

Global Center for Food Systems Innovation

# FOOD SYSTEM INNOVATION PROJECTS

*Stories from the field*

**March 2017**

**Written by:**

*Katie Deska*

*Ali Hussain*

*Lizzy LaFave*



**MICHIGAN STATE  
UNIVERSITY**

Global Center for Food  
Systems Innovation

## Innovations in Africa

### Kenya

- Cell Phones as a Lifeline for African Beekeepers p. 1  
Primary Investigators: Maryann Fraizer and Benjamin Muli
- Mobile App Helps Farmers Work Smarter, Not Harder p. 3  
Primary Investigators: Travis Lybbert and Emilia Tjernstrom
- Wild-Caught Protein: Grasshoppers and Locusts Help Curb Malnourishment p. 5  
Primary Investigators: John Nduko and Anthony King'ori

### Tanzania

- Towards Zero-Waste Cassava Processing p. 7  
Primary Investigators: Anselm Moshi and Humphrey Ndossi
- Power of Sweet Potatoes: Tanzanian Women Build Vitamin A Enterprise p. 9  
Primary Investigators: Channa Prakash and Theobald Mosha
- SoilDoc + Climate: Researchers Improve Farmer-Centered Forecasting Device p. 11  
Primary Investigators: Clare Sullivan and Johnson Semoka

### Uganda

- Cooking, Cooling, and Cultivating with Waste p. 13  
Primary Investigator: Rebecca Larson
- Contextualizing Irrigation Challenges in Rural Uganda p. 15  
Primary Investigators: Kate Scow and Abraham Salomon

### Zambia

- Dual-Platform Bean Thresher Reduces Burden from Women's Backs p. 17  
Primary Investigators: Adam Lyman and Ronald Averill

## Innovations in Asia

### India

- Advancing India's Food Security with Low-Impact Refrigeration p. 19  
Primary Investigators: Sangeeta Chopra and Randy Beaudry

### Vietnam

- Modeling Cassava, the "Rambo" of Food Crops p. 21  
Primary Investigators: Julian Ramirez-Villegas and Tin Maung Aye

### Philippines

- Coconut Farmers Receive Valuable Warnings via Text p. 23  
Primary Investigators: Ana Herrera



## Cell Phones as a Lifeline for African Beekeepers

In its 2009 National Beekeeping Policy, the Kenyan government estimated that the nation is producing only a mere 15 percent of available honey, and harvesting just over one percent of potential beeswax. To help beekeepers get more out of the hives, a group of seven researchers launched a grassroots-style, cell phone-based, data collection initiative aimed at identifying best management practices and most productive landscapes for honey bees.

“There’s a lot of anecdotal information about beekeeping, but there’s little scientific data,” said Maryann Frazier, a beekeeper and extension associate at Pennsylvania State University who partnered with Benjamin Muli, of South Eastern Kenya University (SEKU). “We’re trying to get hard data from the beekeepers that can be utilized to increase their honey and wax production. We’ll model the data they provide and create recommendations for them and deliver these via cellphone, which is how we’re collecting the data... We’ll be making recommendations to the beekeepers in the next couple months.”

Funded by a 2015 Early Innovation Grant from the Global Center for Food Systems Innovation (GCFSI), the project consists of nearly 40 beekeepers who have been providing researchers with data for the last year, generating over 400 records that were used to create a map that indexes the landscape in relation to honey production.



Utilizing a cellphone and a pre-paid SIM card, participating beekeepers tell Janet Kilonzo, project manager and recent graduate of SEKU, how much honey and wax they produce and when, and what circumstances they experience throughout the year. Beekeepers report what plants are blooming, if they’ve encountered problems with drought, and whether or not there’s been colony loss due to ants or issues with honey badger attacks. They also record and report how many of their hives are occupied, and the time at which the bees abscond or recolonize the hive.

“We have recorded the GPS coordinates for each beekeeper’s hives and Eric (Lonsdorf), a specialist in landscape ecology, used satellite imagery to index the land cover, rating it in terms of quality for honey bee foraging. Our preliminary results show that we can see the impacts of landscape quality on honey production. Using these tools, we hope to be able to help beekeepers predict where they are likely to have the healthiest colonies and produce the most honey,” said Frazier.

As for the beeswax, there is a high demand from the international cosmetics industry for clean, pesticide-free wax, characteristic of many of East Africa's hives. However, many beekeepers in Kenya and elsewhere are unaware that the wax – which is commonly thrown away – could provide extra income. To encourage beekeepers to harvest the wax, each project participant was given a solar wax melter to aid with processing.

Other hive-based products include bee venom, royal jelly, brood, pollen and propolis. Each has the potential to contribute to income generation, employment creation, and enterprise development.

Aimed at collecting data and disseminating information, resources, and equipment, the GCFSI-funded project helps to advance Kenya's goal of developing a more robust beekeeping industry – one that can improve the livelihoods of rural farmers.



*Beekeeper calls to report data*



*New combs in traditional log hive*



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Mobile App Helps Farmers Work Smarter, Not Harder

FarmVille, a farming simulation game, is among the most popular social networking games ever launched. Since its 2009 debut on Facebook, the virtual game has been played by over 400 million users in 215 countries. Ever wondered how a game like FarmVille could actually be used to improve agriculture? That was the challenge accepted by two researchers, Emilia Tjernstrom, of the University of Wisconsin-Madison, and Travis Lybbert, of the University of California-Davis.

Unlike flipping on the hose or starting the sprinklers, most African farmers rely on unpredictable rain to irrigate food crops. In such variable conditions, learning about the benefits of improved maize varieties or fertilizer is costly and risky. And, when farmers' livelihoods depend on the success of their crop, experimentation is curtailed.

Seeking a comparatively low-risk method to assist farmers in selecting best practices, Tjernstrom and Lybbert leveraged a grant from the Global Center for Food Systems Innovation (GCFSI) to develop Mahindi Master, a game-like mobile app inspired by FarmVille.



Translated from Swahili to English as “Maize” Master, the game allows users to virtually experiment with different fertilizers, seeds, and other agricultural inputs to predict how each would likely affect crop yields on the farmer’s particular plot. By populating a maize crop model with real world data from soil samples, the app calibrates the interactions of inputs that affect growth, particularly fertilizer and weather conditions. After running through multiple growing scenarios as part of the game, the user will see which combination of inputs was most fruitful for their virtual yield.

As players proceed through the different modules of the game, they can select from three different fertilizers – diammonium phosphate (DAP), calcium ammonium nitrate (CAN), or lime – to see how their maize harvest is expected to respond to each. Reflecting on the pretesting conducted in Rongo, Kenya, Tjernstrom said, “Farmers felt that the app was conducive to learning about fertilizer and expressed a desire to play the game again once it was calibrated to their plot’s soil characteristics. (We) received valuable feedback on the animations, which will enable us to adjust certain colors of the seeds and fertilizers to reflect their actual appearance in Western Kenya, and to present the weather scenarios in a clearer way.”

Further pilot testing is scheduled to occur in Kenya and to encourage participation by the target audience, the research team will provide incentive in the form of valuable resources for farmers to use in the upcoming growing season.

“After farmers complete their module on the app, they will be given a cash allowance and a menu of agro-inputs, such as seeds and fertilizer. They will identify a demo plot of specific dimensions and then purchase the inputs they would like to use for the demo plot,” said Lybbert, noting that the materials will later be delivered to the actual demo plot, which will be managed by the farmer as part of the pilot test.



A screen shot of Mahindi Master, a game-like mobile app that allows farmers to virtually experiment with agricultural inputs, such as fertilizer.

“By (evaluating) their input choices from the menu, we’ll be able to assess how much they trust what they have learned. It’s innovative in the sense that it turns agricultural extension into an interactive, customized experience. One of the underlying principles is that people learn best when they actively seek to understand something new or more deeply. By gamifying farming in a way that is salient to them, the app aims to encourage farmers to discover, on their own, how inputs affect productivity.”



Kenyan farmers play Mahindi Master during pilot testing.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Wild-Caught Protein: Grasshoppers and Locusts Help Curb Malnourishment

Proteins are known as the body’s building blocks, but for many people in Kenya, protein sources are too expensive, leading to nutrient-poor diets linked to diseases and cognitive development problems. To improve availability of protein-rich food, researchers John Nduko and Anthony King’ori, of Egerton University, turned to wild-caught protein, namely grasshoppers and locusts.

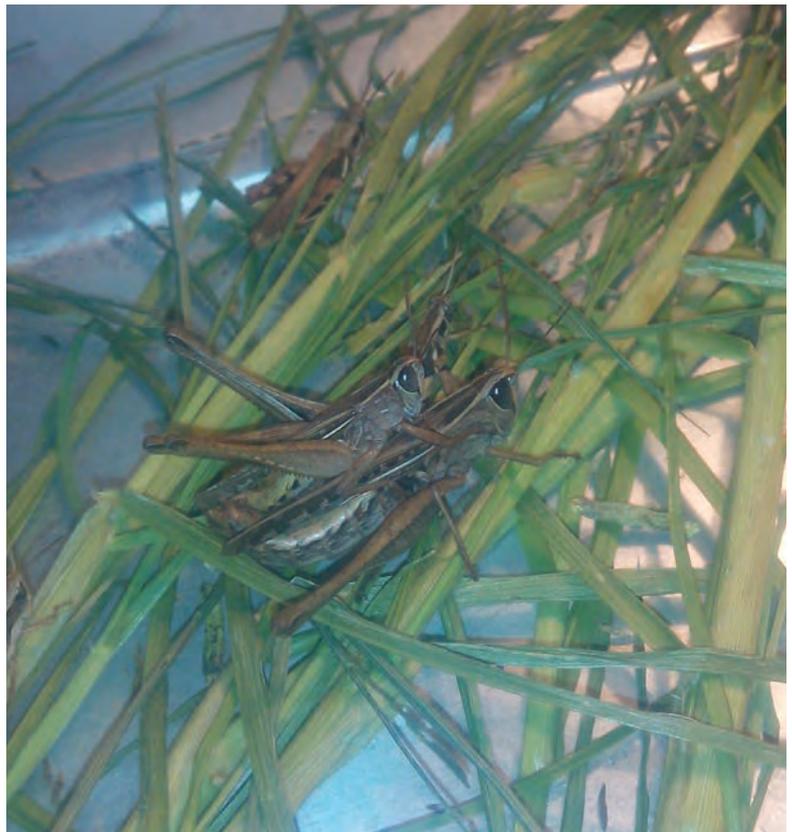
Collected in Kenya’s Nakuru and Baringo counties, the research team launched the project by foraging about 50 insects, mostly locust, in 2016. “It was difficult to find them,” said Nduko. “Climate change has had an effect, and this made us expand the geographical areas to find the most abundant insects.”

Kept in small cages, the bugs continue to multiply while researchers work to establish the best incubator conditions for reproduction and hatching. “In one month we’ll have a huge number. After we have lots of insects, we’ll freeze dry them and they’ll be ground into a powder.”

Funded through a start-up grant from the Global Center for Food Systems Innovation, Nduko and King’ori partnered to develop a toolkit that would make insect rearing and processing available to smallholder farmers, providing a cheap and low-risk method of generating more protein for human consumption and animal feed. Once dried and ground, the insect powder can be fed to babies in sorghum or millet porridge, and can be fed to fatten up chickens, rabbits and other non-ruminant animals.

When used as animal feed, locust and grasshoppers can save farmers money, and offer a much-needed alternative to traditional feed sources.

“With increased population, and increases in living standards, the demand for protein-rich foods is increasing, and this in turn increases demand for animal feeds, which have serious environmental effect. A lot of animal feeds are sourced from fish, and because of climate change, so fish from the wild are becoming extinct. Dairy and beef cattle are becoming a challenge because the amount of available land is shrinking, and most small-scale farmers cannot do that,” said Nduko. “The small-scale farmer can rear non-ruminant animals, such as poultry, however, the cost of feeds hinders productivity and this keeps most farmers under the cycle of this poverty. 70 percent of the

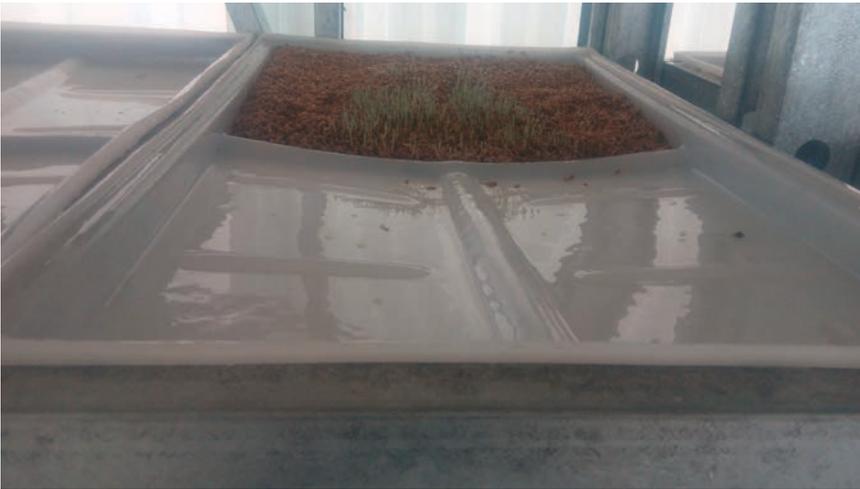


production cost for chicken is just to feed them. But, if you use insects that eat grass, it's cheap and requires only a small space."

By facilitating the rearing and processing of grasshopper and locust for food products, Nduko said, "We foresee a situation to provide inexpensive food and feed, to contribute to the end of malnutrition, and contribute to food security in Kenya and Africa. The market is there."

With the pilot in full swing and small scale production underway, researchers are focused on scaling up the model, and collaborating with industry leaders. In a stakeholders meeting in March, Nduko and King'ori will discuss the project with representatives from the baby food and chicken feed industries.

"Despite challenges, we are moving well so far. The number of people who expect our project to develop into an inexpensive method of obtaining proteins is overwhelming, at the same time encouraging," said Nduko.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Towards Zero-Waste Cassava Processing

An important subsistence crop in Tanzania, cassava is grown in all regions of the country, yet processing constraints make it difficult for small and medium scale farmers to compete with large scale operations. To level the playing field, two researchers developed a low-cost processing system that produces high-value cassava flour with virtually no waste.

Currently in the pilot stage, the new system has the capacity to mill 500 kg of cassava flour per day. Developed by Anselm Moshi and Humphrey Ndossi, both of the Tanzania Industrial Research and Development Organization, the system is powered by renewable energy and utilizes the entire crop, including plant material previously wasted.

“The overall goal of this project is to improve income of small to medium scale farmers in the cassava value chain through innovative processing technology,” said Moshi, who was awarded a start-up grant in 2015 from the Global Center for Food Systems Innovation. “There is a lot of cassava grown and it grows very quickly, but there needed to be a better system.”

The researchers found room for improvement at the processing level – particularly in the drying stage.

The mills that local farmers traditionally have access to do not dry the crop in a uniform fashion, which results in discoloration of the flour. “When they use the local mills to dry the cassava, they end up with a brown flour which means it is not a high quality flour and they cannot sell the low quality flour at markets at a high price,” said Moshi. “We have designed a very innovative type of hybrid dryer which uses all renewable energy sources, but specifically allows for uniform drying.”



*AD-solar system for efficient drying of cassava grits*



*Women peeling cassava for processing into cassava flour;  
Most of the cassava processing groups are women*

Typically, converting raw cassava into cassava flour produces an enormous amount of bio-waste in the form of peels, fiber, and even liquids. But, in Moshi and Ndossi’s design, the bio-waste is converted to ethanol and used to power the cassava grating machine. Additionally, biogas is generated and then combined with solar power to run the dryer. The fibrous part of peels is used to produce a special type of polysaccharides, called prebiotics, utilized at the end of processing to fortify the flour with nutrients that can lower cholesterol.

.....

“Cassava is a very perishable product, but it is a valued product. When you process cassava you lose about 50 percent of the tuber in the peels and pulp, and 16 percent of the tuber in liquid and gaseous waste. If you are just throwing this away, it is a big loss of product and nutrition,” said Moshi. “People are most excited about the high quality flour, and (that) they can sell it at the high quality markets. But the process that generates and utilizes renewable energy, to them, is very cool because now they can get the better price and better product, which means more income for their families.”

There is plenty of room in the current market for economic growth from male and female farmers, and Moshi said the innovative system can help fill the gender gap. “There are a lot of women farmers in our groups that get involved. They join processing groups, or they grow cassava themselves.”

Once the pilot phase of the project is complete, researchers plan to build a large demonstration site in the southern coastal zone of Tanzania.



*Upgraded biogas (>95% CH4) is collected in a gas bag and used to heat the hybrid dryer for drying cassava grits*



*Grating cassava tubers using a grating machine*



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

# Power of Sweet Potatoes: Tanzanian Women Build Vitamin-A Enterprise

Introduced to Sub-Saharan Africa as a crop that could alleviate vitamin A deficiency, especially common in women and children, the orange-fleshed sweet potato is a biofortified intervention that adds nutritional value to the community, while at the same time spawns economic activity and empowerment among rural women.

“We now see that women growing the orange-fleshed sweet potato are able to make more money, a small level of increase of income, and most importantly, have vitamin A-rich food,” said Channa Prakash, of Tuskegee University, who partnered with Theobald Moshia, of Sokoine University of Agriculture (SUA), to train Tanzanian women in food processing, product development and business management activities associated with the particular orange-fleshed sweet potato variety. Supporting approximately 200 women with seed money from the Global Center for Food Systems for Innovation, researchers helped the budding entrepreneurs establish a network of Village Community Banks (VICOBA), purchase processing equipment, and learn about food safety, marketing skills, and profit margin calculation.

Project manager and recent graduate of SUA, Domina Leonce Swai, worked on the ground with the women to help them become familiar with the nontraditional tuber, and troubleshoot their way through starting a business. “She lived with them for six months and they treated her as one amongst family. She was easily accepted into the village group. And their children now have access to healthy food to eat more readily because now (the sweet potato) is in a form that is much more fun to eat,” said Prakash, noting that the women were taught recipes for cookies, French fries, and tortilla-like bread made from the orange sweet potato flour.



Citing improvements from the Green Revolution, Prakash said, “We’re able to feed people in a reasonable manner but, they’re not getting quality food. They’re missing vitamin A, iron, and zinc – three major nutrients. It’s not a high-tech solution, people have already been growing and eating sweet potatoes, but we provided a variety that has an orange color and that makes it more rich in nutrients, and our body gets vitamin A. It’s a solution that’s helped by changing the diet a little bit.”

Before encouragement from the African government and international aid groups, Tanzanian farmers traditionally grew a different type of sweet potato, along with cassava, both “white foods,” said Prakash, which are drought tolerant but lack crucial micronutrients.

When the new variety was introduced to farmers, “the problem was, they were not able to make the traditional sweet potato foods the same way, so we helped them with a whole range of recipes.”

Started in 2014, the project emphasizes capacity building and outreach, and leverages cell phone technology to facilitate the development of microenterprises. Currently in the final phase of study, researchers are focused on evaluating impact. “We know they’re eating (the orange-fleshed sweet potato), and we want to make sure it is making a difference in health and growth,” said Prakash, noting that stunted growth and night blindness are frequent results of vitamin A deficiency.



“We have developed a questionnaire and now are getting detailed data on how the women feel, and on how much economic activity—how much extra money—they have been making. Like us, there are many people who are working on popularizing the orange-flesh sweet potatoes. Many are doing it, and I think collectively it has made a difference. I’ve been involved with sweet potato breeding the last 27 years. Today, we’re looking for how we can scale this up.”



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## SoilDoc + Climate: Researchers Improve Farmer-Centered Forecasting Device

Forward-thinking researchers Clare Sullivan and Johnson Semoka, two grantees funded through the Global Center for Food Systems Innovation, are piloting a new and improved version of the mobile soil management tool known as SoilDoc – first developed through the Earth Institute (EI) at Columbia University with support from the Alliance for a Green Revolution in Africa.

Renamed SoilDoc + Climate, the updated app incorporates data related to climate forecasts that gives farmers more information from which to make decisions. Sullivan, of EI, and Semoka, of Tanzania's Sokoine University of Agriculture, are currently managing the project as it undergoes field testing in the Morogoro, Junbae and Mbeya regions of Tanzania.

By harnessing data from the built-in GPS function, or generating data from manually-entered GPS coordinates, the app provides the user with information about historical precipitation trends, and the effects of El Nino and La Nina global temperature patterns.

Designed to be used by agricultural extension service providers, agro-input dealers, and importers, Sullivan said the app can improve income generation, and ultimately enhance food security and resiliency. By integrating weather and soil conditions to better predict the seasonal changes, SoilDoc + Climate can help reduce risks and maximize investments for farmers and extension workers.

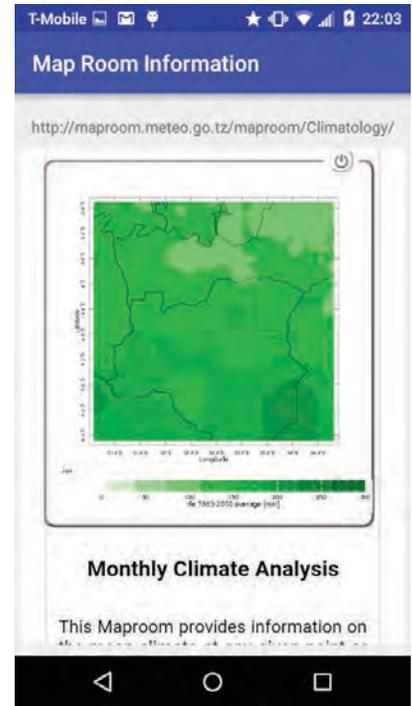
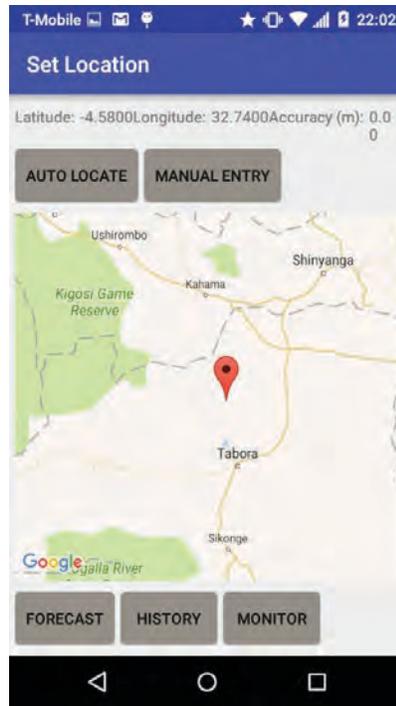


“Decisions based on site-specific soil conditions and weather forecasts will provide cost-effective use of inputs, such as fertilizer, and higher returns on investment, combined with surplus production,” Sullivan said.

So, how does it work?

SoilDoc + Climate diagnoses soil in a farmer’s field using mini-versions of laboratory meters to perform a suite of tests that assess nutrients and soil physical properties. All the instruments are battery powered and provide on-the-spot tailored results and recommendations, even in the most remote locations.

Designed to be used with 7-inch tablets, the app works on Android devices and is available through the Google Play.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Cooking, Cooling and Cultivating with Waste

When properly processed, decomposing human and animal waste has the power to change lives. While it might sound – and smell – funny, the power of poop lies in biogas, a renewable energy source produced during anaerobic digestion, or the breakdown of waste. Sped up through a system of digesters, the process yields a gas of about 60 percent methane that can be used for cooking, refrigeration, and other basic needs. Moreover, the waste itself can be processed and applied to fields to enrich the soil and improve crop production.

Researchers Rebecca Larson, assistant professor at the University of Wisconsin-Madison, and Vianney Tumwesige, CEO of Green Heat, a Ugandan energy company, teamed up on a host of projects in Kampala, Uganda that demonstrate new ways to transform waste to resource. Funded through the Global Center for Food Systems Innovation (GCFSI), the team developed and continues to evaluate a biogas-powered refrigeration unit; a waste separation system that yields no-cost fertilizer; and a dual-fuel stove that cuts down on deforestation while easing cooking challenges at a local school.

Traditionally, the cook at Kampala’s Lweza Primary School prepared meals for the students over a wood-burning stove. While reliable, the smoldering indoor fire caused poor air quality in the kitchen and contributed to the relentless harvest of timber. Seeking an alternative, the school switched to a biogas-powered stove, but struggled with the problem of burning through the biogas supply before the food was fully cooked.

To solve the problem, Larson and researchers designed a second-generation biogas stove that has the option to run on biogas or rewood. With the grant from GCFSI, the team refined the design and settled on a solution that gives the user flexibility to switch from biogas to rewood, or vice versa. Since being provided with the new dual-fuel stove, Lweza Primary School is able to improve indoor air quality and reduce wood consumption.

Building on the success of the dual-fuel stove, a team member from Green Heat modified a natural gas-powered refrigeration unit to run on biogas, which is cheaper and more accessible than natural gas. Like the stove, the modified cooler can run on more than one source of energy. “If you run it on biogas first, you can switch to electricity, and if the electricity goes out, you can switch to biogas,” said Larson. In a region that has unpredictable electrical service, multiple power options provides increased dependability.



But, harvesting the potential of waste doesn’t stop there – the waste itself can be put to use.

The team in Kampala successfully implemented a new low-cost slurry separation system that divides liquid waste, called effluent, from solid waste. Once the separated solids are dried, they can be applied to fields to enrich crop production. More desirable to handle than raw manure, and more economically viable than purchasing chemical fertilizers, the separated solids are a good alternative for cash-strapped farmers.

“The solid-liquid separator is very popular. We installed 50 of the systems. We designed it, and with this (GCFSI) grant we refined our design,” said Larson. “Green Heat built their inventory and have been installing them in Uganda, and will install some in Ethiopia. A lot of people weren’t managing the effluent, and it was going to the wastewater treatment, or worse off, running into a stream. We wanted a system to allow them to better manage the effluent from the digester.”

With the systems installed and refinements made, the team is busy evaluating performance and determining best practices for field application, water conservation, and other considerations.

Field data on the impact of separated solids on agricultural plots shows promise. Findings indicate that while actual grain production is consistent across different nutrient sources, use of separated solids on maize increases plant biomass, like leaves and stalks, which can be fed to livestock, or used to generate more biogas – continuing the cycle.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Contextualizing Irrigation Challenges in Rural Uganda

Irrigation is a high-priority issue in the largely rain-fed agricultural communities of Uganda. Without it, farmers struggle to adapt to tough growing conditions, from severe drought to disastrous flooding. However necessary, upfront system costs and top-down approaches have left many valuable crop plots at the whim of the weather.

Researchers Kate Scow and Abraham Salomon, both of the University of California-Davis, work in eastern Uganda, collaborating with local farmers, social advocates, and engineers on irrigation interventions that are flexible and community-managed. “Currently, a lot of vegetables are grown in other regions, often considerable distances away, and brought in even though the potential is there locally,” said Scow. By installing and maintaining an adaptable irrigation system that allows tomatoes, cabbage, beans and other vegetables to thrive in the dry seasons and the unpredictable rainy seasons, communities gain food security.

Funded by a grant from the Global Center for Food Systems Innovation, Scow and her team took a decidedly participatory and adaptive research approach to design irrigation systems that suit local conditions and farmers’ needs, and that are adaptable to unforeseen challenges.



Researchers work at six sites meeting regularly with groups of farmers, who formed farmer committees tasked with developing plans for an irrigation system for the local farmers.

Near the town of Jinja, said Scow, “The farmers and engineers agreed that the best plan was to install a centralized irrigation system that brought water to a large plot of land. Then, a large land owner would rent out small plots of the irrigated land to farmers.”

Everything was installed successfully, but the farmers were not leasing the plots. Discussion with farmers revealed that many of them, especially women, were uneasy about relying on land owned by just one landlord. “They were afraid if they invested in it, they wouldn’t have big enough plots to be able to actually make an income. Also, they were worried the rent would fluctuate with the water supply and access to the equipment.”

The local committee went back to the drawing board and designed a very different, decentralized system, where water was delivered to multiple small plots distributed throughout the landscape. Now the water would be controlled by the actual users themselves. “Though it required pulling out the original system, the second time we all

tried to really listen to one another and pay better attention to the needs of everyone.”

Scow said that the Jinja site showed the importance of developing an irrigation system that is flexible and can be adapted to changing needs and the dynamics of human relationships. While irrigation is a high-priority issue in Uganda, she said it is pointless to develop a system that is not flexible to the social dimensions and tensions of the farming community.



“Flexibility is required in dealing with the social norms and constraints that must also be considered in setting up the shared infrastructure often typical of irrigation projects. Some of the social aspects are more complicated than the technologies themselves, and they can make or break implementations of a good irrigation system,” said Scow.

“The ultimate goal of the participatory research is an empowering process for farmers to handle challenges and influence the direction of their own lives. We thought we would be focusing on irrigation technology intervention, but often finding ways to deal with the challenges of complex social interactions is the type of innovation most needed.”

Going forward, researchers will continue to receive feedback from stakeholders at the six sites. Their on-the-ground experience serves to more fully identify emerging issues that lead to greater, or lesser, empowerment over the farmers’ use of irrigation.

“All of these activities are feeding into our goal of co-creating a framework and planning tool for organizations to consider the real needs of African smallholders, especially women, when developing irrigation programs,” said Scow.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Dual-Platform Bean Thresher Reduces Burden from Women’s Backs

After receiving a technology evaluation grant from the Global Center for Food Systems Innovation, Michigan State University graduate Adam Lyman traveled to Zambia in 2016 to evaluate the effectiveness of a bicycle-powered bean thresher. Originally developed to thresh pigeon peas grown in Guatemala, the thresher concept was adapted and re-created to effectively shuck common beans, a staple food in the northern province of Zambia.

Arriving in the small town of Kasama last April, Lyman began assembling the thresher, which he constructed on the campus of MSU with support of faculty researchers Ronald Averill and James Kelly. Compared to other project challenges, transporting the thresher was a no-brainer. “I packed it in suitcases,” he said, “I packed it with my socks!”

While mechanization of farming practices has increased throughout much of Africa, including southern and central Zambia, northern Zambia remains more traditional, and the foundation of mechanization is still being established.

“Currently, bean threshing is performed by heaping plant material onto the ground and beating it with sticks. After beating, bean seed is collected and placed into shallow, round baskets. These baskets are then raised above the laborer’s head,” said Lyman, “and poured into an additional basket on the ground. As the seed falls from one basket to the other, dirt and small plant debris are blown from the seed. This process is called winnowing, and is repeated several times until most of the unwanted material has been removed.”

Designed to shuck beans four times faster than the manual method, the bike-powered bean thresher speeds up processing and eases physical strain felt by laborers, who are mostly women.

“I can say we’re reducing time, but what I perceive as the problem is different than what they perceive as the problem. If I ask the men, ‘No, there’s not a problem,’ they say. But, they’re not always doing the work. In talking to the women,” Lyman said, “yes, time was part of the problem, but a large part of the problem with threshing is physical discomfort. Dust in the eyes and mouth. Back and wrist pain. And that information helps to solidify the design. The problem I’m trying to solve is not necessarily bean threshing rates – rather, we’re trying to increase bean production to help alleviate poverty and malnutrition. This is an intensely complex problem and increasing bean production in no way will be a silver bullet.”



Working with the Zambia Agriculture Research Institution, Lyman gathered feedback from local farmers through a survey and a participatory evaluation.

“We drove around in a convoy—a Land Rover packed with people to administer the surveys, and a pick-up truck with the bean thresher strapped in the back. I showed up with a working prototype, but first surveyed (the community) as if there was no machine.”

The baseline data collected during the survey gives researchers insight to the overall problems associated with bean processing, and contextualizes the issues that would ideally be addressed by the bean thresher. Following the survey of 270 farmers, 135 participants took turns hopping on the stationary bike and pedaling their way to a heap of clean beans.

Since the evaluation phase, Lyman has been working to modify the thresher in response to user feedback. “The majority of farmers were content with the bike,” he said, “but some requested motor power... Based on their scale of production, and level of income, some farmers thought a solar powered device would be more appropriate.”

Harnessing the eager minds of MSU engineering students, Lyman sponsored a project through Brian Thompson’s Humanitarian Engineering class in the fall of 2016. Working with Lyman, the group developed a prototype of a solar-powered platform, designed specifically for the bean thresher. “The point was to develop a new iteration on users’ feedback,” said Lyman. “The bicycle platform was also modified, and the second option, solar, can be presented back to farmers and ask, ‘How does this fit into your production scheme?’”

Back in East Lansing, Lyman continues to paw through over 5,000 pages of survey responses and evaluation data. In hopes of returning to Zambia and testing the new solar power platform, he’s also judiciously seeking sources of follow-on funding. “If we continue to get supported to finish the project, that’s how farmers will see the impact.”



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

# Advancing India's Food Security with Low-Impact Refrigeration

While hunger plagues a quarter of India's 1.3 billion people, food losses continue to stack up, rotting and wilting during post-harvest and processing. To improve on-farm food storage and divert food waste, a team of researchers funded through the Global Center for Food Systems Innovation are implementing two types of evaporative cooling (EC) technology.

Led by Sangeeta Chopra, of the Indian Agricultural Research Institute (IARI), and Randy Beaudry, of the Department of Horticulture at Michigan State University, the team has constructed four EC structures on the IARI campus in New Delhi. Designed to stand alone or be retted with a refrigeration system to improve cooling, the storage structures keep food cool through two types of evaporative cooling technology.

The first – high porosity bricks – enhances evaporation and cooling potential, similar to how a clay pitcher keeps water cool in hot environments. The second runs on a solar-powered refrigeration unit, keeping electricity costs low and making it more practical for farmers to use. The solar-powered unit also provides a renewable energy source for activities in village communities.

Explaining the science behind the cooling technology, Chopra said, "The walls of the structure are wetted at a controlled rate to achieve maximum evaporative cooling. The design and material for the roof and floor have also been optimized for lowest heat transfer."

Aimed at increasing the capabilities of smallholder farmers in India, the team is comparing the performance of different materials used in the storage container walls, which include pervious concrete, traditional brick-sand-brick layering, and mesh-supported fabric. The results of the tests are used to validate mathematical models that predict performance.

Discussing preliminary results, Chopra said, "A fabric-covered mesh structure with low thermal mass and high thermal transmittance outperforms other designs, cooling faster and obtaining lower temperatures. (It) also cost significantly less to build, and was easier to construct than brick- or concrete-based designs."

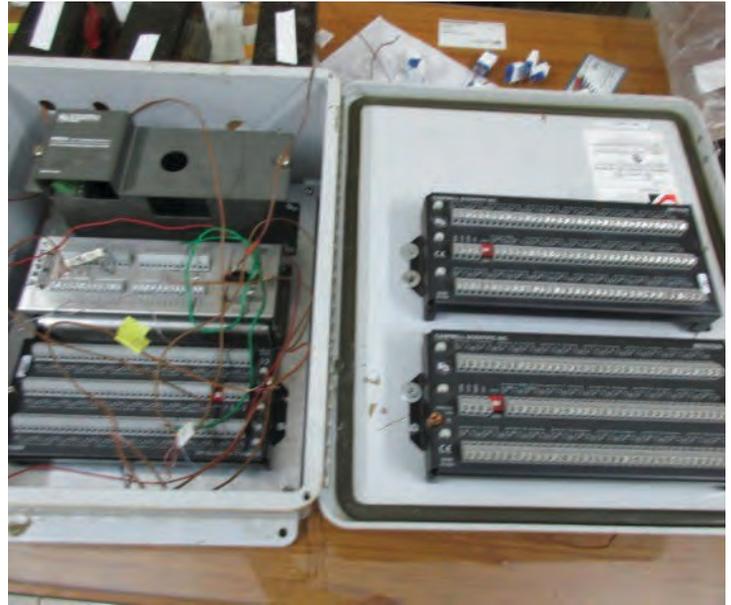
Back in the States, the team has partnered with Turbo Ventures to develop a specialized solar-powered refrigeration compressor at Michigan State University.

With advanced cooling technology and improved refrigeration capacity, low carbon footprint storage containers decrease food waste and enhance food security. Even if just one-fourth of the food lost globally were saved, it would feed 870 million hungry mouths.





Prototypes of cool storage structures



Solar refrigeration system



Testing the AAC blocks for strength



Hydrogen bubbles in the AAC block keeps them oat



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Modeling Cassava, the “Rambo” of Food Crops

Referring to the film series starring Sylvester Stallone as a brute survivalist, researcher Julian Ramirez-Villegas joked, “cassava is the ‘Rambo’ of the food crops.” Extremely resistant to variable climate conditions, the starchy tuber is the focus of a new simulation model that recommends best practices for the popular crop.

Leveraging a grant from the Global Center for Food Systems Innovation, Ramirez-Villegas and his researcher partner, Tin Maung Aye, both of the International Center for Tropical Agriculture, developed a computer model that simulates cassava growth based on field data the team generated while working in Vietnam.

By utilizing data on water balance, phenology, photosynthesis, and carbohydrate distribution within the plant, the model considers climate, crop strain, fertilizer, and soil type and predicts the best growing conditions for maximum yields.

“We’re going to use that model to define appropriate management recommendations to increase yields and increase livelihoods in Southeast Asia,” said Ramirez-Villegas.

“It is not practical to think that the local farmers will be directly using this model, as that would require a desktop computer to be common household technology.”

Instead, a farmer will work with an extension agent who will put the farmer’s growing conditions into the model, and tell them the ideal situation to maximize cassava yield.

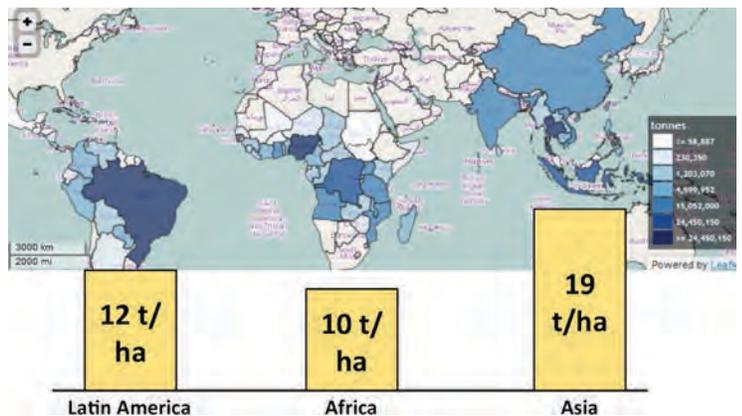
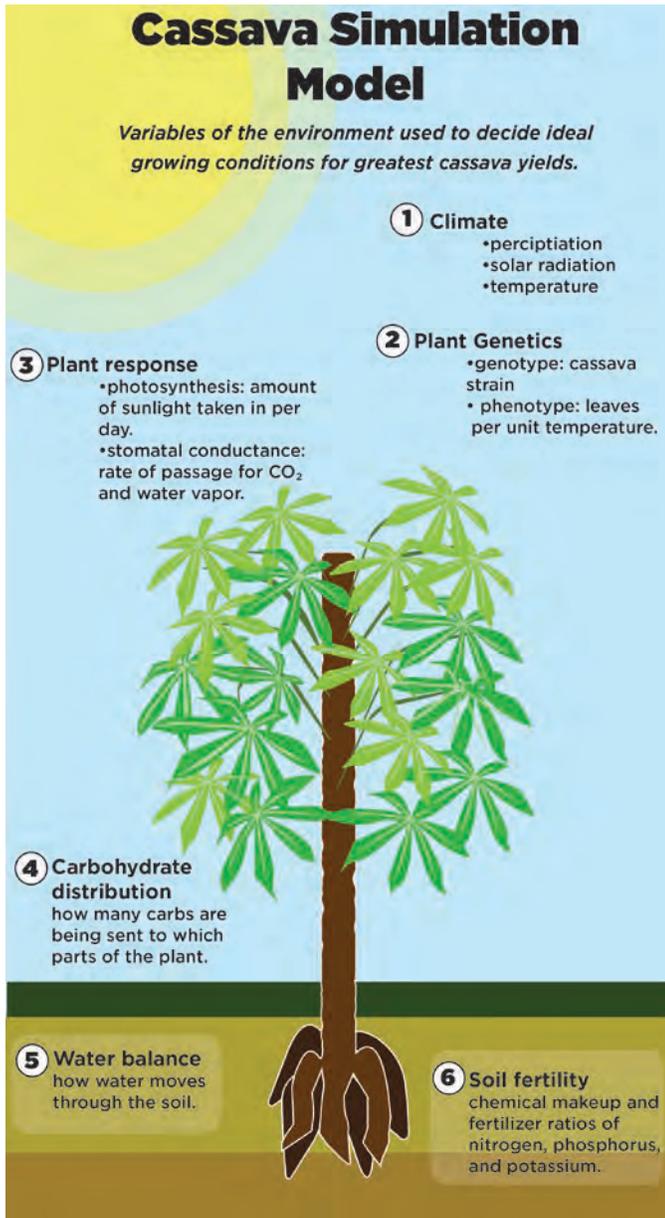
The agent will visit the farmers plot, and collect data from the plant itself and the surrounding environment. By collecting data the simulation device can diagnose growing conditions that are not favorable to yields, such as nitrogen deficiency in the soil, unfavorable energy distribution among the plant parts, or use of a less than ideal strain of cassava.

Also called yucca, cassava is commonly used to make flour, and is popular to grow due to its ability to adapt to weather fluctuations.

“If it is too dry, the crop shuts down and waits for a couple weeks or even a month for favorable conditions to come back. If it’s too hot, its yields do not go down, at least not as quickly as wheat, maize, or rice,” Ramirez-Villegas said. “It also requires very little income, so anyone can grow it. It’s ideal for resource-poor farmers.”



According to the team's research, when grown in optimum conditions, cassava yields have the potential to increase substantially. And, by utilizing the simulation model to test different "what if" scenarios, farmers are given insight to make further educated decisions. The combination can lead to enhanced food and income security for smallholders in Vietnam and beyond.



*The six attributes highlighted in the diagram – climate, plant genetics, plant response, carbohydrate distribution, water balance, and soil fertility – indicated the variables tested by the simulation model.*



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu

## Coconut Farmers Receive Valuable Warnings Via Text

Contrary to its name, the coconut is not a nut – it’s the largest stone fruit in the world. Sold in the food and beverage industry, harvested for construction purposes, used in cosmetics, and transformed into decorative objects, the coconut has many applications. While a quarter of the world’s coconut production stems from the Philippines, the country’s coconut farmers are the poorest around the globe. With earnings hovering at \$2 a day, stagnant wages are exacerbated by low production, climate hazards, pests and unfavorable market conditions.

To improve the viability of coconut farming in the Philippines, researchers Ana Herrera and Leo Tobias leveraged a grant from the Global Center for Food Systems Innovation to implement FarmerLink, a Grameen Foundation project that connects farmers with agents who can provide insight into operating a successful coconut farm.

One component of FarmerLink is the Early Warning System, a large-scale digitally connected program that alerts farmers to potential hardships posed by natural shifts in the environment. “We envision the Early Warning System to use on-the-ground data from our field agents (on) weather information and pest and disease models to produce SMS messages sent directly to farmers to warn them against extreme weather events and potential pest and disease outbreaks,” said Herrera.



By early 2017, Herrera and her team trained and deployed ten FarmerLink agents from the Philippine Coconut Authority and Franklin Baker Company of the Philippines. The training focused on the FarmerLink program, communication skills, engaging farmers effectively and the mobile tools. Content development of the coconut mobile tool kit included the design and development of mobile surveys that register farmers so they can receive SMS alerts on weather, pests and diseases, good agricultural practices and financial literacy training.

“Apart from the text messages sent directly to farmers, reports and dashboards will also be available for private and public sector partners to enable them to make decisions for quick response and pest and disease control,” Herrera said.

The project is first of its kind, and aspires to be at over 2,000 coconut farmers. Project partners include Philippine Coconut Authority, Palantir Technologies, aWhere and engageSPARK.



Launched in 2012, the Global Center for Food Systems Innovation at Michigan State University is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu



## About GCFSI

Michigan State University's Global Center for Food Systems Innovation addresses critical pressures on the world's food supply by creating, testing and enabling the scaling of solutions. GCFSI takes a multidisciplinary approach that encompasses the entire food system and considers major environmental, economic and social trends, as well as workforce development needs that will impact future food security. Launched in 2012, GCFSI is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



@GCFSI



@GCFSI



gcfsi.msu.edu



MICHIGAN STATE  
UNIVERSITY

Global Center for Food  
Systems Innovation

## Appendix 7: SELECT GCFSI COMMUNICATIONS PRODUCTS

The following pages include select communication products generated by GCFSI staff during the reporting period, excluding Stories from the Field and any stories or podcasts that first appeared on the Food Fix.

# Action Research in Malawi: Students, Apply Now!

Published: *Thursday, 16 Mar 2017*

Author: Katie Deska

Department: Global Center for Food Systems Innovation

MSU's [Global Center for Food Systems Innovation](#) is now accepting applications for the third annual [Frugal Innovation Practicum](#), an experiential, service-learning opportunity offered June 25 - August 24, 2017. The practicum is open to graduate and upper-level undergraduate students in diverse disciplines and will provide students with a deeper understanding of food environments in urban Africa.

Led by [Dr. Stephanie White](#), an assistant professor in the Department of Community Sustainability, the practicum combines online and in-person classes; two half-day Michigan-based field trips; and two weeks of hands-on field work in Malawi, Africa.

While abroad, students from MSU will collaborate with their counterparts from Malawi's [Lilongwe University of Agriculture and Natural Resources](#) and engage small- to medium-scaled food entrepreneurs. Through action research at urban food markets, the group will work to identify and propose appropriate (or, frugal) solutions to common problems in urban markets.

"It opens you up to the international development space and that's something that every student needs to learn to navigate in an increasingly globalized world. You get to work with real world problems with your peers from a different institution," said MSU graduate Trish Abalo, who attended the practicum in 2015 before joining the staff of GCFSI last year. "This program is an amazing investment because the returns far outweigh any costs. For me, that's meant I had an internship with the federal government, directly because of this program, specifically with the U.S. Agency for International Development. And, the program has led me to my very first job out of college."

Although the practicum is not affiliated with any particular course for credit, nor with MSU's Office of Study Abroad, a number of former practicum students have arranged with their departments to receive course credit. For details and the application, please visit [Frugal Innovation Practicum, 2017](#).

"You know those moments that completely change your life and you can't exactly get across to people why?" said Abalo, "The Frugal Innovation Practicum has been that for me, and continues to shape me in ways I can't even say to people."

Click [here](#) to learn more about Abalo's story, or [listen](#) to Dr. White discuss the program, which she launched through GCFSI in 2015.

*Housed within MSU's department of International Studies and Programs, the Global Center for Food Systems Innovation addresses critical pressures on the world's food supply by creating, testing and enabling the scaling of solutions. GCFSI takes a multidisciplinary approach that encompasses the entire food system and considers major environmental, economic and social trends, as well as workforce development needs that will impact future food security. Launched in 2012, GCFSI is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.*

# Innovation through Education: GCFSI hosts workshop at Malawian university

Published: *Thursday, 26 Jan 2017*

Author: Katherine Laurel Deska

Department: Global Center for Food Systems Innovation

Like in the US, the private sector in Malawi relies on an educated and creative workforce to lead the nation through the next phase of growth. And, as the county's premier agricultural college, the Lilongwe University of Agriculture and Natural Resources (LUANAR) has the opportunity to heavily impact the region's progress toward food security.

In the midst of a multiyear drought, Malawians face unpredictable growing seasons, stunted crop yields, and related hardships such as malnutrition and loss of income. An increasing population, coupled with the trend of urbanization, adds further strain to farmers and families. To address the current challenges, researchers, educators, students and government officials focus on developing innovative solutions to tackle the system food insecurity issue.

To that end, Michigan State University's Global Center for Food Systems Innovation (GCFSI) partnered with LUANAR to host the inaugural Innovation Scholars Program, a 12-month professional development program designed for faculty and administrators in Lilongwe.

"We're attempting to solve issues around food security by empowering LUANAR faculty to create their own solutions," said Kurt Richter, assistant director of GCFSI. "Arriving at innovation means something has to be done differently—to change the outcome you have to change the thinking."

With that in mind, GCFSI held the third workshop for scholars on the Lilongwe campus in December of 2016.

Throughout the three-day workshop, facilitators took time to emphasize 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.

Aimed at catalyzing the skills of faculty and administrators at LUANAR, the Innovation Scholars Program encourages participants to conceptualize solutions to real-world problems utilizing local knowledge. Rather than lecturing at participants, the Innovation Scholars Program is designed to engage LUANAR staff as they conceptualize solutions to current problems. To do so, faculty members receive grants used to fund solution-focused research projects, which are informed by content presented during the series of workshops.

"You know when you go to a good conference and leave with all these great ideas, and then never find a way to apply them? We're trying to stop that from happening," said Richter, noting that one participant is developing an app for tutoring biochemistry.

While the university has been growing in popularity—jumping from 1,000 to 6,000 students over the last decade—teachers and students continue to face logistical challenges, including a lack of electricity and internet, unwieldy class sizes, and a shortage of classroom space. Although such challenges have the potential to impede student success, there remains viable opportunity for innovative thinking that plays a role in alleviating food insecurity.

# GCFSI Innovator Develops 2-in-1 Tool for Planting Maize

Published: *Thursday, 02 Feb 2017*

Author: Katie Deska

Department: Global Center for Food Systems Innovation

Of the 52 million people who call Tanzania home, 70 percent are farmers by trade, relying on tractors or hand tools to plant seeds year after year. While the efficiency of hand tools pales in comparison to the use of a tractor, the tractor is too expensive for many households.

Salim Msury, an engineering student at the country's Arusha Technical College, sought to develop a low-cost alternative, which he has been actively testing in nearby villages. Made possible through the Global Center for Food Systems Innovation, one of USAID's eight global development labs established by the agency's Higher Education Solutions Network, the two-in-one mechanical soil ripper and seed planter is a simple, yet innovative tool that hits the sweet spot of affordability and productivity.

Rolled along the ground like a wheelbarrow, it slices a small trench in the soil with a narrow point. As it moves down the row – either pushed by humans, or pulled by livestock – seeds automatically drop from a container into the soil. By combining the ripping and planting process with a single tool, it saves farmers time and conserves labor costs.

Because Msury's ripper and planter is cheaper than a tractor, yet more efficient than traditional hand tools, the innovation has been well received in the field. However, he experienced some pushback from farmers who prefer the tractor's ability to till a more sizable swath of land with ease.

In response, Msury engaged in conversations with farmers about land conservation, and discussed how tractors can contribute to soil erosion, further aggravating the impacts of drought. Once farmers understand how the ripper and planter saves time by combining the ripping and planting process into a single mechanism – and also protects their land, they are eager to give it a try, said Msury.

Dedicated to improving the tool, he and his team collected feedback from farmers who tested it, and refined the design accordingly.

Elirehema Petro, a local farmer in the Engorora village of Arusha, provided Msury with an idea

for improvement, stating, "it has a good ripping but it needs to have a depth control and a guide or mark for the animals to follow in order to make a ripping path straight."

The latest generation is made primarily out of steel and accommodates soft and semi-hard soil. It's designed to drop seeds with adequate spacing for maize crops, though Msury would like to engineer attachments for the machine that would allow the user to plant different types of seeds, depending on spacing and size requirements.

With agricultural goods contributing to 30 percent of Tanzania's export profits, "there is big money in farming and there are a lot of cash crops," said Msury, "But it has to be done in an efficient way."

East Lansing, Mich.  
December 21, 2016

## **Mobilizing Innovators to Address Food Security: Three examples from the Global Center for Food Systems Innovation at Michigan State University**

### **Anaerobic digestion heats up innovation in Uganda**

To tackle the problem of energy availability and waste treatment in and around Kampala, Uganda, Dr. Rebecca Larson, assistant professor at the University of Wisconsin—Madison, partnered with Vianney Tumwesige of CEO of Ugandan-based Green Heat, and W2E on a grant project funded through the Global Center for Food Systems Innovation at Michigan State University.

A continuing theme within their project is education and community outreach, which is executed on the demonstration site and at other locations throughout the area. Larson and her team developed, introduced and are testing multiple innovations, including a dual-fuel stove that can run on biogas and firewood, which is currently in operation at Lweza Primary School, located in Kampala District.

To facilitate collaboration and peer-to-peer learning among locals, the team visited Rwanda to see another demonstration site that featured anaerobic digestion and other practices.

“They were really inspiring each other. Some Ugandans saw how great the site was in Rwanda and it drove them to develop their site to be better,” said Larson. “The key thing is always having someone from the community.”

In addition to working with the innovators and end-users, the biogas systems are being used for education. Through Lweza Primary School and Makerere University, among other forums, the research engages students and stakeholders to teach them the science behind anaerobic digestion and the practical application of biogas to their households, schools, and businesses.

### **Community of scholars create culture of innovation in Malawi**

With the establishment of the Innovation Scholars Program at the Lilongwe University of Agriculture and Natural Resources (LUANAR), the Global Center for Food Systems Innovation (GCFSI) unites and builds upon the network of innovators in and around Lilongwe, Malawi. Launched in June of 2016, faculty and administrators at LUANAR continue to receive the tools and support necessary to bolster a culture of innovation at the university and beyond. Through a series of ongoing workshops, participants are guided through the development of 10 design teams, each of which received funding for research through the program. In addition, the program is facilitating an ongoing conversation between the private sector, stakeholders and universities on their current needs for innovation, skilled graduates and relevant research that targets food system innovation.

A field trip scheduled for the coming spring will take the scholars Nairobi, Kenya to a technology innovation community that involves public and private sector universities and the iHub, a technology incubator. The scholars will be immersed in the innovation ecosystem developing in the region, and can bring back ideas and make connections that can be further refined at the newly established Innovation Hub at LUANAR. The Hub creates space for researchers to use their academic training to solve problems in the food system in Malawi, and provides students a platform to gain the skills to address local challenges.

To further advance progress in the local food system, GCFSI provided grants to faculty members who identified specific local problems that need solving. This serves to catalyze the scholars' skills as researchers to be used on creating practical solutions to the problems, such as reducing levels of aflatoxins in locally-grown maize; diversifying farmers' income sources; developing a locally-sourced protein for animal feed that can further enrich the nutritional value of the food supply.

### **Practicum targets food accessibility at market level**

The Frugal Innovation Practicum, a program of the Global Center for Food Systems Innovation (GCFSI) at Michigan State University (MSU), addresses food security in the urban centers of Lilongwe, Malawi by focusing on local "wet" markets, critical points of food access and food-based livelihood. In doing so, GCFSI addresses some of the most critical and broadly relevant aspects of urban food insecurity, including availability of safe and affordable food.

The citizens of Lilongwe have to shop multiple times a week because of limited income, inconsistent electricity and lack of refrigeration. As a result, the market traders are the urban population's access for food.

The Frugal Innovation Practicum—conducted in partnership with the Lilongwe University of Agriculture and Natural Resources (LUANAR)—was a rigorous, hands-on educational experience that culminated with a two-week trip to Malawi where MSU and LUANAR students studied urban markets, spoke with urban food retailers about obstacles and opportunities in food-based livelihoods, and then presented their findings to local government officials. Over a year later, their involvement continues to pay serious dividends.

Over 2 million kwacha, or \$3,000 USD, was dispersed to four Lilongwe markets at the end of November 2016. The money is managed by the local market committee, and used to fund specific improvement projects, including fixing a public restroom, installing lighting, and building a security gate. "Students (in the Frugal Innovation Practicum), went through the planning process with the market committee, and the city council was there listening-- and that's something that doesn't happen," said Dr. Stephanie White, of the

Global Center for Food Systems Innovation at Michigan State University. "We want city council to be able to see that, given the chance and the resources, people in the markets will plan it, manage it, and be successful. It will help city council feel better about reinvesting local tax dollars to the markets."

Prior to the work of students in GCFSI's Frugal Innovation Practicum, market vendors struggled with accountability, transparency and communicating with city council. Now, with the establishment of a market committee, locals have a platform to improve relations with the council and work together to plan additional improvements to the markets. The model of linking LUANAR, a local university with public and private sectors reflects a commitment to the land-grant model of community engagement.

To celebrate the transfer of funds to the bank account of each market committee, a ceremony was held in Tsoka Market on November 30, 2016.

###

#### **About Global Center for Food Systems Innovation (GCFSI):**

Founded in 2012, the Michigan State University (MSU) Global Center for Food Systems Innovation (GCFSI) is one of only eight development labs supported by the [US Global Development Lab](#) at the [United States Agency for International Development](#) (USAID).

Dedicated to improving global food security, GCFSI seeks to create, test and enable the scaling of innovations in the food system. Employing a multi-disciplinary approach, GCFSI focuses on the entire food system and is forward-looking – considering major environmental, economic, and social trends and workforce development needs that will impact future food system performance.

#### **Media Contact:**

Katie Deska

Communications Manager

Global Center for Food Systems Innovation

Michigan State University

Manly Miles Bldg., Rm. 308

1405 S. Harrison Rd.

East Lansing, MI 48823

Tel: 517.884.8507 | [deskakat@msu.edu](mailto:deskakat@msu.edu) | @GCFSI

<http://gcfsi.isp.msu.edu/>

<https://msufoodfix.wordpress.com/>

Newsletter - December 5, 2016

## GCFSI Participates in TechCon at MIT, Boston

November 10-12, 2016



Students, faculty, development experts, researchers, and entrepreneurs gathered together at MIT to explore how science, technology, and innovation can solve tomorrow's development challenges.

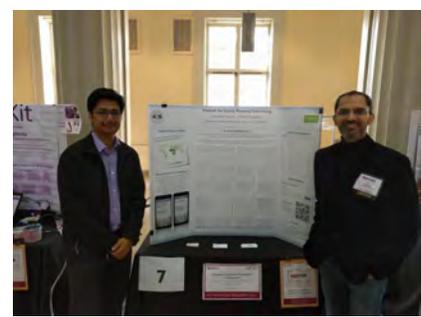
Dr. Andy Safalaoh (left), Associate Professor in Animal Nutrition, traveled from Lilongwe, Malawi to attend TechCon, held at Massachusetts Institute of Technology (MIT). The coordinator for the Innovation Hub at Lilongwe University of Agriculture & Natural Resources (LUANAR), Safalaoh collaborates with GCFSI on projects including LUANAR's Innovation Scholars Program, designed to elevate the research and innovation skills of faculty and administration, and train the next generation of food system entrepreneurs.

Safalaoh shared his experience with the Innovation Hub during a panel moderated by GCFSI's Assistant Director Kurt Richter. Richter led the discussion, which focused on the ins-and-outs of developing innovation hubs.

Also in from Malawi was Dr. Sera Gondwe (right), faculty member at LUANAR, who presented at TechCon on strategies for staying in control of content. "Who do I have to engage to get to where I am?" said Gondwe. "It's about context. It has to start with you. You have to push."

TechCon 2016, co-hosted by MIT and USAID, featured some of the many successful GCFSI-funded innovations from students and alumni researchers.





GCFSI faculty and student participating at TechCon panel discussions and Innovation Marketplace.

## Bicycle Bean Thresher pedals on in Zambia

Adam Lyman took a break from his research in Zambia to present his findings thus far at TechCon. Lyman said the most exciting of presenting at TechCon was to see the innovation he created three years ago, as a graduate student at Michigan State University (MSU), not only being shared with farmers in Zambia, but also with members of international development community. Below is the video GCFSI made for Lyman to share at TechCon. Could your agricultural innovation be next?



Watch the full video [here](#).

## Making Sorghum Available, and Easy to Eat

Sorghum is a cereal grain that grows tall like corn. It originated in Africa, where it has grown for 10,000 years. Bread and porridge are the most common foods prepared from sorghum. It is the main source of energy, protein, vitamins and minerals for millions of people.

Sorghum's biggest advantage is that it resists heat and drought. It survives extreme conditions with little water. Still, it's not as popular as wheat or corn because of its complex protein structure that makes it hard to digest. That's a hard crop to crack right?

Well, Nana Baah Pepra-Ameyaw, a doctoral student in the Department of Food Science and Human Nutrition at MSU, studies how to process Sorghum to make it easier to digest. His research could improve food security by making sorghum easier to process and eat in food-scarce regions of the world. He spoke to Ali Hussain, a reporter for The Food Fix, the multimedia and storytelling platform of the GCFSI Translational Scholars Corps. [Listen to the podcast](#)



Nana Baah Pepra-Ameyaw

## Tiny Little Livestock Solving Big Problems

Could a plate full of these little insects be the future of the American diet?

The Food and Agriculture Organization (FAO) estimates the world's population will grow to 9 billion by 2050. And it will take a big increase in food production to feed all those people.

Eating insects is well-established in Africa, Asia and Australia. But the agency concludes that the practice called entomophagy should increase in North America as well.



The problem: It's hard to convince people to eat bugs. How will the Great Lakes region find solutions to these problems? [Read More](#)

## Zambia Report: Maize Production

Prof. Eric Crawford, Director of GCFSI, and Ryan Vroegindewey, Research Assistant with the MSU Department of Agricultural, Food and Resource Economics, recently released a paper that presents findings on maize production and analysis of climate resistant maize varieties. Entitled, "Crop Budgets for Maize Production Costs and Returns: Zambia, 2010/11 to 2013/14," the paper is the first in a series of reports on Zambia, and was made possible through the support of USAID.

### Some Results

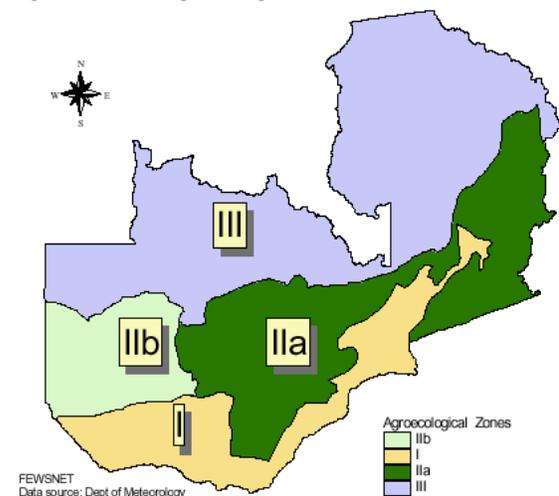
To the right is a map of Zambia's agroecological zone (AEZs), drawn from Davies, Greenberg and Swanepoel (2015).

1. The most suitable zone for maize is AEZ IIa. This zone includes most of Central, Eastern and Lusaka Provinces. (See Figure 2 for a map of Zambia's provinces.)

2. AEZ III is moderately suitable for maize, characterized by higher rainfall but lower fertility and sometimes acidic soils. This zone includes Northwest, Copperbelt, Luapula, and Northern Provinces (now divided into Northern and Muchinga Provinces).

3. AEZ I is marginally suitable for maize, being generally hot and dry. This includes part of Western Province, Southern Province and low-lying parts of Lusaka-- the country's capital-- and Eastern Provinces.

Figure 1 : Zambia Agro-ecological Zones



[Read more](#)

## New Publication: Gender relations along the pigeon pea value chain in Malawi.

If pigeon pea is to be promoted for sustainable intensification within maize dominated systems as a means for increased food security outcomes, the gender dynamics which influence adoption and expansion of the legume at farm level, and the performance of the post-farm nodes of the value chain need to be clearly understood and considered in the design of innovations.

GCFSI researchers Nathalie Me-Nsope<sup>1</sup> and Michelle Larkins published a paper on using a gendered approach to value chain analysis to examine pigeon pea as an example of a multipurpose legume in Malawi.

They recognize that: 1) it takes more than just growing more legumes to make people more food secure. The food has to be distributed. [Read Full Paper](#)

## MSU Grad returns to Campus, Joins GCFSI

MSU alumni Katie Deska ('08) joined GCFSI last month as the Center's communications manager. Prior to joining GCFSI, Deska was a reporter for a news magazine in the Detroit area. "I'm looking forward to the day I get to travel abroad and see some of the innovations in action," said Deska.

Keep her in the loop at [deskakat@msu.edu](mailto:deskakat@msu.edu).

## Protecting Potatoes

### When All Your Money Is Underground

French fries, hash browns and crispy chips come to mind when we think about potatoes. Potatoes are the most widely consumed crops in the United States, and the world's fourth-largest food crop, after maize, wheat, and rice.

Potatoes grow on almost every continent. They adapt well to climate and are a good source of potassium, vitamin C and carbohydrates. Their greatest enemy is soil borne diseases. Currently, those diseases are controlled by fumigating the soil with chemicals. That's expensive both economically and environmentally. And it kills beneficial organisms!

Luke Steere, a doctoral student in the Department of Plant, Soil and Microbial Sciences at Michigan State University, says potatoes have chosen him. Why? He talks to Ali Hussain about his research of molecular techniques and how it could reduce fumigation and improve production of potatoes.

[Listen to the Podcast](#)



## Uganda: Anaerobic Digestion Heats Up Innovation

To tackle the problem of energy availability and waste treatment in and around Kampala, Uganda, Dr. Rebecca Larson, assistant professor at the University of Wisconsin-Madison, partnered with Vianney Tumwesige, CEO of Ugandan-based Green Heat, and W2E on a grant project funded through the Global Center for Food Systems Innovation at Michigan State University.

A continuing theme within the project is education and community outreach, which is executed on the demonstration site and at other locations throughout the area. Larson and her team developed, introduced and are testing multiple innovations, including a dual-fuel stove that can run on biogas and firewood, which is currently in operation at Lweza Primary School, located in Kampala District.

To facilitate collaboration and peer-to-peer learning among locals, the team visited Rwanda to see another demonstration site that featured anaerobic digestion and other practices.

"They were really inspiring each other. Some Ugandans saw how great the site was in Rwanda and it drove them to develop their site to be better," said Larson. "The key thing is always having someone from the community."

In addition to working with the innovators and end-users, the biogas systems are being used for education. Through Lweza Primary School and Makerere University, among other forums, the research engages students and stakeholders to teach them the science behind anaerobic digestion and the practical application of biogas to their households, schools, and businesses.



# Malawi: Cultivating Entrepreneurial Scientists

Like in the US, the private sector in Malawi relies on an educated and creative workforce to lead the nation through the next phase of growth. And, as the country's premier agricultural college, the Lilongwe University of Agriculture and Natural Resources (LUANAR) has the opportunity to heavily impact the region's progress toward food security.

In the midst of a multiyear drought, Malawians face unpredictable growing seasons, stunted crop yields, and related hardships such as malnutrition and loss of income. An increasing population, coupled with the trend of urbanization, adds further strain to farmers and families. To address the current challenges, researchers, educators, students and government officials focus on developing innovative solutions to tackle food insecurity, a systemic issue.

To that end, Michigan State University's Global Center for Food Systems Innovation (GCFSI) partnered with LUANAR to host the inaugural Innovation Scholars Program, a 12-month professional development program designed for faculty and administrators in Lilongwe.

"We're attempting to solve issues around food security by empowering LUANAR faculty to create their own solutions," said Kurt Richter, assistant director of GCFSI. "Arriving at innovation means something has to be done differently-- to change the outcome, you have to change the thinking."

With that in mind, GCFSI held the third workshop for scholars on the Lilongwe campus in December of 2016.

Throughout the three-day workshop, facilitators took time to emphasize 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, along 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, attended the event to express unique perspectives and answer questions.

Aimed at catalyzing the skills of faculty and administrators at LUANAR, the Innovation Scholars Program encourages participants to conceptualize solutions to real-world problems utilizing local knowledge. Rather than lecturing at participants, the Innovation Scholars Program engages LUANAR staff as they conceptualize solutions to current issues. Faculty members receive grants used to fund solution-focused research projects, which are informed by content presented during the series of workshops.

"You know when you go to a good conference and leave with all these great ideas, and then never find a way to apply them? We're trying to stop that from happening," said Richter, noting that one participant is developing an app for tutoring biochemistry.

While the university has been growing in popularity-- jumping from 1,000 to 6,000 students over the last decade-- teachers and students continue to face logistical challenges, including a lack of electricity and internet, unwieldy class sizes, and a shortage of classroom space. Although such challenges have the potential to impede student success, there remains viable opportunity for innovative thinking that plays a role in alleviating food insecurity.

# Malawi: Improving Wet Market Operations

The Frugal Innovation Practicum, a program of the Global Center for Food Systems Innovation (GCFSI) at Michigan State University (MSU), addresses food security in the urban centers of Lilongwe, Malawi by focusing on local "wet" markets, critical points of food access and food-based livelihood. In doing so, GCFSI addresses some of the most critical and broadly relevant aspects of urban food insecurity, including availability of safe and affordable food.



The citizens of Lilongwe have to shop multiple times a week because of limited income, inconsistent electricity and lack of refrigeration. As a result, the market traders are the urban population's access for food.

The Frugal Innovation Practicum-- conducted in partnership with the Lilongwe University of Agriculture and Natural Resources (LUANAR)-- is a rigorous, hands-on educational experience that culminates in a two-week trip to Malawi where MSU and LUANAR students studied urban markets; spoke with urban food retailers about obstacles and opportunities in food-based livelihoods; and presented their findings to local government officials.

As a result of the 2016 practicum, over 2 million kwacha, or \$3,000 USD, was dispersed to four Lilongwe markets at the end of the year. Managed by the local market committee, the money has been used to fund specific improvement projects, including fixing a public restroom and building a security gate. Another market is working on installing lighting.

"Students (in the Frugal Innovation Practicum), went through the planning process with the market committee, and the city council was there listening-- and that's something that doesn't happen," said Dr. Stephanie White, leader of the practicum. "We want city council to be able to see that, given the chance and the resources, people in the markets will plan it, manage it, and be successful. It will help city council feel better about reinvesting local tax dollars to the markets."

Prior to the work of students in GCFSI's Frugal Innovation Practicum, market vendors struggled with accountability, transparency and communicating with city council. Now, with the establishment of a market committee, locals have a platform to improve relations with the council and work together to plan additional improvements to the markets. The model of linking LUANAR, a local university with public and private sectors reflects a commitment to the land-grant model of community engagement.

To celebrate the transfer of funds to the bank account of each market committee, a ceremony was held in Tsoka Market.



Dr. Stephanie White talks about FIP in Malawi.

## About GCFSI

Founded in 2012, the Global Center for Food Systems Innovation at Michigan State University addresses current and future barriers to global food security by developing, evaluating and facilitating the implementation of evidence-based solutions. GCFSI is one of eight development labs within the Higher Education Solutions Network of the United States Agency for International Development. Click [here](#) for more information.

February 2017

## Virtual Game Helps Kenyan Maize Farmers Work Smarter, Not Harder



FarmVille, a farming simulation game, is among the most popular social networking games ever launched. Since its 2009 debut on Facebook, the virtual game has been played by over 400 million users in 215 countries. Ever wondered how a game like FarmVille could actually be used to improve agriculture? That was the challenge accepted by two researchers, Emilia Tjernstrom, of the University of Wisconsin-Madison, and Travis Lybbert, of the University of California-Davis.

Unlike flipping on the hose or starting the sprinklers, most African farmers rely on unpredictable rain to irrigate food crops. In such variable conditions, learning about the benefits of improved maize varieties or fertilizer is costly and risky. And, when farmers' livelihoods depend on the success of their crop, experimentation is curtailed.

Seeking a comparatively low-risk method to assist farmers in selecting best practices, Tjernstrom and Lybbert leveraged a Global Center for Food Systems Innovation (GCFSI) grant to develop Mahindi Master, a game-like mobile app inspired by FarmVille.

Translated from Swahili to English as "Maize" Master, the game allows users to virtually experiment with different fertilizers, seeds, and other agricultural inputs to predict how each would likely affect crop yields on the farmer's particular plot. By populating a maize crop model with real world data from soil samples, the app calibrates the interactions of inputs that affect growth, particularly fertilizer and weather conditions. After running through multiple growing scenarios as part of the game, the user will see which combination of inputs was most fruitful for yield. [More >>](#)



## Advancing India's Food Security with Low-Impact Refrigeration

While hunger plagues a quarter of India's 1.3 billion people, food losses continue to stack up, rotting and wilting during post-harvest and processing. To improve on-farm food storage and divert food waste, a team of researchers funded the Global Center for Food Systems Innovation are implementing two types of evaporative cooling (EC) technology.

Led by Sangeeta Chopra, of the Indian Agricultural Research Institute (IARI), and Randy Beaudry, of the Department of Horticulture at Michigan State University, the team has constructed four EC structures on the IARI campus in New Delhi. Designed to stand alone or be retrofitted with a refrigeration system to improve cooling, the storage structures keep food cool through two types of evaporative cooling technology.

The first - high porosity bricks - enhances evaporation and cooling potential, similar to how a clay pitcher keeps water cool in hot environments. The second runs on a solar-powered refrigeration unit, keeping electricity costs low and making it more practical for farmers to use. The solar-powered unit also provides a renewable energy source for activities in village communities.

Explaining the science behind the cooling technology, Chopra said, "The walls of the structure are wetted at a controlled rate to achieve maximum evaporative cooling. The design and material for the roof and floor have also been finalized for lowest heat transfer." [More >>](#)



## Tanzanian Student Pilots 2-in-1 Maize Tool, Saving Farmers Time, Money, and Land

The vast majority of Tanzanians make their livelihood by farming, yet those who can afford a tractor are in the minority. While it's more time consuming and labor intensive to rely on hand tools for ripping soil and planting seeds, it's cheaper and less disruptive to the drought-stricken soil than tilling with a gasoline-powered tractor. Seeking a new middle ground, Salim Msury, an engineering student in Tanzania, developed the two-in-one soil ripper and seed planter, a mechanized tool that saves time, money, and the land.

With the cost of tractors out of reach for many of the 70 percent of Tanzanians who rely on farming for income, Salim Msury, an engineering student at the country's Arusha Technical College, sought to develop a low-cost alternative, which he has been actively testing in nearby villages. Made possible through GCFSI, the two-in-one mechanical soil ripper and seed planter is a simple, yet innovative tool.

Rolled along the ground like a wheelbarrow, it slices a small trench in the soil with a narrow disc. As it moves down the row -- either pushed by humans, or pulled by livestock -- seeds automatically drop from a container into the soil. By combining the ripping and planting process with a single tool, it saves farmers time and labor costs.

[More >>](#)



*First prototype on a field test at Kiserian-Arusha, Tanzania*



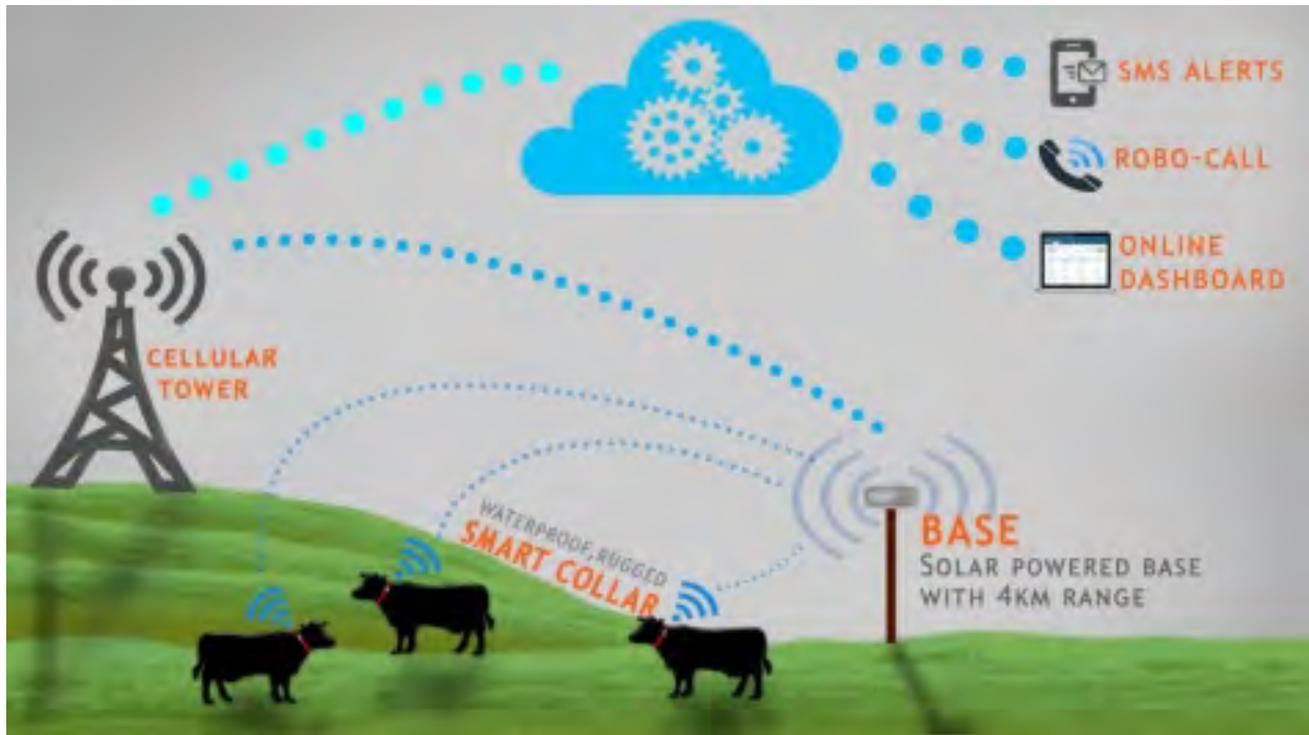
*The fourth prototype on a field test at Engorora-Arusha, Tanzania*

## Food Fix Podcast: Fitbit for Cows to Boost Dairy Farming

Every year a trillion dollars of milk is sold worldwide. Small farmers in many developing countries face problems with low milk production. But an electrical engineer and innovator from Pakistan hopes to help them with a fitbit for cows. It's called the Cowlar, a collar for cows that is equipped with sensors to monitor

their health, production and even if someone is stealing them.

Umer Adnan, a graduate of electrical engineering from Arizona State University now living in Memphis, Tennessee, says his invention texts such critical information directly to farmers. The result is reduced costs, more milk and more profits. Ali Hussain, a reporter for The Food Fix, interviewed Umer. [Listen to the Podcast](#)



## Food Fix Podcast: Unlocking Plant Secrets to Feed the World

The world's population grows by more than two hundred thousand daily. That's tens of millions of people annually. To feed them, food production must nearly double by 2050. That's a task.

Doing that in the face of climate change and the scarcity of land and water presents one of the world's greatest challenges. Plants are stressed by drought, disease and non-native competitors. But people need to eat, no matter where they are.

In this episode, Michigan State University researcher Brad Day describes the tools he is creating to unlock the secrets of plants to better feed the world. His research could produce more resilient, stress-tolerant crops that use water and nutrients more efficiently.

[Listen to the Podcast](#)



Brad Day in his lab. Photo: Derrick Turner, MSU Photography Services

## About Global Center for Food Systems

## Innovation

Founded in 2012, the Global Center for Food Systems Innovation at Michigan State University addresses current and future barriers to global food security by developing, evaluating and facilitating the implementation of evidence-based solutions. GCFSI is one of eight development labs within the Higher Education Solutions Network of the United States Agency for International Development. Click [here](#) for more information.

Food Fix podcasts, featured above, were previously published on The Food Fix, the multimedia storytelling platform of the Translational Scholars Corps, a GCFSI program that teaches students and researchers how to communicate complex research projects to a general audience. Learn more about The Food Fix [here](#).

## GCFSI-Affiliated Researchers Published in *Nature Plants*

Congratulations to Dr. Joseph Messina, Dr. Sieglinde Snapp, and doctoral student Brad Peter, on their recent article in *Nature Plants*, published this month!

"Re-evaluating the Malawian Farm Input Subsidy Programme" provides readers with evidence that calls into question the reported success of Malawi's fertilizer subsidy program, which has received wide acclaim. Those with access to the journal can view the article [online](#).

Based at Michigan State University, the three researchers have field experience in Malawi, and lead climate resilient maize (CRM) projects through the Global Center for Food Systems Innovation. Messina and Peter focus on harnessing **big data to improve targeted use of drought tolerant seeds**, and Snapp digs into the benefits of **sustainable intensification for CRM**.



## Students: Travel to Malawi with the 3rd Annual Frugal Innovation Practicum!

Hosted by Dr. Stephanie White, assistant professor in MSU's Department of Community Sustainability, the **Frugal Innovation Practicum** is an experiential, service-learning opportunity offered June 25 - August 24, 2017.

Frugal Innovations alumnus and GCFSI employee, Trish Abalo, shares how the practicum changed her life -- and her career trajectory. View the video below.



Through a combination of classes, field trips, and two weeks of hands-on field work in Malawi, Africa, the practicum provides students with a deeper understanding of urban food systems. While abroad, MSU students will collaborate with their counterparts from Malawi's **Lilongwe University of Agriculture and Natural Resources** and engage small- to medium-scaled food entrepreneurs.

## Podcast: Managing Bacterial Diseases in Onion

The onion has been a part of the human diet for more than 7,000 years. But it's not just for eating. Onions have been used as currency and even exchanged as a gift!

Bacterial diseases are the most significant threat to their production. Despite considerable effort to control these diseases with chemicals, farmers still lose a lot of onions.

Kim Eang Tho, a doctoral student in the department of plant, soil and microbial science at Michigan State University, is studying the source of bacterial pathogens in onions to find strategies to better manage diseases. He spoke with Ali Hussain, a reporter for The Food Fix. [Listen to the Podcast](#)



## Toward High-Value, Zero-Waste Cassava Processing

An important subsistence crop in Tanzania, cassava is grown in all regions of the country, yet processing constraints make it difficult for small and medium scale farmers to compete with large scale operations. To level the playing field, two researchers developed a low-cost processing system that produces high-value cassava flour with virtually no waste. Currently in the pilot stage, the new system has the capacity to mill 500 kg of cassava flour per day. [Read Full Article](#)



## Valuable Warnings Reach Coconut Farmers by Text Message

Contrary to its name, the coconut is not a nut - it's the largest stone fruit in the world. Sold in the food and beverage industry, harvested for construction purposes, used in cosmetics, and transformed into decorative objects, the coconut has many applications. While a quarter of the world's coconut production stems from the Philippines, the country's coconut farmers are the poorest around the globe. [Read Full Article](#)



## Grasshoppers, Locusts Help Curb

# Malnourishment in E. Africa

Proteins are known as the body's building blocks, but for many people in Kenya, protein sources are too expensive, leading to nutrient-poor diets linked to diseases and cognitive development problems. To improve availability of protein-rich food, researchers John Nduko and Anthony King'ori, of Egerton University, turned to wild-caught protein, namely grasshoppers and locusts. [Read Full Article](#)



## About Global Center for Food Systems Innovation

Founded in 2012, the Global Center for Food Systems Innovation at Michigan State University addresses current and future barriers to global food security by developing, evaluating and facilitating the implementation of evidence-based solutions. GCFSI is one of eight development labs within the Higher Education Solutions Network of the United States Agency for International Development. Click [here](#) for more information.

Food Fix podcasts, featured above, were previously published on The Food Fix, the multimedia storytelling platform of the Translational Scholars Corps, a GCFSI program that teaches students and researchers how to communicate complex research projects to a general audience. Learn more about The Food Fix [here](#).

April 2017

## Assessing Irrigation Challenges in Rural Uganda

Irrigation is a high-priority issue in the largely rain-fed agricultural communities of Uganda. Without it, farmers struggle to adapt to tough growing conditions, from severe drought to disastrous flooding. However necessary, upfront system costs and top-down approaches have left many valuable crop plots at the whim of the weather. Researchers Kate Scow and Abraham Salomon, both of the University of California-Davis, work in eastern Uganda, collaborating with local farmers, social advocates, and engineers on irrigation interventions that are flexible and community-managed.



Funded by a grant from the Global Center for Food Systems Innovation (GCFSI), Scow and her team took a decidedly participatory and adaptive research approach to design irrigation systems that suit local conditions and farmers' needs, and that are adaptable to unforeseen challenges. [Read More](#)

## Cell Phones as a Lifeline for African Beekeepers

In its 2009 National Beekeeping Policy, the Kenyan government estimated that the nation is producing only a mere 15 percent of available honey, and harvesting just over one percent of potential beeswax. To help beekeepers get more out of the hives, a group of seven researchers launched a grassroots-style, cell phone-based, data collection initiative aimed at identifying best management practices and most productive landscapes for honey bees.



Funded by a 2015 Early Innovation Grant from GCFSI, the project consists of nearly 40 beekeepers who have been providing researchers with data for the last year, generating over 400 records that were used to create a map that indexes the landscape in relation to honey production. [Read More](#)

## Innovation Grantee Workshop 2017

Dedicated to smoothing the bumpy road to a food secure world, nearly twenty innovators funded through MSU's Global Center for Food Systems Innovation (GCFSI) came together on MSU's campus for a weekend workshop in March. Geared towards capacity building, the workshop brought together international researchers of diverse disciplines, familiar with different frameworks, and equipped with unique perspectives. The unifying motivation to hop a plane and travel to chilly East Lansing? A shared passion to solve one of the world's most critical issues: food security. [Read More](#)



## The Food Fix Presents: Food System Innovators Talk Progress & Pitfalls

### Ana Herrera: Mobile Tech Benefits Coconut Farmers

To improve the viability of coconut farming in the Philippines, researcher Ana Herrera, of Grameen Foundation, connects farmers with agents who teach them how to operate a successful coconut farm. It's called FarmerLink. And its key component is an Early Warning System which alerts farmers to potential hazards from natural shifts in the environment. [Listen to the Podcast](#)



### Rebecca Larson: The Power of Biogas

Decomposing human and animal waste has the power to change lives. While it might sound - and smell - funny, the power of poop lies in biogas, a renewable energy source produced during the breakdown of waste. Rebecca Larson, of University of Wisconsin-Madison, partnered with Vianney Tumwesige, CEO of Green Heat, to lead a host of projects in Uganda that demonstrate new ways to transform waste to resource. [Listen to the Podcast](#)



## About Global Center for Food Systems Innovation

Founded in 2012, the Global Center for Food Systems Innovation at Michigan State University addresses current and future barriers to global food security by developing, evaluating and facilitating the implementation of evidence-based solutions. GCFSI is one of eight development labs within the Higher Education Solutions Network of the United States Agency for International Development. Click [here](#) for more information.

Food Fix podcasts, featured above, were previously published on The Food Fix, the multimedia storytelling platform of the Translational Scholars Corps, a GCFSI program that teaches students and researchers how to communicate complex research projects to a general audience. Learn more about The Food Fix [here](#).

## Twitter Cheat Sheet



### Workshop Hashtag:

#GCFSIWorkshop

### Twitter Handles:

@GCFSI

@USAID

@GlobalDevLab

@michiganstateu (official Twitter account of Michigan State University)

### Useful Hashtags:

#MSU

#MichiganState

#HESN (Higher Education Solutions Network, the parent of the GCFSI Development Lab)

#foodsecurity

#hunger

#drought

#farmers

#Agriculture

#smallholder

#malnutrition

#endpoverty

#innovation

#capacitybuilding

#gender

#gendergap

#WomeninAg

### What is a hashtag? How does it function?

A hashtag is a word or phrase preceded by a # symbol. It creates a hyperlink that when visited, generates a thread of Twitter posts that all include the hashtag, but are shared by various users. A hashtag helps to connect Twitter users who are posting about similar topics, but may not be affiliated with each other.

### About GCFSI:

Michigan State University's Global Center for Food Systems Innovation addresses critical pressures on the world's food supply by creating, testing and enabling the scaling of solutions. GCFSI takes a multidisciplinary approach that encompasses the entire food system and considers major environmental, economic and social trends, as well as workforce development needs that will impact future food security. Launched in 2012, GCFSI is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



Global Center for Food Systems Innovation  
MICHIGAN STATE UNIVERSITY

## Twitter Cheat Sheet

### Excursion Hashtag:

#GCFSlexcursion

### Key Twitter Handles:

@GCFSI (Global Center for Food Systems Innovation)

@USAID (United States Agency for International Development)

@GlobalDevLab (parent of GCFSI)

@LuanarBunda (LUANAR)

@kurtrichter2 (Kurt Richter)

@BillHridesbikes (Bill Heinrich)

@jerekan (Jeremiah Kang'ombe)

@wezimkwaila



### Handles Related to Excursion Site Visits

@DiscoverJKUAT (Jomo Kenyatta University of Agriculture and Technology)

@KenyattaUni (Kenyatta University)

@ChandariaBIIC (Chandaria Business Innovation and Incubation Centre, at Kenyatta University)

@USIUAfrica (United State International University-Africa)

@uonbi (University of Nairobi)

@ILRI (International Livestock Research Institute)

@Cipotato (International Potato Center)

@iHub (Nairobi's Innovation Hub)

@CUEA\_OFFICIAL (The Catholic University of Eastern Africa)

@thenailab (Nailab, business incubator in Nairobi that helps launch start-ups)

@brcknet (BRCK, mobile WiFi device designed in Nairobi)

@afromusing (Juliana Rotich, co-founder of BRCK)

@wguteafrican (Erik Hersman, co-founder of BRCK)

@iTosh (Tosh Juma, founder of Nairobi.Design-- creative leadership through design education)

@owigarj (Judith Owiga, co-founder of AkriaChix, nonprofit organization in Nairobi that supports women working on technology solutions)

### Useful Hashtags:

#MSU

#MichiganState

#HESN (Higher Education Solutions Network, the parent of the GCFSI Development Lab)

#CIP

#JKUAT

#foodsecurity

#hunger

#drought

#farmers

#Agriculture

#smallholder

#malnutrition

#nutrition

#livestock  
#seeds  
#climatechange  
#science

#AfricasFuture  
#endpoverty  
#economicdevelopment  
#success  
#Entrepreneur  
#tech  
#developers  
#policy  
#leadership  
#designthinking  
#education  
#edtech  
#edchat  
#innovation  
#capacitybuilding  
#projectmanagement

#gender  
#gendergap  
#WomeninAg

### **What is a hashtag? How does it function?**

A hashtag is a word or phrase preceded by a # symbol. It creates a hyperlink that when visited, generates a thread of Twitter posts that all include the hashtag, but are shared by various users. A hashtag helps to connect Twitter users who are posting about similar topics, but may not be affiliated with each other.

### **About GCFSI:**

Michigan State University's Global Center for Food Systems Innovation addresses critical pressures on the world's food supply by creating, testing and enabling the scaling of solutions. GCFSI takes a multidisciplinary approach that encompasses the entire food system and considers major environmental, economic and social trends, as well as workforce development needs that will impact future food security. Launched in 2012, GCFSI is one of eight development labs established through the Higher Education Solutions Network of the United States Agency for International Development.



Global Center for Food Systems Innovation  
MICHIGAN STATE UNIVERSITY

# 3rd Annual Frugal Innovation Practicum

## Service learning in Malawi, Africa

June 25 - August 24, 2017

Hosted by MSU's **Global Center for Food Systems Innovation**, the practicum involves a mix of online and in-person classes; two half-day Michigan-based field trips; and two weeks of hands-on field work in Lilongwe, Malawi.

While actively working towards advancing food security and improving livelihoods, students will develop a deeper understanding of food environments in urban Africa.

Working side by side their peers from Malawi's Lilongwe University of Agriculture and Natural Resources, students will engage food entrepreneurs in urban food markets to propose appropriate (or, frugal) solutions to food security challenges.



## Apply Online!

Visit [goo.gl/rWGJNy](http://goo.gl/rWGJNy)

Due: April 9, 2017

For questions, contact Dr. Stephanie White,  
517-884-8505 or [whites25@anr.msu.edu](mailto:whites25@anr.msu.edu).



[gcfsi.msu.edu](http://gcfsi.msu.edu)  
[@GCFSI](https://twitter.com/GCFSI)



Global Center for  
Food Systems Innovation  
MICHIGAN STATE UNIVERSITY