

Borlaug Higher Education for Agricultural Research and Development Final Report: BHEARD Uganda



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List of Acronyms

BHEARD: Borlaug Higher Education for Agricultural Research and Development

CAES: College of Agricultural and Environmental Sciences (Makerere University)

HCD: Human Centered Design

ISP: Innovation Scholars Program

LUANAR: Lilongwe University of Agriculture and Natural Resources

MUST: Malawi University of Science and Technology

MSU: Michigan State University

USAID: United States Agency for International Development

Annual Report

1. BACKGROUND

Makerere University's College of Agricultural and Environmental Sciences (CAES) and Michigan State University's (MSU) Borlaug Higher Education for Agriculture Research and Development (BHEARD) Program is working together to advance CAES toward the strategic vision "to be a leading institution of academic excellence and innovations in Africa." The CAES Innovation Scholars Program (CAES-ISP) offers an opportunity during which CAES academic personnel work as interdisciplinary teams to solve food system problems that are relevant to the food systems in Africa, while at the same time offering support to the CAES leadership team to invigorate the innovation culture within the college.

The Innovation Scholars Program aligns with BHEARD's two objectives: individual and institutional capacity development. The CAES Innovation Scholars Program (CAES-ISP) is a 24-month academic professional development program that develops scholars' innovation mindsets and then allows opportunity to practice innovation to improve the value, efficiency and effectiveness of their teaching, research and outreach engagements. The program intends to foster human-centered design thinking among scholars and also support scholars to spearhead the institutionalization of the innovation culture in CAES. The program is modeled after a successful, field-tested capacity development program for academic staff and institutional leaders implemented at the Lilongwe University of Agriculture and Natural Resources (LUANAR) and the Malawi University of Science and Technology (MUST), yet tailored for innovation and contextual realities at Makerere University

The program consisted of 12 scholars that addressed "Grand Challenges"; systems-level challenges identified by members from the 8 departments that form the College of Agricultural and Environmental Sciences. Scholars were selected through a competitive process that resulted in 8 academic staff participating in a Faculty Track and 4 academic staff participating in a Top Management Track. Each scholar brought together a design team, a group of multi-disciplinary team members that looked at identifying solutions related to a particular Grand Challenge. The program was implemented through a number of workshops, guided by facilitation teams from Makerere University, MSU, and LUANAR. The scholars were also supported by innovation Coaches with experience in Human Centered Design (HCD).

2. MAJOR MILESTONES / ACHIEVEMENTS

CAES-ISP scholars drawn from 6 (out of 8) departments that make up the College of Agricultural and Environmental Sciences at Makerere University completed the program through a series of eight workshops including training on design thinking, science communication, and technical training for SprintBase, a virtual tool for design thinking application. In addition to the workshops, the scholars attended an excursion in Ghana in which they were exposed to diverse innovations, ways of thinking, and practical examples of supporting innovation via teaching, learning, and partnerships. As a direct result of the CAES-ISP, all nine teams (four scholars comprised one top management team) successfully went through the five stages of the design thinking process and developed innovative products or services. In addition to the innovations:

- Two scholars generated manuscripts which will be published for wider dissemination.
- Two scholars generated policy briefs related to their innovations.
- Two scholars presented their innovations on a city-wide radio program in Accra, Ghana.
- Four scholars attended an additional excursion in Malawi to further strengthen Malawi/Uganda partnerships and share learnings with top management and faculty from LUANAR and the Malawi University of Science and Technology (MUST).
- Three scholar teams and CAES program management leadership presented their innovations and processes at the Higher Education Global Summit.

While eight of the teams were led by a faculty member within CAES, the top management team had a unique focus to address the challenge of inculcating a culture of innovation within CAES and, ultimately, increase the potential for innovation within the University. The project, “Skilling to Innovate (STI) in agricultural and environmental sciences” was led by Professor Gorette Nabanoga who was elected as CAES Principal during the ISP.

Top Management Project Summary

The CAES-ISP sought to invigorate the innovation culture at CAES through re-orienting an innovative mindset via the CAES-ISP cohort. Faculty-track scholars moved this innovation agenda in CAES both in teaching and research engagements. The STI program engaged students, faculty, industry and external stakeholders via HCD to first, better understand barriers to deliver courses that cultivate young entrepreneurs, connect research to industry and create innovations from the prior two. Then, the approach was employed to brainstorm new practices that would contribute to faculty and students’ development and success as CAES innovators.

Results: Prof. Nabanoga’s top management design team co-created a “Transformation Pact” that facilitated a conducive environment to nurture scholars’ (i.e., students and faculty across CAES) creativity, exploration, discovery and commercialization of knowledge aimed at impacting Uganda outside of academia. The pact was compiled by assessing skillsets, attributes, experiences and environments that contributed to innovator development and best practices of instilling these experiences in students and faculty. The short-term success of the program points to long-term prospects that will increase the number of adoptable innovations in agricultural and environmental sectors, improve the livelihoods Ugandans, and contribute to the country’s wider economic development. A bulleted list of key process elements and short-term outputs are outlined below:

Key process elements:

- Took time to meet with both students and faculty, ask five whys, and humbly learn about the source of disempowerment and engagement.
- Frequently broke traditional hierarchies to get in touch with students and staff about their needs and learn about what needed to be present.
- Empowered the inclusion and participation of staff and students with consideration for possibility beyond the University.

Key outputs:

- Established transformation pact via ‘grassroots’ departmental engagement (rather than top-down agenda) for entire college to spur innovation
- Designed new CAES curricula with innovation and entrepreneurship embedded
- Beginning curricular reviews that include factors of ‘innovation’ and ‘entrepreneurship’ in assessment
- Established new college mantra - “Innovation Intentional”
- Started monthly peer-recognition for faculty conducting innovative research
- Designed and started testing a pilot department model that reduces teaching loads and allocates additional faculty time for creative outreach efforts (e.g., creating industry internships)

3. SUMMARY OF KEY ACTIVITIES

Several key activities were accomplished over the life of the program to advance the objectives and intermediate results. Below each event includes a list of intermediate results that feed into the one or several program indicators.

3.1 Hosted a design workshop

The workshop contextualized the Innovation Scholars Program for Makerere University, culminating in identifying 5 Grand Challenges that focused the call for innovations

- *Grand Challenge #1: Effectively preparing students for a changing international and local market*
- *Grand Challenge #2: Preparing students for self-driven career paths*
- *Grand Challenge #3: Developing innovative technology for the market*
- *Grand Challenge #4: Strengthening CAES’ influence in policy decision making*
- *Grand Challenge #5: Developing a thriving CAES innovation environment (CAES Top Management Track only)*

3.2 Identified and empowered nine innovation project teams to solve local problems

Scholars identified a problem they were poised to solve, developed their idea, and tested a working prototype of their solution.

Innovation projects:

- *ICT for organic food chains*
- *Juice processing for local markets*
- *Distance-learning platform*
- *Industry-informed curriculum*
- *Seed quality protocol*
- *Problem-centered teaching pedagogy*
- *Institutional innovation system*
- *Student engagement strategy*
- *Industry network for student internships*

Intermediate Outcomes

- *Six of nine scholars teams reached the testing phase in their innovation process (i.e., completed their innovation projects) and three of nine reached the prototyping stage*

3.3 Provided tailored innovation coaching for each scholar

ISP scholars were supported with a coach to help them successfully navigate through the HCD process, provide feedback on their ideas, and facilitate the way of working effectively with their design team. When problems arose in the innovation process, coach challenged scholars to resolve situations or help them to view the issue from a different perspective. Like an effective teacher, the coach provided support, posed questions, and gave feedback and guidance to facilitate innovation. Importantly, coaches were not responsible for providing a solution. Coaches met multiple times per month with their scholars to provide feedback and support for their ongoing project work. Once monthly, coaches participated in a coaching check-in where updates and challenges were discussed.

Key Outputs

- Continued cross-university learning and network growth support
- Provided ongoing mentorship and support to all nine scholars and their respective design teams
- Compiled monthly progress reports completed by coaches to help the program identify areas for support
- Provided additional resources and input into innovation decision making for scholars

3.4 Designed and delivered tailored workshops to support innovation projects and processes:

Workshop 1: An Introduction to Design Thinking

- Scholars were introduced to the five stages of design thinking (empathy, define, ideate, prototype, test) and provided examples to see how they might apply design thinking to their own innovation journey.

Workshop 2: Network Needs Assessment

- Scholars were introduced to a tool to help them think critically about their social and professional network(s) and how they could utilize their strong and weak tie connections to better understand the problem space, access resources, and garner support.

Workshop 3: Design Thinking: Define and Ideate Refresher

- After participants spent time in the empathy phase, this workshop was designed to help scholars and their design teams revisit their initial assumptions about the problem and identify various solutions.

Workshop 4: Communicating Research

- Communication experts specializing in communicating science worked with scholars and their design teams to develop compelling narratives about their work in a format shareable to diverse audiences.

Workshop 5: Prototype and Testing

- Scholars and design teams learned how they can take early versions of their solution and present it to stakeholders to gather crucial feedback on what's effective and where iteration is needed.

Workshop 6: Communicating research and developing your pitch (part 2)

- While on the innovation excursion in Accra, Ghana, Scholars refined their pitches and identified target audiences and outcomes for further feedback.

Key Outputs

- >50 participants in workshops where design teams participated with scholars, maximizing HCD capacity development across design teams and the CAES innovation ecosystem
- Increased comfort and familiarity with Sprintbase, the online design thinking tool used by the CAES-ISP
- New tools learnt from peer presentations and Sprintbase instruction to collect and analyze data oriented towards a HCD approach. Confidence levels enhanced on use of the innovative tools within design teams.
- Developed and refined communication pieces, engaged workshop facilitators to edit, and presented to multiple innovation centers and universities.

3.5 Designed and hosted a learning excursion to a regional innovation ecosystem in Ghana

Scholars traveled to Accra to present their work and learn from other agricultural innovators. The trip included opportunities for scholars to connect with other innovators who have shared interests and face similar challenges with the goal to gain new perspectives to apply to their project work.

Key Outputs

- Scholars, coaches and the management team congregated together physically for the first time (due to prior pandemic restrictions)
- Scholars received additional communication training from a Ghanaian scientist and communication expert with particular expertise in sharing scientific innovations with diverse audiences including public dissemination.
- Scholars engaged with experienced international guest speakers and expanded their network
- Scholars learned about innovative technologies, processes, and mindsets within a Ghana's agricultural innovation ecosystem
- Scholar innovation networks expanded to further support their innovations and careers
- The CAES-ISP innovations were shared with the Ghanaian audience via an invitation to appear on Ghana's third largest radio station to discuss scientific innovation.
- Strengthened the innovation ecosystem within Makerere via shared learning during the excursion

3.6 Hosted an Innovation Showcase to highlight innovations, disseminate knowledge, and sustain success via local and international networks.

At a two-day event, scholars presented their work to various stakeholders in and outside of academia via powerpoint and poster presentations. Key stakeholders included the USAID Deputy Mission Director, University Top Management, Ugandan industry partners, invited guests from the international community particularly from USA, Malawi, Kenya and Ghana. The international community had discussions with the University top management and key stakeholders within the university including RUFORUM and the Alliance for Africa Partnership (AAP).

Key Outputs

CAES-ISP scholars:

- Developed academic posters to communicate the innovation process taken to develop a prototype
- Delivered 8-12-minute presentations to attendees about processes taken to develop a prototype

In tandem with this showcase, over 70 Makerere undergraduate students received a crash course in human-centered design.

3.7 Designed and hosted a leadership and networking excursion for African innovators in Malawi

After the showcase, five scholars traveled to meet with university faculty and leaders in Malawi where the Innovation Scholars Program originated: ISP 1.0 (LUANAR) and ISP 2.0 (MUST). CAES-ISP scholars including two members of the top management track team and three members of the Faculty track team. The visiting team interacted with management, and ISP alumni where they exchanged ideas on creating and strengthening partnerships between and across the three institutions and other entrepreneurial ecosystem actors.

Key Outputs

- Sharing of strategies and lessons used to enhance innovative culture within institutions, and teaching of entrepreneurial skills experientially.
- Increased exposure of CAES-ISP innovations at LUANAR and MUST, which informed collaborations among respective researchers i.e. on processing and value addition.
- Interface with innovation hubs at LUANAR and MUST, which were established following capacity built under ISP 1.0 and ISP 2.0. The meetings and discussions were led by ISP Coaches to enhance sharing of practicalities of possibly setting up and running a successful innovation hub at CAES.

3.8 Successfully managed and disbursed all funds via tranches

CAES developed a protocol to receive/ reconcile funds and ensure activities are embedded with human centered design (HCD). Workplans and budgets for each of five tranches of funding were reviewed by each scholars' innovation coach. Upon submitting documents, ISP management adhered to CAES guidelines, which are then passed onto to the college's finance

office for fund disbursement. At program close, all activities have been completed, scholars have submitted all technical reports and requisition forms to ISP for approval.

Key Outputs

- Streamlined the delivery of funds allowing scholars to receive up to five of five tranches of funding
- Collected various artifacts (e.g., technical reports, budgets) to track HCD competency
- Edited manuscripts based on review of various artifacts from tranche disbursement protocol and finalizing for submission to peer-reviewed journals

4. ENGAGEMENT WITH PARTNERS

LUANAR Partnership Engagement

The CAES-ISP provided multiple opportunities for coaching, professional development and growing networks, including the following:

- Engagement of five faculty members from LUANAR who interacted with scholars and their scholar teams from conceptualization to testing. These included Prof. Emmanuel Kaunda (current Vice Chancellor), Dr. Sera Gondwe, and ISP alumni coaches that included Dr. Andrew Safalaoh, Prof. Jeremiah Kang'ombe, and Ms. Zion Kalumikiza. Each of these faculty members created a network of scholars through the scholar they were coaching, and their design teammates, who they continue to reach out to for collaborations on research and proposal writing among others topics.
- Five members of LUANAR's faculty and top management staff participated in the Ghana learning excursion
- Beyond this, LUANAR team members who were part of the Ghana excursion developed partnership with Ghanaian entrepreneur and design thinking educator Freda Yawson, an experienced HCD trainer and entrepreneur who in a month following the meet, delivered an HCD workshop for faculty and postgraduate students at LUANAR, in collaboration with ISP coaches. The training attracted over 80 applicants from LUANAR and MUST, with requests from other institutions to include them in subsequent trainings.

CAES Partnership Engagement

CAES ISP scholars engaged a number stakeholders to develop prototypes using the Design thinking framework, and improve the impact of CAES-ISP innovations and teaching in the target communities. The stakeholders varied between ISP projects and were based on the services provided by the stakeholders and/or the target beneficiaries. The following stakeholders were engaged based on the ISP project:

1. Benchmarking strategies to increase engagement of students in practical knowledge in value chain operations and management. Scholar: Dr. Alice Turinawe

The design team engaged representatives from the following units: Uganda registration Services Bureau (UBRS), Jesa Farm Dairy Ltd, Kampala City Council Authority (KCCA), Agromax, and Uganda Industrial Research, to benchmark strategies to increase engagement of students of the College of Agricultural and Environmental Sciences (CAES) in practical hands-

on experiences in agricultural marketing and small business management courses. The project contributes to solving the problem of lack of practical hands-on knowledge in value chain operations and management including knowledge on how to start business in a hostile environment.

The ISP project liaises with the stakeholders to provide student with services required for them to become competent in building a viable business model. In turn, CAES is expected to churn out graduates with the required skills required in the job market. The level of entrepreneurship and business ventures are expected to increase, particularly in the agribusiness sector.

The following were engaged at individual level: (1) Mr. Robert Mugabe from Uganda Registration Services Bureau. Robert's input into the ISP included hands-on skills in business startup and registration; (2) Ms. Angella Najjemba of Jesa Farm Dairy Ltd brought in experience in milk value chain management; (3) Kato Godfrey of KCCA provided valuable information related to policy environment and support given by KCCA particularly that related to agro-value chains; (4) Ms. Sarah Nalubwama from Agromax brought in the private sector experience in agro-input value chains; and (5) Ms. Maria Goretti Nalugya of Uganda Industrial Research Institute (UIRI) provided information on support provided by UIRI to new startup businesses.

2. Deployment of a problem-solving teaching and learning approach using the teach-think-pair-share model for increased skilling among agricultural students. Scholar: Dr. Patrick Musinguzi

The project is aimed at improving delivery of content to increase critical thinking and skills among students. Farmers are the target ultimate beneficiaries as students that whose education background that is centered around problem solving, rather theory learnt in class, are likely to respond better to community of field based challenges. To pretest the prototype curriculum, ISP linked up to a number of stakeholders that included ABI-trust, Geomik Africa Ltd, Aesthetic Landscape Consult, Akright Project Ltd, and Geomaster international. The stakeholders were represented by Mr. Paga Moses of ABI-Trust, Mr. Banduga Moses of Geomik Africa Ltd, Mr. Samula Kevin of Aesthetic Landscape Consult, Vianny from Akright Projects Limited, and Mr. Ahebwa Julius fro, GeoMaster International Ltd.

3. Strengthening the Department of Agricultural and Bio Systems Engineering's (ABE) industrial training to improve students' critical thinking, innovativeness and entrepreneurial ability. Scholar: Dr. Allan Komakech

The project aims at increasing the innovativeness of ABE students through improving the curriculum and industrial training partnership with industrial players during industrial training. Students benefit from the program by obtaining employable and entrepreneurship skills while ABE-CAES provides outreach to the wider industry community. The industry players are expected to receive graduates with employable skills. The ISP reached out to a number of stakeholders from industry and particularly those involved in the Agri-value addition business/industry development: Kakira Sugar Works, Rwenzori Tea, National Agricultural Research Organisation (NAR)), MAAIF, and Kinyara Sugar. The companies were represented by James Mutengu – the training manager of Kakira Sugar Works, Rukia Namirember – the

Human Resource Manager of Ruwenzori Tea, Florence Kinyimba of NARO, Dominic Musinguzi – an Assistant Commissioner in MAAIF, and Fred Ogwok – Training manager of Kinyara Sugar Ltd.

4. Disentangling secrets of biology, engineering and ICT for linking local organic agricultural business and Global Markets. Scholar: Prof. Fred. Kabi

The project addresses the problem of expensive certification for organic products by finding the cheapest way of testing for pesticide residues. This solution enables farmers to exploit the great global market worth USD 100 billion. The project engaged the following stakeholders to test and validate the KEBERA prototype for testing organic products for pesticide residues: CERES certifying body, Organic Consumer Of MAAIF, Uganda Export Promotion Board (UEPB), Uganda National Farmers' Federation (UNIFFE), and selected farmers. The stakeholders were represented by Dr. Charles Walaga of CERES, Mr. Alastair Tailor of Organic Consumer – MAAIF, Mr. Ronald Kawuki – Farmer from Lusanja, Ms. Noreen Kamoti from UEPB, and Mr. Daudi Sentongo from UNIFFE. There are stakeholders from outside the university that were co-opted in the Design Team, and these included Mr. Ramathan Nkutu from MIIC, Mr. Geoffrey Kajubi from MIIC, Mr. Allan Lule from MIIC, Mr. Abdul-Bastu Lujja from MIIC, Mr. David Wagalinemera from MIIC, Mr. Chariton Namuwoza from NOGAMU, Mr. Robert Guloba from PELUM, Ms. Harriet Adong from RAN, and Ms. Harriet Nakasi from ACSA.

5. Engaging stakeholders and policy to address challenges in seed quality in the horticulture industry of Uganda: a case of tomato and pepper. Scholar: Prof. Jenina Karungi

The project is aimed at reducing transmission of tomato viruses through seeds by designing end-user friendly policies, and promoting appropriate seed quality standards and mechanisms for regulation, production and sale of quality declared seed and reduce cases of home saved seed. The project also aims at skilling seed scientists, technicians and other actors in the seed value chain to manage seed systems. Direct beneficiaries of the stakeholder engaging are farmers who access virus free seed, developing the horticultural seed system from majorly informal to formal and seed scientists capable of handling problems of the seed industry particularly in the horticultural industry. The project engaged stakeholders from the following institutions: MAAIF, NARO, seed companies, INBS, UNSA, UNIFFE, UPEB, Ministry of Science and Technology (MoST), Uganda National Agro-Input Dealers Association (UNADA), and selected farmers in the tomato and pepper industry.

6. Developing innovative technology for the medium, small and micro enterprises in the food industry. Scholar: Julia Kigozi

The project is aimed at building capacity for Makerere to support the MSMEs to build capacity to enable them compete on the domestic, regional and international markets through appropriate, low costs and accessible equipment and infrastructure by processors. The direct beneficiaries include agro-processors through accessing affordable equipment optimized to meet needs of individual processors. To achieve these aims, the project engaged stakeholders from Merisa Beverages Development Association, Foodilicious Enterprises, Hometech Food Processors

Limited, Farm Solutions Uganda Limited, Mbunda Company of Natural Products, and Badaye Technologies, to test and validate the prototype developed by the design team.

The stakeholders were represented by Emmanuel Baidhe from Badaye technologies who was incorporated in the design team; Elizabeth Kwiryara Mbabazi from MERISA Beverages Development Association, Joan Namakula from Foodilicious Enterprises, Waluswa Timothy from Hometech Food Processors Limited, Wilberforce Muyomba from Farm Solutions Uganda Ltd, and Muhindo Enoch from Mbunda Company of Natural Products.

7. Enhancing the Capacity of Faculty and Students on the Bachelor of Agricultural and Rural Innovations (BAX) External Degree Programme for E-Learning at Makerere University. Professor Nelson Turyahabwe

The stakeholders for Professor Nelson Turyahabwe's team were Dr. Florence Birungi Kyazze and Dr. Christopher Mawa, who teach on the BAX program, and selected students. The project title "enhancing capacity of the faculty and students on the Bachelor of Agricultural and rural innovations External Programme for e-learning at Makerere. It is aimed at improving instruction and methods of teaching particularly those using online platforms, and to address policy issues related to management and administration of the BAX degree program. It is expected to impact positively on the external programmes of the university education system.

8. Learner-centered and work-integrated training in environmental science and management, Prof. Justine Namaalwa

This project made adjustments in the approaches of training and delivering of the courses in the Department by applying 'learning through problem- solving', 'curiosity driven inquiry', experiential learning and 'theory improvement inquiry' with academic staff and practitioners as facilitators. The project engaged stakeholders from within the university as the ultimate beneficiaries, both students and staff.

9. Skilling to innovate (STI) in agricultural and environmental sciences. Prof. Gorettie Nabanoga

Professor Gorettie Nabanoga's project is aimed at identifying and assessing skill sets, attributes, experiences and environments that contribute to innovators' developments and success, and explore best practices of instilling them into students and faculty (see section 2.0 for further details, achievements, and outputs).

MSU Partnership Engagement

MSU utilized two institutional sub awards with CAES and LUANAR. Their partnership activities directly and indirectly created new and nurtured existing partnerships described here.

LUANAR institutional partnerships

The opportunity provided by the CAES-ISP to have previous scholars as co-designers and coaches provided room for institutional reflection. The reflection led to a realization that Innovation ecosystem hinges on conducive policy environment, financial support and ICT services, and hence the University Registrar, Director of Finance, and ICT Manager were requested to accompany Prof. Emmanuel Kaunda and Dr Sera Gondwe(Coaches) on the excursion journey to Ghana. The following key actions resulted out of the excursion

- Lessons from University of Ghana applied sciences department raised the need to enhance corporation between the Industry and the University regarding innovations and technologies. LUANAR is currently in talks with a private sector to partner on commercialization of innovations.
- West African Centre of Excellence for Crop Improvement (WACC), is one of successful centres led by Professor Danquah. LUANAR planning to invite him to provide insights on how to run ACEs at LUANAR, particularly in their formative stages. LUANAR was awarded grants to establish three Centers of Excellence, hence a timely network link.

In addition, the organisation of the innovation showcase in Uganda inspired how LUANAR@10 years celebrations have been designed, for more impact. We anticipate better awareness of service offered by LUANAR, and hence more impact.

CAES institutional partnerships

CAES provided scholars for the program, the personnel that managed the project and also provided meeting infrastructure and physical resources for the project to operate. MSU provided funding, training and also the facilitation team that guided program implementation and monitoring. Uganda government ministries, agencies and departments provided expertise and experiences through the design team members. These agencies included Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Makerere Innovation and Incubation Center (MIIC), PELUM Uganda, National Organic Movement of Uganda (Nogamu), National Environmental Management Authority (NEMA), Uganda National Farmers Federation (UNFFE), National Agricultural Research Organization (NARO), MERISA Beverages Development Association, Delicious Enterprises, HomeTech Food Processors Limited, Farm Solutions Uganda Limited, Badaye Technologies Limited, Mbunda company pf Natural products, Uganda National Agro-input Dealers Association (UNADA), Ministry of Science Technology and Industry (MoSTI), Uganda National Bureau of Standards (UNBS), Uganda National Academy of Sciences (UNAS), Uganda Export Promotion Board (UEPB), CERES certifying body, Kakira Sugar Works, Rwenzori Tea company, AbiTrust, Geomik Africa Limited, Aesthetic Landscape Consult, Geomaster International, Uganda Registration Services Bureau, Jesa Farm Dairy Limited, KCCA, AgroMax, Uganda Industrial Research Institute (UIRI)

Coaches Network

In this iteration of the Innovation Scholars Program, additional networks were actively engaged via our coaches. The coaching team included entrepreneurs, scientists, and senior faculty from MSU, LUANAR, and MUST. For many scholars, the coaches became integral members of their team and even after program completion, are considered to be mentors, resources, and friends. Additionally, the networks of our coaches became accessible to scholars and their design teams. Our coaches were selected both for their interest and willingness to engage in the

Program but also with expectation that their networks would add additional strength to the CAES-ISP. For example, Dr. Amy Jamison is the Co-Director of the Alliance for African Partnership. Her network was generously extended not only to her scholar but to our Program at various times, including setting up meetings in Uganda for our team to build local relationships. Dr. John Bonnell's relationship with Dr. Amos Njuguna, the Dean of Graduate Studies at the United States International University Africa (USIU), enabled us to invite him to attend the Innovation Showcase and serve as a guest speaker and panelist, expanding the network of scholars to other areas of East Africa.

These partnerships also benefited our coaches and colleagues at LUANAR and MUST: as a result of their leadership roles as coaches and program implementers, Dr. Mkwambisi from MUST and Dr. Sera Gondwe and Prof Emmanuel Kaunda from LUANAR were able to increase the visibility of their own institutions. Both universities are moving forward with MOUs with Makerere University as well as expanding their own networks, maintaining relationships with new contacts in Ghana, Kenya, and Uganda based on their time within the CAES-ISP.

5. MONITORING, EVALUATION, AND LEARNING (MEL)

Progress Against Indicators

Provide us with the most up-to-date progress against indicators, using the Indicator table.

Please make sure all indicators have targets through the end of the project.

INDICATOR NAME	DESCRIPTION	Y1 TARGET/ ACTUAL	Y2 TARGET / ACTUAL	COMMENTS
Research to innovation	Assessment of whether scholars illustrate the creation of a prototype based on (a) understanding a problem through end-user empathy and (b) co-creation with end-user feedback. Completion of their project indicates a scholar engaged with all five design thinking stages, including developing and testing a prototype with end-users	No scholars are expected to develop and test their prototypes in Project Year 1 (i.e., 0/9). 1 scholar has reached the Empathy (i.e., 1 st) stage; 4 scholars have reached the Define (i.e., 2 nd) stage; 4 scholars have reached the Ideate (i.e., 3 rd) stage	All scholars are expected to develop and test their prototypes in Project Year 2 (i.e., 9/9). 3 teams have progressed through the Prototype (i.e., 4 th) stage; 6 teams have progressed through the Testing (i.e., 5 th) stage	The 3 teams that have not tested their prototypes have put in requests for funds to fulfill this phase. The issue for them was that their prototypes took longer to develop

Design thinking (DT) competency	Determine whether scholars demonstrate a proficient understanding of DT (i.e., cognition) as well as evidence of putting the framework in practice (i.e., application)	0% of scholars reached 6/10 score of design thinking competency 1 out of 9 scholars reached proficiency (>=6) while the remaining scored 5 or below.	A majority (i.e., 5/9 scholars) will score 6/10 or higher 9/9 scholars scored >6/10 in design thinking competency	Year 2 outcome exceeds Year 2 target. Participation in workshops yielded higher cognition while engagement in the third, fourth and fifth stages of design thinking in Year 2 led to higher application. Both activities, therefore, afforded higher DT competency scores.
Innovation Network Growth	The quantity and level of professional relationships a design team accrues (with individuals, organizations and/or information hubs) to (a) understand a problem and/or (b) develop an innovation	0% of individuals reach “meaningful growth ¹¹ ” in their innovation network by Year 1. 66.7% (6/9) of the scholars have made significant growth in their innovation network as evidenced in interviews and network logs.	A majority (i.e., 5/9) scholars will reach meaningful growth by Year 2 9/9 of the scholars have made meaningful growth in their innovation network as evidenced in final interviews and network logs	This outcome exceeds the Year 2 target
Organizational growth process	Shared DT competency among the administrative track design team to communicate and support innovation at department, college and/or university	The administrative-track design team does not share a DT competency score of 6/10 between 3 (out of 5 members) on the team. 1 of 5 members scored 6/10	Majority of members (i.e., 3/5) score 6/10 4 of 5 members scored >6/10	None

<p>Organizational change product</p>	<p>Application of DT stages in one or more projects (# dependent upon how many outlined by the administrative track design team).</p>	<p>Engagement with 2/5 DT stages in at least 50% of projects by the end of Year 1.</p> <p>The team reached the Empathy stage (i.e., the 1st stage of DT), and therefore, did not reach the Year 1 target (i.e., engaging in the 2nd stage of DT).</p>	<p>Engagement with 5/5 DT stages in at least 50% of innovation projects (e.g., 2/4 innovations reached the testing phase of DT)</p> <p>Reached 4/5 phases (i.e., prototype) with their transformational pact</p>	<p>Progress was impeded by low engagement among end-users in an initial empathy activity, which delayed following processes, but the team will test pilots just after program ends.</p>
<p>Communicating research for innovation</p>	<p>A deliberate action to compose and present three communications pieces regarding an innovation informed by HCD which aims to address one or more grand challenges</p>	<p>1/3 communication pieces delivered among every scholar (9/9).</p> <p>All scholars composed a 100-word communication piece (i.e., 1/3 comm-pieces completed) at the fourth workshop</p>	<p>3/3 communication pieces delivered as well as 1/3 informed by HCD.</p> <p>9/9 scholars completed 3/3 communication pieces including one informed by HCD; 9/9 scholars completed 4 or more communication pieces</p>	<p>This outcome exceeds the Year 2 target. Many scholars exceeded the target as they presented two HCD presentations at the innovation showcase, which as not anticipated in the CAES-ISP</p>
<p>Targeted fora & publications</p>	<p>Composition of white papers, peer-reviewed articles, assessments, analyses and evaluations on development challenges, innovations, technologies, approaches and/or contexts.</p>	<p>1-3 manuscripts composed by scholars (with mention of a HCD framework) intended to be submitted to a peer-reviewed journal</p> <p>2 manuscripts being composed</p>	<p>1-3 manuscripts composed by scholars (with mention of a HCD framework) submitted to a peer-reviewed journal</p> <p>2 design teams are in the process of finalizing and editing a manuscript to submit to NJAS and the IJAS</p>	<p>2 manuscripts were planned to be written only about the first 3 phases of design thinking, but scholars wanted to include all 5 phases (which protracted writing activities)</p>

[1] “Meaningful growth” is defined as a scholar having a (1) more access to across (2) larger population of stakeholders to understand a problem and/or develop an innovation prior to CAES-ISP. If the scholar mentions both points occurred in the final open-ended interview, it will be assumed that meaningful growth occurred.

M&E Updates

There have been no changes to M&E processes over the reporting period except for the scale used to assess design thinking competency. The scale was previously scored from 0-9, but then changed to 0-6. This change was made to assist coaches with scoring the monthly progress of their scholar in terms of application and cognition.

Research to innovation

Three of nine teams were able to reach the testing stage within the 24-month program, and the remainder are doing so after the project timeline. Delays in reaching the final stage were not attributed to low productivity (e.g., slow data analysis), but rather iterations in the design cycle. That is, teams adapted their prototypes with end-users before moving forward to test them in the field. Others note that online training could “only assist [them] so far” in terms of prototyping. That is, they struggled applying online lessons to their field activities where they had transfer end-user insights from the ideation phase to inform a physical prototype. Still, all nine teams in the program were able to develop a prototype. One of the driving factors to pushing teams to reach a prototype was setting an innovation showcase where multiple stakeholders were invited to evaluate their innovations. Other supporting factors were timely distribution of funds to design teams led by the internal CAES-ISP management team. Below is a short summary of the working prototypes.

The summary of prototypes developed included:

Prototypes that have been tested	Prototypes in the testing phase
1. Industry-Informed Curriculum	1. CAES Transformational Pact for Innovation
2. Two pulpers & one pasteurizer for micro, small and medium fruit processors	2. Organic Produce Scanner that Supports Uganda Participatory Guarantee System
3. Tomato and pepper seed quality policy brief	3. Online Platform (MUELE)) for Training Students & Faculty
4. Problem-Centered Teaching Brief for CAES	

5. CAES Online Platform to Pair Students with Industries & for Industries to Evaluate Potential Employees	
6. Student-Centered Brief for Evaluating CAES Course	

Design thinking (DT) competency

DT competency was assessed through numerous artifacts that demonstrated cognition, but also application. Scholars score high across both concepts (i.e., 6 out of 6).

Cognition was most evident during project closing interviews as several scholars illustrated their deep understanding by making statements such as, "...developing innovations from end-user perspectives" or "...curtailing the prototype according to needs identified in testing". These statements describe the final phases of design thinking (hence, affording a 6 out of 6 proficiency score) where the mid-program interview only had quotes discussing the initial stages (i.e., 3 out of 6 proficiency score). Statements were more focused on understanding the problem from end-user perspectives rather than ideating or iterating with them to develop a solution. This deep understanding may be attributed to the number of exercises that scholars completed during the program such as developing posters and presentations, which invited them to continually consider their end-user perspectives and appropriate communication practices for diverse audiences.

Application was most apparent not just in project activities, but also in work scholars were conducting outside of the CAES-ISP. For example, many scholars note they have applied empathy on projects related to pastoralism, commodities, diversity and inclusion. Others have used empathy to inform data collection instruments or frameworks in proposals (two of which were awarded). Strong forms of application may be attributed to data instruments and/or frameworks provided in online workshops and Sprintbase, as scholars mentioned they adapted them to project activities.

Innovation Network Growth

All scholars noted during the final interview of the program that meaningful growth" occurred in their innovation network. That is, they had (1) more access across a (2) larger population of stakeholders to understand a problem and/or develop an innovation prior to CAES-ISP. To date, the nine scholars have logged 320 research, industry and community related organizations and individuals they readily have access to when developing their innovation. Many noted during the final project interview that innovation excursions and events like the innovation showcase facilitated an environment for them to connect with individuals and organizations outside of Makerere University and increase their network.

Organizational growth process

Organizational growth was determined much like the design thinking indicator, but with the second level of complexity. That is, each design team member of the upper management track

was interviewed and artifacts (e.g., PowerPoint presentations) from their project activities were reviewed to assess design thinking competency. In order to reach the target of organizational growth, a simple majority needed to score proficiently (i.e., three out of five or more members needed to demonstrate a 6/6 design thinking score).

All but one member scored proficiently. Reasons for one team member not scoring proficiently may have been attributed to less engagement with the project given their busy schedule. Cognition was most evident during project closing interviews as these scholars made several key remarks including, "...ensuring solutions are co-created through a process that is not straight forward " or "...making sure innovation rhymes with what the community needs" One reason for high competency among almost all team members was because they cooperatively composed a "Transformation Pact" that was embedded with HCD; thus, they had to articulate various aspects of HCD within the document (which is a form of cognition) as well as offer tools to faculty to make more innovative classrooms (which is a form of application).

Organizational change product

The organizational product reached the prototype phase, but not the testing phase at the end of the program. One reason for the innovation not reaching the testing phase was that the team leader was being interviewed for an extensive job promotion within the college, which took attention away from the project. Still, other team members carried the project forward, documenting insights from end-users in an online platform named SprintBase, which guided design thinking processes.

At the Innovation Showcase, the design team showed strong evidence that they worked through various phases of design thinking to complete the "Transformational Pact". During a MEL exercise, team members were asked to list evidence (in the form of a Post-Its) of how they applied design thinking in four quadrants that represented organizational change - political, human resource, symbolic, and structural. Some of the most notable Post-Its were "shared vision in transformation pact", "mantras at CAES like innovation intentional", and "public recognition for innovation" within the symbolism quadrants. Others included "reducing teach loads to allocate more time to outreach efforts [with industry]" and "curriculum reviews that include 'entrepreneurship' and 'innovation'" within the structural quadrant. Both quadrants represent not only a shift in structure but all language among team members. One driving factor for this shift in language and structure may have been attributed to an excursion where all team members went on to visit Ghanaian universities where they learned how other top managers and leaders cultivated a culture of innovation within their own institutions.

Communicating research for innovation

All scholars exceeded the target of presenting three communication pieces about their innovation process (one of which was informed by design thinking). Many scholars presented and/or composed more than three communication pieces because of the opportunities they were provided in the CAES-ISP, including support by consultants, opportunities to present to stakeholders on innovation excursions, poster and PowerPoint presentation templates provided to fill out and present at an innovation showcase and the human resources they were connected with to compose manuscripts.

Targeted fora & publications

Three scholars are still in the process of developing manuscripts to submit for publication. The target for this indicator; therefore, was not met. Scholar teams were encouraged to publish manuscripts on the initial phases of their innovation process (i.e., empathy, define and/or ideation). Scholar teams; however, felt it was necessary to write about their entire process rather than three phases of design thinking. In addition, deadlines were not set for when certain sections of the manuscripts were supposed to be completed. This may have encouraged finishing the manuscript sooner than later, but iteration in their design process also led them to rewrite certain sections. Still, as BHEARD staff met with scholar teams on a weekly or biweekly basis, progress was slowly made and by the end of December 2022, all teams are confident they will be able to submit their manuscripts for publication.

6. USAID ENGAGEMENT

CAES-ISP engaged Dr. Simon Byabagambi from the USAID Uganda Mission office in Kampala for brief regular updates on the program's progress. The Mission Director Richard Nelson and the Deputy Mission Director Daniele Nyirandutiye were engaged during preparations and programming for the Final Showcase event.

7. LESSONS LEARNED / BEST PRACTICES

LUANAR

Continuous engagement and reflecting on lessons to guide next actions in project implementation is key to a Program's success. Communicating innovative interventions taking place is one way to start building innovation culture, as it gives evidence and confidence to others.

MSU

The pandemic had a major role in implementation of the CAES-ISP and through it, we saw the importance of in-person connection. The Ghana excursion was the first time the full team met together and within one week, the relationships and progress made arguably exceeded a year of virtual connection. Hybrid engagement is highly beneficial but key, in-person touchpoints strengthen relationships and allow team members to be fully present with each other and their program goals.

Another key lesson was the importance of clarifying roles and expectations. It is especially important for a multi-institutional program team to revisit expectations and roles at key junctures. Many members of our team are high performers at competitive institutions where their time is always being requested by competing projects. Providing more opportunities for check-ins around roles will help the full team understand when priorities may need to shift or responsibilities may need to be delegated,

Finally, in this third iteration of the Innovation Scholars Program, we heavily prioritized the role of coaching and it became clear that it played an integral role in scholar support and learning. Moving forward, investing in strong coaches and agreeing on clear expectations will provide greater opportunities for impact.

Makerere

Engaging multiple scholars, each with a unique project can be a sure way of achieving multiple results within a specified period. In two and a half years of the CAES-ISP, the college realized outputs of nine scholars working in multi-disciplinary teams. Design team working (people with different backgrounds and experiences) enhances innovation and prototyping. Finally, CAES community highly engaged in the project which enhanced the innovation environment.

Best Practices That Emerged

LUANAR

Leadership is key in enhancing uptake of innovative ways for members of staff as a way of providing a conducive environment. Use of alumni to take part in co designing, delivery or coaching for in other institutions provides a self-reflection opportunity that further improves what was started while delivering better for the new areas. Finally, deliberately targeting specific people as champions within the institution can assist with creation of community of practice, but it has to be intentional and supported accordingly.

MSU

The program will only be successful if energy and time are spent on developing strong collaborations with university partners and previous ISP scholars (i.e. LUANAR and MUST) This includes building a program management team that actively engaged higher education African leaders. Operationally, it's very useful to gather input from scholars/design teams before and after workshops to understand if expectations align with delivery as well as learn what was done well/needs work to maintain a high standard of excellence. Importantly, if feedback is provided, the leadership team should either *incorporate* ideas or note why they might not. Addressing feedback builds trust and ensures participants in the program feel they are being heard. Finally, the host-institution program management team should lead the local implementation and serves as the point of contact for the host university (e.g. direct communication with scholars, messaging and engaging local leadership, etc).

Makerere

The system of making small disbursements towards meeting specific activities is effective. While it entails multiple planning sessions (including budgeting, work planning and reporting) which could be construed as time-consuming and laborious, the benefits obtained from planning for small manageable activities were evident across all scholar projects. The system also improves accountability and ensures effective resource use.

Regular online meetings with the facilitation team at MSU enabled smooth program management at CAES by enabling timely transfer of information across all project component teams (facilitation, program management, scholars and coaches). Regular mentoring and support for the program management team at CAES was important for achieving early successes on the project. Clear lines of communication between facilitation team at MSU and program management team at CAES enabled timely execution of activities.

8. PIVOT POINTS/ CHALLENGES

Pivot Points

The COVID-19 pandemic and the ensuing lockdowns and restrictions on movement delayed scholars whose engagements required to travel to meet their stakeholders. It also meant that physical meetings were not possible and any engagements could only be conducted on-line, which was initially challenging. The result meant two years of strategic pivoting as the program adapted to a new normal, identified creative ways to hold workshops, and supported logistical challenges for scholars and their work.

More than 95% of all meetings between program management team and facilitators at MSU were conducted online, occasioned by the inability to travel during lockdowns. Adjustments were made in the way meetings were held, regarding setting up of doodle polls, downloading online meeting calendars and installing zoom software. In addition, internet data and connectivity became important component parts of the program as means for communication exchange and meetings.

Challenges + Solutions

One of the challenges surrounding a pivot to over a year of fully online engagement centered around scholar and design team familiarity with new technologies. Design team members, particularly those who were younger or had more experience with various technologies became a deliberate act. These design team members became champions of the technology being introduced and helped to facilitate the learning process for all members.

The passing away of one of the scholars and a design team member for another scholar team during the project implementation phase meant that re-organization of scholar teams was necessary. In the case of the loss of scholar Professor Banadda, project documents such as technical and financial reports were lost making it difficult to perform M&E for the project.

9. GENDER/SOCIAL INCLUSIONS CONSIDERATIONS

Fifty percent (50%) of the scholars on the CAES-ISP were female including one female lead scholar for the Top Management Track who, during the project implementation phase, was voted as the first ever female College Principal for CAES. All, but one scholar team had at least one female as a member of their design team. Seven out of nine scholar teams had more than one female in their design teams. All innovations resulting from scholar activities are gender-sensitive.

10. DELIVERABLES COMPLETED

Research to Innovation

- Information Communication Technology (ICT) used to scan produce and certify farmers in the participatory guarantee system
 - This will be diffused across the entire country for organic certification purposes
- Three prototypes for pulping and pasteurizing for pineapple and hibiscus among micro, small to medium enterprises (MSMEs)
 - This will be diffused across the Kampala and Luwero District
- Delivery of Hands-on Practical Experiences for Business Management Courses at CAES

- Deployment of a problem solving-centered teaching and learning approach using the Teach-Think-Pair-Share model for increased skilling among Agricultural students
- An online platform that curates data on students' strengths, abilities, interests and preferences and then proposes matching organizations ideal for internship training
 - This will be diffused across the CAES, and eventually, Makerere University
- Audio-visual instructional materials developed to train instructors and students how to access and navigate the Makerere University E-Learning Environment (MUELE) platform
 - Instructional materials will be diffused across the entire university
- Seed Quality protocol: Strategies to addressing challenges in seed quality in the horticulture industry of Uganda (tomato and pepper)
 - This will be diffused across the central and northern regions of the country where tomatoes and peppers are cultivated
- Learner-Centered Training in Environmental Science & Management Industry for Student Internships

Innovation Network Growth

- 2 memorandums of understanding (MOUs) were created between Makerere University and two Malawian universities (i.e., MUST and LUANAR)

Organizational Product

- Transformational Pact - Designed academic programme, whose sequencing and delivery, promotes critical thinking and innovation, and identifies as well as innovatively harnesses partnerships and collaborations to support innovative engagements with industry
 - This will be diffused across the CAES campus

Communication Research to Innovation

- Nine, 10-12 minute recorded presentations were composed that illustrated the process scholars took to innovate (with HCD embedded)
- Nine posters were composed illustrating the process scholars took to innovate (with HCD embedded)
- One radio station recording was captured where three scholars presenting their innovation to the wider public of Accra, Ghana
- Two manuscripts and one policy brief which are nearing completion for the purpose of submitting to peer-reviewed journals.

Targeted fora & publications

- First manuscript development (up to results section) – A manuscript about the re-definition of challenges faced among Ugandan organic farmers, which informed the ideation of ICT Technology to scan produce and certify them as part of legitimizing the Ugandan participatory guarantee system. The scholar aims to submit to [NJAS](#).
- Second manuscript Development (up to results section) – A manuscript about the development and testing of a pulper for MSMEs. The scholar aims to submit to [IJAS](#).

- One Policy Brief (in review stage) a 12-page brief on how to support capacity building for farmers, agriculture service providers, seed dealers/companies' personnel, and policy makers for improving seed quality in the Ugandan horticulture sector.

11. OTHER

Tribute to Prof Noble Banadda

The loss of Professor Noble Banadda due to COVID in the second wave of the pandemic set the program aback. Professor Banadda was one of Uganda's most distinguished researchers, scholars, academics and innovators. The country in general lost a world-renowned, resourceful individual. It goes without saying that his colleagues and friends were deeply affected and the Program and the scientific field is indebted to his contributions.

12. APPENDICES

1. BHEARD CAES-ISP Visual Narrative
2. Innovation Scholar Project Visual Report 1: Developing innovative technology for the medium, small and micro enterprises in the food industry. Scholar: Julia Kigozi
3. Innovation Scholar Project Visual Report 2: Skilling to innovate (STI) in agricultural and environmental sciences. Prof. Gorettie Nabanoga
4. Innovation Scholar Project Visual Report 3: KaBERA Organics: A Handheld Application to Verify Produce On-Farm. Scholar: Fred Kabi

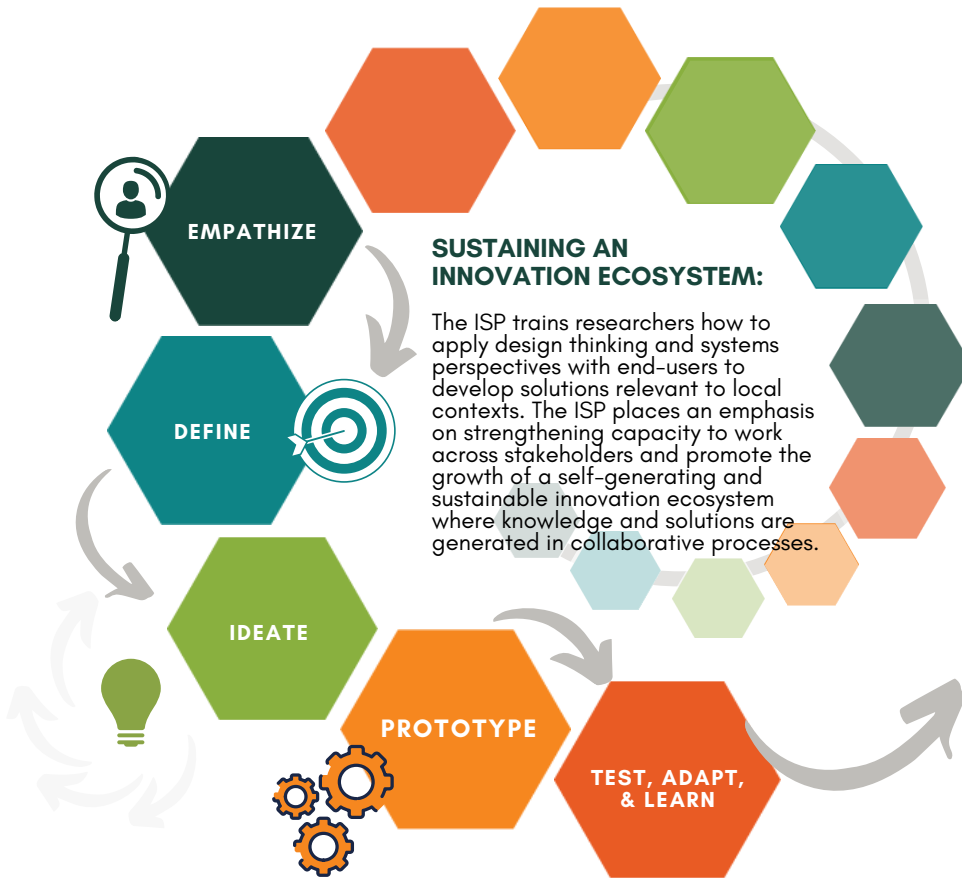
For more information about the CAES-ISP Program, [please see the MSU BHEARD website](#) which is home to several videos documenting various scholar innovation journeys.

MSU BHEARD: <https://www.canr.msu.edu/bheard/index>



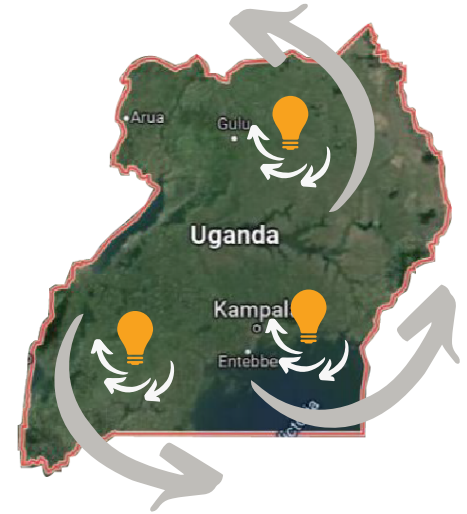
Innovation Scholars Program

College of Agricultural and Environmental Sciences (CAES) 2022 Report



PROCESS FOR CHANGE:

During the second year, each Innovation Scholar continued to address a challenge in their community by using a design thinking approach to problem solving. Scholars were supported with tailored training, coaching, and reflective assessment.



ISP THEORY OF CHANGE
Local Innovations, Institutional Learning, Systems Change

A LOOK INSIDE OUR SCHOLARS' PROJECTS:



defining problem space with end-user group



developing solution with an interdisciplinary team



testing, learning, and iterating based on feedback

A SCHOLAR PERSPECTIVE:

"I understand why things happen the way they happen. That is the empathy bit. I can begin to understand what they feel, what they need and what should be done. For me, if you do things like that with Human Centered Design at the back of your mind, then processes will move better, faster and easier."

SCOPE OF IMPACT

Innovation Networks

360+
INDIVIDUALS, ORGANIZATIONS, AND CENTERS across the country

Diverse Design Teams

45+
TEAM MEMBERS faculty and students across disciplines, professionals across sectors

SCHOLAR DEMOGRAPHICS

12 SCHOLARS **8** FACULTY **4** TOP MANAGEMENT

6 DEPARTMENTS **56%** WOMEN SCHOLARS

EDUCATIONAL APPROACH

10 COACHES **6** ACTIVE WORKSHOPS **40+** PARTICIPANTS per workshop

2 COUNTRY EXCURSIONS **1** VIRTUAL PLATFORM for design process tracking

INNOVATIONS DEVELOPED IN TESTING PHASE

- ICT for Organic Food Chains
- Juice Processing for Local Markets
- Distance-Learning Platform
- Industry-Informed Curriculum
- Seed Quality Protocol
- Problem-Centered Teaching Pedagogy
- Institutional Innovation System
- Student Engagement Strategy
- Industry Network for Student Internships

INNOVATION BEYOND THE ISP

2 GRANTS AWARDED post-project funding awarded to design-thinking detailed applications

2 MOUs CREATED between Makerere and other African Universities

4 INNOVATIONS DIFFUSED ACROSS UNIVERSITY post-project funding

Developing Affordable Technology for Medium, Small, and Micro Food (MSMEs) Processors in Uganda

Research Question: How might we better meet the needs of **food processors** working at medium, small and micro enterprises across Uganda?

Research Innovator:

Julia **Kigozi**, Senior Lecturer in the Department of Agricultural and Biosystems Engineering

Research Innovation Team:

Emmanuel **Baidhe**
Moses **Kalyango**
Isaac **Oluk**



Dr. Julia Kigozi worked with engineers and engineering students to investigate the context and needs of the Food processing MSMEs, taking time in and outside of the processing facilities to observe the operations of the food processors. One processor in particular, Charles Isaac, showed Dr. Kigozi that while he could operate new equipment despite being blind, the equipment's power source was not well-adapted to the fluctuating energy grid across rural Uganda and cost of day to day operation, creating inconsistency in the quality of the final product.



1 EMPATHIZING + DEFINING
Understand the Problem

With end-users, Dr. Kigozi identified the need for equipment that can be accessed, are safe, easy to use & maintain, are affordable and meet the capacity and quality of product for the consumer.



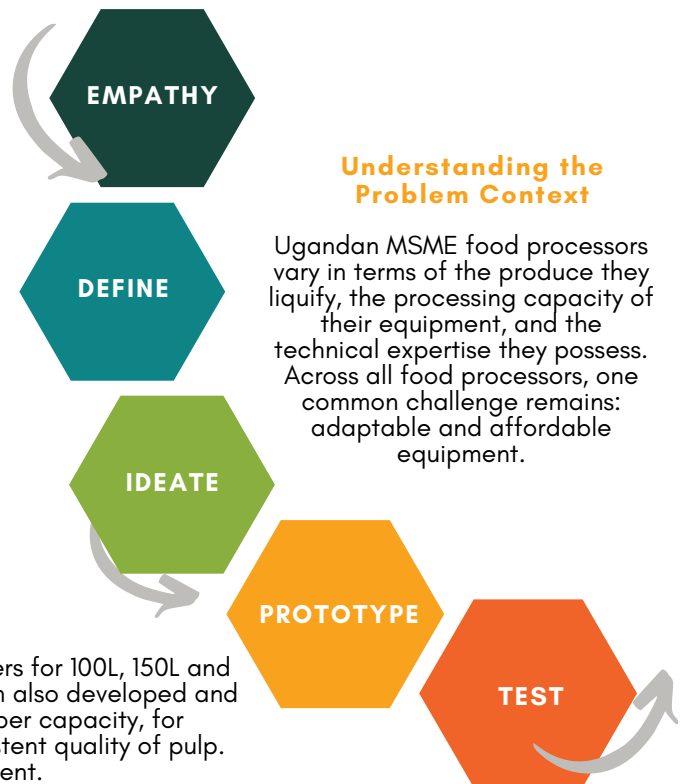
2 IDEATION + PROTOTYPING
Collaborate with Partners

In the process of designing a more usable product, Dr. Kigozi identified the need for a manual with more imagery than text so operators with limited literacy skills could follow and learn the equipment.



3 TESTING + ADAPTING
Re-engage the End-User

Dr. Kigozi's team developed and tested batch pasteurizers for 100L, 150L and 200L powered by electrical or biomass energy. The team also developed and tested a fruit pulper for 25L, 75L and 100L pulping chamber capacity, for application to various fruits ensuring required and consistent quality of pulp. This provided the MSME's with a wider choice of equipment.



Understanding the Problem Context

Ugandan MSME food processors vary in terms of the produce they liquify, the processing capacity of their equipment, and the technical expertise they possess. Across all food processors, one common challenge remains: adaptable and affordable equipment.

What's Next?

While the prototypes Dr. Kigozi and her team developed are quite affordable, the purchasing power of the processors is still low and she is calling for financial support from financial institutions or investment partners in terms of affordable financial packages that can be afforded by the processors.



Innovation in Higher Education: Creating the Enabling Environment

Research Question: How might we equip students and faculty in the **College of Agricultural and Environmental Sciences (CAES)** to drive innovation...

Research Innovator:
Gorette **Nabanoga**,
Principal of the College of
Agricultural and
Environmental Sciences

Research Innovation Team:
Achileo **Kaaya**,
Denis **Mpairwe**,
Justine **Namaalwa**,
Grace **Nakabonge**



...in teaching?



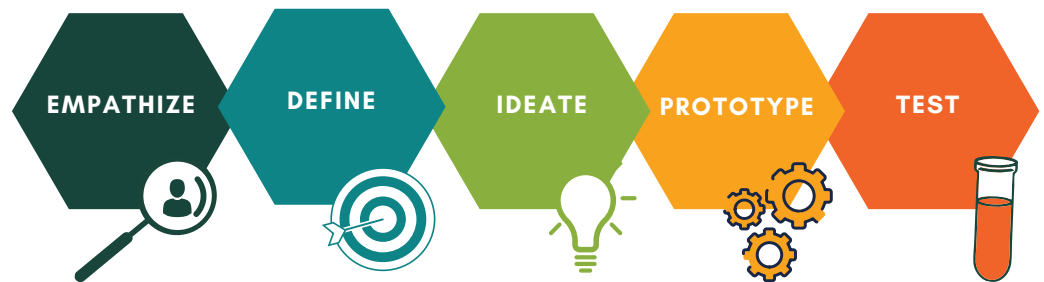

...in research?



...beyond the classroom?

Exploring the Innovation Process

The ISP Innovation Process applies a systems approach to innovation, designing with and for the people most closely impacted by the problem.

Understanding the System Context

Universities are key to building the next generation of innovators and leaders yet outdated curriculums and training tools are limiting the mindset and skillset shifts needed to tackle today's complex challenges. Principal Nabanoga was new to her position and knew that before asking others to "think differently," she had to model it herself. She brought forth a team of Departmental Heads and younger faculty to undergo the process of curriculum redesign collaboratively.

EMPATHIZING: Engage the End User

Principal Nabanoga engaged students, faculty and industry when discussing how CAES might change the innovation culture and prepare students for a changing job market.

DEFINING + IDEATION: Understand the System

She and her team held brainstorming sessions where participants were able to identify root causes challenging innovation growth and learning at CAES.

PROTOTYPING + TESTING Collaborate with Partners

Principal Nabanoga and her team invited stakeholders to contribute to learner-centered training approach that informs industry and supports market-ready graduates.



What's Next?

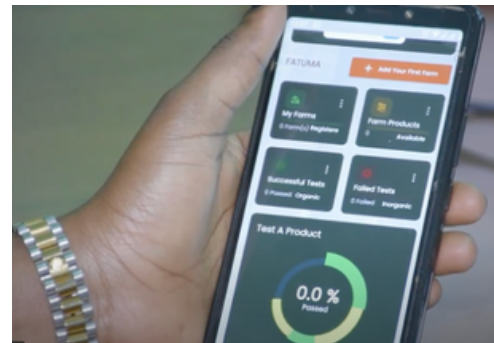
CAES developed an "Innovation Intentional" pact that details action steps needed to continue progress towards a more innovative and market-relevant curricula.

KeBERA; A Handheld Application to Verify Produce On-Farm

Research Question: How might we help **Ugandan smallholder farmers** gain access to international Certified Organic markets (worth >\$100 billion USD)?

Research Innovator:
Fred **Kabi**, Associate Professor from the Department of Agricultural Production, Uganda

Research Innovation Team:
Ambrose **Kamya**, Ramadhan Nkuutu, Dr. Daniel **Basalirwa**, Fatuma **Nabatanzi**, Ronald **Walusimbi**, and Brian **Ogenrwoth Zion**

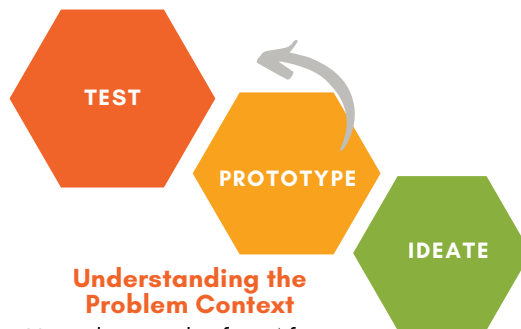


About the Innovation

KeBERA is an inexpensive mobile phone application that provides an alternative for farmers and their cooperatives to collectively certify their produce and meet global market standards. KeBERA verifies if synthetic chemicals were applied to produce and after testing, farmers upload results to an organic farming cooperative database. This reduces the need for field agents to visit rural farms and test for synthetic chemicals increasing opportunities for smallholder farmers to stay profitable.

Exploring the Innovation Process

The ISP Innovation Process applies a systems approach to innovation, designing *with* and *for* the people most closely impacted by the problem.



Understanding the Problem Context

Uganda was the first African country to develop a National Organic Agriculture Policy, with the 2nd largest number of organic farms per country worldwide. Despite an annual global market worth >\$100 billion USD, annual organic exports from Uganda only account for \$50 million USD.



PROTOTYPING + TESTING Collaborate with Partners

Kabi and his team prototype an easy-to-use, on-farm device for farmers to detect synthetic chemical residues in crops.



EMPATHIZING Engage the End User

Small Ugandan farmers (cultivating <2 hectares) lack access to the global markets. How might these farmers identify an economical alternative to certify produce and access markets?



DEFINING + IDEATION Understand the Problem

Farmers face difficulties in locating organic testing centers to certify their produce for the global market. When they do, they are either too expensive or time-intensive.

What's Next?

KeBERA LLC is validating the accuracy of its readings against ones received in laboratories. The National Organic Agricultural Movement of Uganda is organizing farmer groups to share the KeBERA application and offer feedback regarding "ease of use." To learn more, visit <https://keberaorganics.com>