

# FY 2022

---

## ANNUAL PERFORMANCE REPORT



Innovation Lab for Collaborative  
Research on Sustainable Intensification

---

*transforming farming systems for smallholders*



# Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification

*Annual Performance Report FY 2022*

This annual performance report for FY 2022 is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of Kansas State University and do not necessarily reflect the views of USAID or the United States Government.

Program activities are funded by the United States Agency for International Development under Cooperative Agreement No. AID-OAA-L-14-00006.

## Cover Photos

Top Left: The women group of Bambey of Serer learned about the Agricultural Tech Park at CNRA Bambey in Senegal. Photo credit: Doudou Diouf. August 2022.

Top Center: Cover crop blooms during Chinese New Year to welcome visitors and farmers alike in Battambang, Cambodia. Photo credit: Sokleng Mang. March 2022.

Top Right: ASMIH-Bangladesh team attended and presented at the workshop entitled, “Agricultural Mechanization in Bangladesh-the Future”. Photo credit: Sahabuddin Ahamed. March 2022.

Bottom: Group photo of attendees and participants at the 2022 SIIL Annual Meeting in Cambodia. Photo credit: Seven Studios. June 2022.



## Management Entity Information

The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) is housed at Kansas State University in Manhattan, KS. The management entity staff includes the following individuals:



### **Dr. P. V. Vara Prasad – Director**

Email: [vara@ksu.edu](mailto:vara@ksu.edu)

P.V. Vara Prasad, University Distinguished Professor of Crop Ecophysiology, serves as the Program Director of SIIL. He earned his B.S. and M.S. in agronomy from Andhra Pradesh Agricultural University in India, and his Ph.D. in crop physiology from The University of Reading in England. He has extensive international experience in both Africa and Asia and has had significant involvement with several USAID projects in these regions. His research focuses on understanding the response of food-grain crops to changing environments and management practices; developing strategies for management of crops, soil, water, and nutrients for the efficient use of resources; and using farming-system approaches to provide food and nutritional security to smallholder farmers. Prasad provides leadership to SIIL and oversees all of the research, capacity building, knowledge sharing and communication activities of the program. He administers technical and financial aspects of SIIL and serves as the primary contact for donors, advisory groups, and partner organizations.



### **Dr. B. Jan Middendorf – Associate Director**

Email: [jmiddend@ksu.edu](mailto:jmiddend@ksu.edu)

B. Jan Middendorf serves as the Associate Director for the SIIL at Kansas State University (KSU). As Associate Director, Dr. Middendorf conducts research and leads SIIL's impact assessment and monitoring and evaluation efforts. She is also responsible for establishing and maintaining effective partnerships with other U.S. and international institutions, industry, USAID Missions, and developmental partners. As part of these efforts, she develops and implements strategic planning and capacity building initiatives to enhance collaborative research and support organizational change. This experience includes working with various stakeholders at the community, regional, national, and international levels. Dr. Middendorf has over 25 years of experience in project development, management, implementation and evaluation of multi-institutional, interdisciplinary programs and projects in national and international settings. Dr. Middendorf earned her Ph.D. from KSU after completing her Master's and Bachelor's from Ohio University and University of Rhode Island, respectively.



### **Dr. Manny Reyes – Research Professor**

Email: [mannyreyes@ksu.edu](mailto:mannyreyes@ksu.edu)

Manuel Reyes, Research Professor, has more than 30 years of experience working with water quality modeling, natural resources management and conservation agriculture. He is an agroecological engineer, designing food production systems that mimic nature. Reyes has extensive expertise across the globe in research, extension, teaching, and project implementation. Reyes has focused his efforts in Cambodia, working with the Royal University of Agriculture and University of Battambang to enhance human and institutional capacity to conduct research and training of scholars and youth, as well as helping to lead the Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN). He has facilitated partnerships with other Feed the Future Innovation Labs, international organizations and NGOs (Non-Governmental Organizations), local non-profits, and private industry in Cambodia.



### **Jessica Means – Business Manager**

Email: [jess522@ksu.edu](mailto:jess522@ksu.edu)

Jessica Means serves as the Business Manager for the SIIL. She is responsible for the financial management of all grants, including post-award accounting, travel planning, distribution of funding for sub-awards, and working with pre- and post-award services. Jessica holds a B.S. in Business Administration – Accounting with a minor in Leadership Studies, as well as a Masters in Accountancy, both from Kansas State University. Additionally, she has previous experience as an auditor, providing her with much grant compliance and financial experience and prior university experience at Kansas State, Oklahoma State, and University of North Texas.



### **Layne Davis – International Communications Specialist**

Email: [laynewilson@ksu.edu](mailto:laynewilson@ksu.edu)

Layne Davis serves as the International Communications Specialist for the SIIL. She is responsible for developing and implementing communication strategies, success stories and social media content from project activities for effective outreach. She also is in regular communication with all of SIIL's current project leads, and assists with the monitoring, evaluation, and reporting requirements for the SIIL. Layne graduated from Texas Tech University with a Bachelor of Science in Agricultural Communications and a minor in Agribusiness Management.





### **LaTrese Taylor – Program Manager**

Email: [latreset@ksu.edu](mailto:latreset@ksu.edu)

LaTrese Taylor serves as Program Support for the SILL at Kansas State University. LaTrese earned her B.A. in Psychology from the University of Nevada Las Vegas. She holds an M.A. and an M.S. in Human Resource Management and Organizational Management from Webster University, St Louis, and The George Washington University, Washington, DC respectfully. LaTrese was in one of the last U.S. Peace Corps Master's International (MI) cadres, combining service with a degreed program. As an MI, she served as a Peace Corps agriculture volunteer in Senegal from 2016-2019. She received an M.A. in International Development from American University, Washington DC in 2021. She brings experience in project management, monitoring/evaluation, combining research and local farmer programming, and agricultural technical training/extension in farming communities. She speaks Wolof.



### **Dr. Elizabeth Guertal – Program Director**

Email: [guertea@ksu.edu](mailto:guertea@ksu.edu)

Prior to joining the SILL team Beth Guertal was the Rowe Endowed Professor in the Crop, Soil and Environmental Sciences Department at Auburn University, AL. In 2022 she served a one-year assignment with USAID (in ITR/R) as a Jefferson Science Fellow, one of 15 such Fellows selected by the National Academies of Sciences, Engineering and Medicine. Guertal received her B.S. and M.S. degrees from The Ohio State University, and her PhD from Oklahoma State University. Her research program focuses on soil fertility issues in turfgrass management. Guertal served as a Technical Editor for Crop Science, and as an Associate Editor for the Soil Science Society of America (SSSA) Journal, Crop Science (CSSA) and Agronomy Journal (ASA). She is a past-Chair of Division C-5 (Turfgrass Management, CSSA), a Fulbright Fellow and a Fellow of CSSA, SSSA, and ASA. She is a past President of the Crop Science Society of America.



### **Dr. Aliou Faye – iREACH Initiative and Country Coordinator, Senegal**

Email: [alliouselbel@yahoo.fr](mailto:alliouselbel@yahoo.fr) or [aliou.faye@isra.sn](mailto:aliou.faye@isra.sn)

Aliou Faye has two decades of research experience with the Senegalese Agricultural Research Institute (ISRA), the French Institute of Research for Development and the International Centre for Cooperation in Agricultural Development (CIRAD). Faye worked also for 5 years as Chief of Agency of a Saudi group dealing with non-timber forest products in the Tambacounda and Louga regions of Senegal. Faye holds a B.S. in Tropical Forestry, a M.S. in Agronomy, and a Ph.D. in Plant Biology from the Cheikh Anta Diop University of Dakar with field experience at the Tropical Soil Biology and Fertility (CIAT) in Nairobi Kenya. Faye has published at least 20 research articles in different scientific journals. Dr. Faye is currently the head of the Soil-Water and Plant Laboratory of the Centre National de la Recherche Agronomique (CNRA) of ISRA in Bambey, Senegal and serves as the iREACH (Innovation Research, Extension, and Advisory Coordination Hub) Initiative and Country Coordinator for the SILL in Senegal.



**Dr. Hamidou Traore – Country Coordinator, Burkina Faso**

Email: [hamitraore8@yahoo.com](mailto:hamitraore8@yahoo.com)

Dr. Hamidou Traore has over 25 years of research experience in the field of agronomy. Dr. Traore holds a PhD in Weed Science from the University of Montpellier II, Sciences and Techniques of Languedoc, France, and a Diploma of Rural Development Engineering in Agronomy from University of Ouagadougou. Dr. Traore serves as Director of the Institut de l'Environnement et de Recherche Agricoles (INERA), Burkina Faso. He previously held the position of Regional Director of the Eastern and Sahelian Environmental and Agricultural Research Regional Centers. Dr. Traore was also a Fulbright Scholar at the Agronomy Department of Purdue University.



**Araya Berhe – Program Manager**

Email: [aberhe@ksu.edu](mailto:aberhe@ksu.edu)

Araya Berhe serves as Program Manager for Geospatial and Crop Model applications in the Sustainable Intensification Innovation Lab at Kansas State University. He received his Ph.D. in Production Ecology and Resources Conservation from Wageningen University, the Netherlands. Currently, his research is focused on application of crop modeling, geospatial, and agro-meteorological technique for sustainable water management, developing climate change adaptation and resilience strategies, and optimizing resources use for sustainable agricultural production and food security. In addition, his responsibilities include managing research activities related to use of crop modeling, geospatial, and digital tools for reducing impacts of water shortage, climate change and climate variability, and nutrient management related challenges in agriculture at local, regional, and global level.



**Prakash Kumar Jha – Associate Scientist**

Email: [pjha@ksu.edu](mailto:pjha@ksu.edu)

Prakash Kumar Jha is an associate scientist at the Kansas Agricultural Experiment Station and works in collaboration with the SIIL. He earned his B.S. in Agricultural Sciences from Banaras Hindu University, India, his M.S. in Environmental Sciences from Indian Agricultural Research Institute, India, and his Ph.D. in Crop and Soil Sciences from Michigan State University, USA. His advisors are PV Vara Prasad and Ignacio A. Ciampitti. Prakash is currently engaged in the projects on Lonsinger Sustainability Research Farm, and the Digital Tools, Geospatial and Farming Systems Consortium (DGFSC) at Kansas State University.



### **Sanders Barbee – Senior Student Assistant**

Sanders Barbee serves as the Communications Assistant for the SILL. As the Senior Student Assistant, Sanders helps to expand and promote communication strategies, success stories and social media content from project activities for effective outreach. Sanders is currently a sophomore majoring in Agricultural Economics, with a pre-law focus. She is also a fellow with the K-State's Food and Agriculture Policy Fellowship. She is an active leader in the student community in Manhattan, Kansas serving as Secretary in the college MANRRS chapter. Along with this, she participates in the University marching band where she plays the mellophone. Sanders has recently taken on a new role as the Conservation & Sustainability Fellow for the Kansas Grain Sorghum's Producer Association where she will assist Kansas Grain Sorghum in connecting with sustainability projects focusing on farm-oriented programming. She is scheduled to graduate in May 2023.



### **Jenika Hazelbaker – Student Research Assistant**

Jenika Hazelbaker serves as Student Research Assistant for the SILL. In her role, Jenika helps to execute the Lab's communication strategy, such as by assisting with report writing and data collection that involves Spanish translation. Jenika is currently a Senior in the University Honors Program, triple majoring in Agronomy, Spanish, and Global Food Systems Leadership. She has served in several leadership roles around K-State, which include the Vice President of the K-State MANRRS chapter, the Chair of Campaign Marketing for K-State Proud, and the Director of Multicultural Outreach for the Student Foundation. This year, she is the Director of Membership for Blue Key Senior Honorary. Outside of serving in organizations, she has been an active undergraduate researcher, focusing on improving the nutritional quality of sorghum. Jenika has recently served on K-State's International Service Team to The Gambia, where she spent 8 weeks working in agricultural development with a local nonprofit to increase the accessibility and affordability of crop inputs for smallholder farmers. Jenika is a University Presidential Scholar and scheduled to graduate in May 2023.



### **Marleigh Hutchinson – Student Research Assistant**

Marleigh Hutchinson serves as a Student Assistant for the SILL. She is a sophomore majoring in Environmental Engineering with a secondary major in Natural Resources and Environmental Sciences. As a student assistant, she helps create and execute laboratory communication strategies and research reports. Marleigh also serves as an undergraduate research assistant in the Carl R. Ice College of Engineering, where she works alongside faculty to develop and manage new wastewater management technologies. In addition, she is an Ambassador for the College of Engineering, is involved with Engineers Without Borders, and runs social media campaigns for the Carl and Melinda Helwig Department of Biological and Agricultural Engineering. Marleigh will graduate in May 2025.



### **Victoria Ward –Student Research Assistant**

Victoria (Tori) Ward serves as a Research Assistant for the SILL. Ward is currently a Junior majoring in organizational management and Spanish with a Leadership minor and an International Business certificate. After graduation, she intends to attend a highly competitive European graduate school or joining the Peace Corps. In addition to her new position at SILL, she serves as the director of the “Why I Give Week” for the Kansas State Student Foundation, is the Student Director for the College of Business’s annual Women in Business Summit, a mentor in K-State’s International Buddies program, and a member of her sorority Kappa Kappa Gamma. Tori is excited and prepared to help in any way she is needed at SILL. Next semester, she will be studying abroad in Valencia, Spain, but hopes to return to SILL in the fall of 2023. Ward expects to graduate with honors in May 2024.



## External Advisory Board

The External Advisory Board (EAB) is chaired by Jules Pretty. The EAB was actively engaged in evaluating the proposals for focus country research subawards and was responsible for making final decisions on project selection.



### **Professor Jules Pretty – Chair** University of Essex

Jules Pretty is Professor of Environment and Society at the University of Essex, and Director of the Centre for Public and Policy Engagement. He is formerly Deputy Vice-Chancellor (2010-19). His sole-authored books include *Sea Sagas of the North* (forthcoming, 2022), *Green Minds and a Good Life* (forthcoming, 2022), *The East Country* (2017), *The Edge of Extinction* (2014), *This Luminous Coast* (2011, 2014), *The Earth Only Endures* (2007), *Agri-Culture* (2002) and *Regenerating Agriculture* (1995).

He is a Principal Fellow of the Higher Education Academy, Fellow of the Royal Society of Biology and the Royal Society of Arts, former Deputy-Chair of the UK government's Advisory Committee on Releases to the Environment and has served on advisory committees for BBSRC (Biotechnology and Biological Sciences Research Council) and the Royal Society. He was presenter of the 1999 BBC Radio 4 series *Ploughing Eden*, a contributor and writer for the 2001 BBC TV Correspondent program *The Magic Bean*, and a panelist in 2007 for Radio 4's *The Moral Maze*. He received a 1997 award from the Indian Ecological Society, was appointed A D White Professor-at-Large by Cornell University from 2001 and is Chief & Founding Editor of the *International Journal of Agricultural Sustainability*. He received an OBE in 2006 for services to sustainable agriculture, an honorary degree from Ohio State University in 2009, and the British Science Association Presidential Medal (Agriculture and Food) in 2015. He is among the top 1% most cited scientists in the world and is host of the podcast *Louder Than Words*.



### **Dr. John Dixon** Australian Centre for International Agricultural Research - retired

John Dixon is Adjunct Professor focused on farming systems at the University of Queensland, Visiting Fellow on sustainable development policy at the Australian National University and Guest Professor on farming systems at Gansu Agricultural University. Dixon has 40 years developing country experience with agricultural research and sustainable development with FAO (Food and Agriculture Organization) and the CGIAR (Consultative Group of International Agricultural Research) in Asia, Africa, the Middle East, and Latin America. He has worked on many aspects of ecologically, economically, and socially sustainable intensification for food security and poverty reduction, including systems research, innovation, environment and natural resource management, systems agronomy, conservation agriculture, participatory methods, market access and value chain function, policy analysis, M&E, impact assessment, knowledge sharing. He was presented with the M S Swaminathan Award for leadership in agriculture and was elected as a Fellow of the Australian Academy of Technology Science and Engineering. The Global Evergreening Alliance has selected him as a Senior Fellow and as Chair of the Technical Advisory Board of the Restore Australia Program. Dixon is a graduate from the University of New England with a Ph.D. (agricultural economics), Masters (natural resources), Masters (economics) and Bachelor of Rural Science and has published more than 100 books, articles, chapters, and reports on the above subjects.



### **Dr. Cornelia Flora**

*Iowa State University*

Cornelia Flora is an Emeritus Distinguished Professor in the Department of Sociology at Iowa State University. Her research interests include international and domestic development, community, and the sociology of science and technology, particularly as related to agriculture and participatory change. Socio-technical regime change, and capitals transformations (natural, cultural, human, social, political, and financial/built capitals) guide her current research includes work on the community development, sustainable agriculture, and natural resource management, with particular attention to how class, gender, and ethnicity influence and are influenced by technology and policy. She has published 14 books, with a 15<sup>th</sup> co-authored book in preparation. She has served as president of the Rural Sociological Society, the Agriculture, Food and Human Values Society, and the Community Development Society. Her B.A. degree is from the University of California at Berkeley and her MS and PhD degrees are from Cornell University.



### **Dr. Peter Thorne**

*International Livestock Research Institute (ILRI) – retired*

Peter Thorne coordinates the Africa RISING (Research in Sustainable Intensification for Next Generation) project in the Ethiopian Highlands. He completed his Ph.D. at the University of Nottingham in animal nutrition, with a part of his research conducted at the University of the Philippines in Los Banos. His career has allowed him to work in both public and private sectors, focusing largely on the evolution of mixed farming systems in Africa and Asia. Prior to joining ILRI (International Livestock Research Institute), Thorne was responsible for the national dairy benchmarking service in Britain.

## Focus Countries

The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) supports research in West Africa, East Africa, Asia, and Central America. This map includes all countries that SIIL has worked in, both past and present.



## List of Program Partners

### United States

ADM Institute for the Prevention of Postharvest Loss  
 American Soybean Association (ASA)  
 Feed the Future Innovation Lab for Collaborative Research on Nutrition in Africa  
 Feed the Future Innovation Lab for Fish  
 Feed the Future Innovation Lab for Horticulture  
 Feed the Future Innovation Lab for Small Scale Irrigation  
 Feed the Future Innovation Lab for the Reduction of Postharvest Loss  
 Kansas State University  
 Michigan State University  
 Montana State University  
 North Carolina A&T State University  
 Northwestern University  
 Oakland University  
 Pennsylvania State University  
 Rutgers University  
 Stanford University  
 Texas A&M University  
 Tillers International  
 Tufts University  
 United States Peace Corps - Senegal  
 University of California, Davis  
 University of Colorado - Boulder  
 University of Florida  
 University of Illinois at Urbana-Champaign  
 University of Maryland  
 University of Minnesota  
 University of Tennessee Institute of Agriculture (UTIA)  
 University of Wisconsin – Madison

### Bangladesh

ACI Motors Limited  
 Bangladesh Agricultural Research Council (BARC)  
 Bangladesh Agricultural Research Institute (BARI).  
 Bangladesh Agricultural University  
 Bangladesh Rice Research Institute  
 BRAC  
 International Maize and Wheat Improvement Center (CIMMYT)  
 International Agricultural Research Center (IARC)  
 International Rice Research Institute (IRRI)  
 Institute of Water Modeling (IWM)  
 Khulna University  
 Shushilan (National NGO)

### Burkina Faso

Association pour la Promotion de l'Élevage en Savane et au Sahel (APESS)  
 Institut de l'Environnement et de Recherches Agricoles (INERA)  
 International Livestock Research Institute (ILRI)  
 La Fédération Nationale des Groupements Naam (FNGN)



Polytechnic University of Bobo-Dioulasso (UPD)  
The International Union for Conservation of Nature (IUCN)

### Cambodia

Agricultural Development Denmark Asia  
AVRDC – World Vegetable Center  
Cambodian Agricultural Research and Development Institute (CARDI)  
Conservation Agriculture Service Center (CASC)  
Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)  
Department of Agricultural Engineering (DAEng)  
ECHO Asia  
Institute of Technology of Cambodia (ICT)  
Kasetsart University  
Ministry of Agriculture Forestry and Fisheries (MAFF)  
Ministry of Education and Youth (MoEY)  
Provincial Department of Agriculture, Forestry and Fisheries (PDAFF)  
Royal University of Agriculture - Phnom Penh  
SmartAgro  
University of Battambang

### Ethiopia

Africa Research in Sustainable Intensification for the Next Generation (Africa RISING)  
Bahir Dar University / Bahir Dar Institute of Technology  
International Food Policy Research Institute (IFPRI)  
International Livestock Research Institute (ILRI)  
International Water Management Institute (IWMI)  
University of Twente

### Guatemala

Institute of Agricultural Science and Technology (ICTA)

### Haiti

American University of the Caribbean (AUC)  
Campus Henri Christophe de Limonade (CHCL)  
Faculte d'Agronomie et de Medecine Veterinaire (FAMV)  
Quisqueya University (UniQ)  
Université Chrétienne du Nord d'Haïti (UCNH)  
University Notre Dame of Haiti (UNDH)

### Honduras

Directorate of Science and Agricultural Technology (DICTA)  
Universidad de Zamorano

### Mali

Institute of Rural Economy (IER)

### Niger

National Institute of Agronomic Research (INRAN)

### Senegal

Agence Nationale de Conseil Agricole et Rural (ANCAR)

Bureau d'Analyse Macro Economiques (BAME)  
 Centre d'Etude pour l'Amélioration de l'Adaptation à la Sécheresse (CERAAS)  
 Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)  
 Institut de Recherche Pour le Développement (IRD)  
 Institut de Technologie Alimentaire (ITA)  
 Institut Sénégalais de Recherches Agricoles (ISRA) – Centre National de Recherches Agronomiques de Bambey (CNRA – Bambey)  
 ISRA – Laboratoire National d'Élevage et de Recherches Vétérinaire (LNERV)  
 ISRA – Laboratoire National de Recherche sur les Production Végétales (LNRPV)  
 Réseau des Organisations Paysannes et Pastorales du Sénégal (RESOPP)  
 University of Thies – College of Agriculture

#### Tanzania

Africa Research in Sustainable Intensification for the Next Generation (Africa – RISING)  
 International Center for Tropical Agriculture (CIAT)  
 International Institute of Tropical Agriculture (IITA)  
 International Maize and Wheat Improvement Center (CIMMYT)  
 N2Africa  
 Nelson Mandela African Institution of Science and Technology (NM-AIST)  
 Sokoine University of Agriculture (SUA)

#### Additional Partners or Collaborators

African Economic Research Center (AERC)  
 aWhere  
 Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles (CORAF)  
 Corteva Agriscience  
 Descartes Labs  
 Innovation Research, Extension, and Advisory Coordination Hub (iREACH)  
 International Fertilizer Development Center (IFDC)  
 International Institute for Applied Systems Analysis (IIASA)  
 ITC – Netherlands  
 Kifiya Financial Technology Plc.  
 One Acre Fund  
 Quantitative Engineering Design  
 Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)  
 Swiss Federal Institute of Aquatic Science and Technology (EAWAG)  
 Swisscontact  
 Taking Maize Agronomy to Scale in Africa (TAMASA)  
 University of Gaston-Berger  
 University of Rwanda  
 University of Western England  
 Wageningen University and Research Center  
 World Agroforestry Center  
 World Vision

## Acronyms

ACIAR – Australian Centre for International Agricultural Research  
 ADDA – Agricultural Development Denmark Asia  
 ADS – Automated Directives System  
 ADM Institute – Archer Daniels Midland Institute  
 AERC – African Economic Research Center  
 Africa RISING – Africa Research in Sustainable Intensification for the Next Generation  
 AfSIS – Africa Soil Information Service  
 AGRA – Alliance for a Green Revolution in Africa  
 ANCAR - Agence Nationale de Conseil Agricole et Rural  
 AOR – Agreement Officer’s Representative  
 APSS – Association pour la Promotion de l’Elevage en Savane et au Sahel  
 ASA – American Soybean Association  
 ASABE – American Society of Agricultural and Biological Engineering  
 ASM – Appropriate scale mechanization  
 ASMC – Appropriate Scale Mechanization Consortium  
 AUC – African Union Commission  
 AUC – American University of the Caribbean  
 AWP – Annual Work Plan  
 BAME – Bureau d’Analyse Macro Economiques  
 BARC – Bangladesh Agricultural Research Council  
 BARI – Bangladesh Agricultural Research Institute  
 CA – Conservation Agriculture  
 CT – Conventional Tillage  
 CASC – Conservation Agriculture Service Center  
 CASF – Conservation Agriculture Service with a Fee  
 CAST – Commercialization of Aquaculture for Sustainable Trade  
 CERAAS – Centre d’Etude pour l’Amélioration de l’Adaptation à la Sécheresse  
 CE SAIN – Center of Excellence on Sustainable Agricultural Intensification and Nutrition  
 CE MARCH – Center of Excellence on Mitigation, Adaptation and Resilience to Climate-Change in Haiti  
 CGIAR – Consultative Group on International Agricultural Research  
 CHCL – Campus Henri Christophe de Limonade  
 CIAT – International Center for Tropical Agriculture  
 CIMMYT – International Maize and Wheat Improvement Center  
 CIRAD – Centre de Coopération Internationale en Recherche Agronomique pour le Développement  
 CNRA – Centre National de Recherches Agronomiques (CNRA)  
 CORAF – Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles  
 CSA – Climate smart agriculture  
 CSISA-MEA – Cereal Systems Initiative for South Asia – Mechanization Extension Activities  
 CSIRO – Commonwealth Scientific and Industrial Research Organization  
 DAEng – Department of Agricultural Engineering  
 DAOUST – Dakar American University of Science and Technology)  
 DDL – Data Development Library  
 DICTA – Directorate of Science and Agricultural Technology  
 EAB – External Advisory Board  
 EMMP – Environmental Management and Mitigation Plan  
 EAWAG – Swiss Federal Institute of Aquatic Science and Technology  
 FAA – Federal Aviation Administration  
 FABI – Faculty of Agricultural Biosystems Engineering  
 FAMB – Faculte d’Agronomie et de Medecine Veterinaire  
 FAO – Food and Agriculture Organization

FGD – Focus Group Discussions  
 FNGN – La Fédération Nationale des Groupements Naam  
 FLMLA – Faculty of Land Management and Land Administration  
 FTFMS – Feed the Future Monitoring System  
 FY – Fiscal year  
 GFC – Geospatial and Farming Systems Research Consortium  
 GIS – Geographic Information System  
 GMCC – Green Manure Cover Crops  
 HYV – High Yielding Varieties  
 IARC – International Agricultural Research Center  
 ICRIAT – International Crops Research Institute for the Semi-Arid Tropics  
 ICT – Institute of Technology of Cambodia  
 ICTA - Institute of Agricultural Science and Technology  
 IDRC – International Development Research Centre  
 IDSS – Integrated Decision Support System  
 IER – Institute of Rural Economy  
 IFDC – International Fertilizer Development Center  
 IFPRI – International Food Policy Research Institute  
 IIASA – International Institute for Applied Systems Analysis  
 IITA – International Institute of Tropical Agriculture  
 IL – Innovation Lab  
 ILRI – International Livestock Research Institute  
 ILSSI – Innovation Lab for Small Scale Irrigation  
 INERA – Institut de l’Environnement et de Recherches Agricoles de Burkina Faso  
 INGENAES – Integrating Gender and Nutrition within Agricultural Extension Services  
 INRAN – Institut National de la Recherche Agronomique du Niger  
 IPM – Integrated Pest Management  
 iREACH – Innovation Research, Extension, and Advisory Coordination Hub  
 IRD – Institut de Recherche Pour le Développement  
 IRRI – International Rice Research Institute  
 ISRA – Institut Sénégalais de Recherches Agricoles  
 ITA – Institut de Technologie Alimentaire  
 IUCN – International Union for Conservation of Nature  
 IWMI – International Water Management Institute  
 LIVES – Livestock and Irrigation Value Chains for Ethiopian Smallholders  
 LNERV – Laboratoire National d’Élevage et de Recherches Vétérinaire  
 LNRPV – Laboratoire National de Recherche sur les Production Végétales (LNRPV)  
 MAFF – Ministry of Agriculture Forestry and Fisheries  
 ME – Management Entity  
 MoEY – Ministry of Education and Youth  
 MOU – Memorandum of Understanding  
 MSU – Michigan State University  
 NARS – National Agricultural Research Systems  
 NUBB – National University of Battambang / University of Battambang  
 NGO – Nongovernmental organization  
 NM-AIST - Nelson Mandela African Institution of Science and Technology  
 NUS – Neglected and underutilized species  
 PDAFF – Provincial Department of Agriculture, Forestry and Fisheries  
 PRC – Policy Research Consortium  
 PI – Principal investigator  
 PTOS – Power Tiller Operated System



R4D – Research for Development  
 RESOPP – Réseau des Organisations Paysannes et Pastorales du Senegal  
 RHoMIS – Rural Household Multiple Indicator Survey  
 RUA – Royal University of Agriculture  
 SAR – Synthetic Aperture Radar  
 SBIR – Small Business Innovation Research  
 SEARCA - Southeast Asian Regional Center for Graduate Study and Research in Agriculture  
 SI – Sustainable intensification  
 SIIL – Sustainable Intensification Innovation Lab  
 SIPS – Sustainably intensified production systems  
 STEM – Science, Technology, Engineering and Mathematics  
 SSA – Sub-Saharan Africa  
 SUA – Sokoine University of Agriculture  
 TAMASA – Taking Maize Agronomy to Scale in Africa  
 TP – Technology Park  
 TRA – Technology Readiness Assessment  
 UAV – Unmanned Aerial Vehicle  
 UBB – University of Battambang / National University of Battambang  
 UCNH – Université Chrétienne du Nord d’Haïti  
 UNDH – University Notre Dame of Haiti  
 UniQ – Quisqueya University  
 UPB – Polytechnic University of Bobo-Dioulasso  
 USAID – United States Agency for International Development  
 USG – United States Government  
 UTIA – University of Tennessee Institute of Agriculture  
 WAgN – Women in Agriculture Network

## Table of Contents

Management Entity Information .....	iii
External Advisory Board.....	ix
Focus Countries.....	xi
List of Program Partners.....	xii
Acronyms .....	xv
I. Executive Summary.....	20
II. Focus Country Key Accomplishments.....	21
Bangladesh .....	21
ASMC II: .....	21
Pathways of scaling agricultural innovations for sustainable intensification in the polders of coastal Bangladesh.....	21
Burkina Faso.....	21
ASMC II: .....	21
Cambodia.....	22
ASMC II: .....	22
S3 Cambodia – Scaling Suitable Sustainable Technologies: .....	22
Guatemala/Honduras.....	22
Economic impact of improved bean varieties in Central America and the USA:.....	22
Niger/Senegal.....	22
Improving food and nutrition security of smallholder agro-pastoral farming systems by integrating crop-livestock-human nutrition in Senegal and Niger:.....	23
Senegal.....	23
ASMC II: .....	23
III. Research Program Overview and Structure .....	24
Digital Tools, Geospatial, and Farming Systems Consortium – Building a new era of Predictive Agricultural Innovation to Improve the Livelihoods of Smallholder Farmers .....	24
The Appropriate Scale Mechanization Consortium (ASMC II) .....	24
Focus Country Research Subawards .....	24
IV. Theory of Change .....	25
V. Research Project Reports .....	26
Theme I: Geospatial and Digital Tools .....	26
Digital Tools, Geospatial, and Farming Systems Consortium (FY2020 – FY 2023).....	26
Theme II: Appropriate Scale Mechanization for Smallholder Farmers .....	28
Summary of ASMC II Activities .....	28
ASMC II – Bangladesh.....	29
ASMC 2 – Burkina Faso.....	32
ASMC II – Cambodia.....	33

	19
Theme III: Rice Fallows and Horticulture – South Asia .....	35
• Bangladesh .....	35
• Cambodia.....	36
Theme IV: Crop-Livestock Interactions - West Africa .....	38
• Senegal and Niger .....	38
VI. Associate Award Research Project Reports and Initiatives.....	39
Haiti Agricultural University Partnership (HAUP): Center of Excellence on Mitigation, Adaptation, and Resilience to Climate-Change in Haiti (CE MARCH) .....	39
Innovation Research, Extension and Advisory Coordination Hub (iREACH) .....	40
VII. Human and Institutional Capacity Development.....	48
Short-term Training .....	48
Long-term Training .....	53
Institutional Development .....	56
VIII. Innovation Transfer and Scaling Partnerships .....	57
Plan of Action .....	57
IX. Environmental Management and Mitigation Plan (EMMP) .....	58
X. Open Data Management Plan.....	58
XI. Governance and Management Entity Information.....	59
Regional and Country Coordinator Activity.....	59
SIIL Personnel Highlights.....	61
Policy Research Impact Study Consortium Closeout.....	61
Expanding the Sustainable Intensification Assessment Framework.....	61
XII. Other Topics.....	62
Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) at the Royal University of Agriculture.....	62
Gender Integration Highlights: .....	64
Nutrition Integration Highlights:.....	64
XIII. Issues .....	65
Anticipated No-Cost Extensions for our Consortia and Focus Country Subawards.....	65
Challenges related to implementation in Haiti.....	65
XIV. Future Directions and Activities.....	66
SIIL Management Entity .....	66
iREACH Coordination Hubs Implementation and Expansion .....	66
CE SAIN Institutionalization at the Royal University of Agriculture .....	66
XV. Appendices .....	67
Appendix A – List of Awards Given to U.S. Universities .....	67
Appendix B – Success Stories.....	69

## I. Executive Summary

The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (SIIL) successfully completed its eight year since inception. This report covers current activities in Bangladesh, Burkina Faso, Cambodia, Guatemala, Haiti, Honduras, Niger, and Senegal. The SIIL continues to support the goal of developing an integrated research portfolio of sustainable intensification practices that offers the greatest potential to reduce hunger while improving the resilience and nutrition of smallholder farmers in the target regions. This fiscal year, SIIL has positioned itself to build on the achievements of past years while ensuring the continued relevance of the research with a renewed focus on leveraging regional efforts, scaling innovations, and strengthening local institutional and human capacity with the goal of working toward the *journey to self-reliance*.

During this past year, research projects and consortia have been working on scaling (identifying appropriate partners) technologies and innovations with appropriate partners, and this report highlights the accomplishments and lessons learned during that time. Project teams had already identified promising innovations from their research by using a holistic approach by actively collaborating with strategic partners to leverage investments from both the public and private sectors. They were then able to communicate their successes through multiple knowledge management platforms, which have been key to successful implementation that will ensure greater impact, reach, and return on investments. The SIIL continues to grow and collaborates with over 120 national and international entities (including 9 CGIAR (Consultative Group of International Agricultural Research Centers) and 19 US universities) and supporting > than 200 students and young scientists to work towards increasing agriculture productivity and resilience of cropping systems and supporting nutritional outcomes.

This summary serves to highlight a few of the key achievements of SIIL from this past year: On June 23-25, 2022, the SIIL held its Annual Meeting in Phnom Penh, Cambodia. This consisted of an “International Delegation Day and Knowledge Sharing,” with representation from the USAID-Missions in Cambodia, Guatemala, Haiti, and West Africa, as well as the local government and other federal agencies (e.g., USDA, United States Department of Agriculture) and American Soybean Association board members and representatives from the private sector. There were over 130 participants over the course of the three days, and the SIIL showcased the collaboration between its consortia, focus country subawards, and initiatives. The SIIL also launched the collaboration with the Minority Serving Institutions (MSI) in the spring of 2022 by assisting with the implementation of the 1890 Association of Research Directors (ARD) Symposium and exploring ways in improve collaboration with more MSI’s with USAID and Innovation Labs. Additionally, the SIIL successfully completed the close-out of the Feed the Future Policy Research Consortium and worked to appropriately disseminate the crucial findings through a final conference and further outlets.

Other highlights include a) the Center for Sustainable Agricultural Intensification and Nutrition (CE SAIN) at Royal University of Agriculture in Cambodia showcased its capacity by hosting its third SAIN Conference in June 2022; b) the Center of Excellence on Mitigation, Adaptation, and Resilience to Climate-Change (CEMARCH) initiated and secured Memorandum of Understanding (MOU) agreements between Kansas State University and all the Haiti Agriculture University partners; and c) engagement with the USAID Missions, Innovation Labs, and CORAF (Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles) on the implementation of the activity tracker to support collaboration and coordination activities in West Africa as it relates to iREACH (Innovation Research, Extension, and Advisory Coordination Hub).

In addition to these key highlights and achievements, restrictions relating to COVID-19 were lifted and project leaders began traveling again and were able to complete the implementation of activities. SIIL’s consortia, focus country subawards, and initiatives had many accomplishments during this reporting period, and they are highlighted in the sections below.

SIIL is committed to human and institutional capacity building as evidenced by the 96 short-term trainings offered to 7,159 individuals (2,655 women, 37%). During FY 2022, SIIL supported 61 with 51% females. There are 19 Ph.D. students (32% female), 28 M.S. students (54% female), and 14 B.S. students (71% female). SIIL country coordinators continued to provide support to partners on the implementation and coordination of research, capacity building activities, communication, and support of ongoing research. Collectively, SIIL’s researchers produced over 65 peer-reviewed publications and delivered over 42 presentations in FY 2022.



## II. Focus Country Key Accomplishments

### Bangladesh

The Appropriate Scale Mechanization Consortium, (ASMC II), continued to concentrate on scaling up improved mechanization innovations and techniques. Additionally, the project, “Pathways of scaling agricultural innovations for sustainable intensification in the polders of coastal Bangladesh” moved forward with its work in polder communities focused on improved rice planting techniques and improved production and cultivation practices. Below are highlights from the projects that worked in Bangladesh during FY 2022:

#### ASMC II:

1. The ASMIH-Bangladesh Virtual Annual Symposium 2021 on “Appropriate Scale Mechanization for Sustainable Intensification in Agricultural Production Systems” was successfully held on November 16, 2021, via the Zoom platform. There was a total of 178 participants from partners across the globe.
2. ASMIH-Bangladesh established five single shed service points and two Technology Park single shed service points in southern delta of Bangladesh and nearby Bangladesh Agricultural University, Mymensingh.
3. Agricultural Machinery Fair and Seminar was held at Phulpur Upazila Parishad, Mymensingh on June 14, 2022, where 435 participants (Male: 252; Female: 183) attended and five private agricultural machinery companies (SQ Group, Metal Pvt. Ltd., Banglamar, and ACI Motors Ltd.) joined in the fair to display their agricultural machineries.
4. The Reaper with Open Power Transmission System has been successfully set-up at the Laboratory under the Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh for the practical learning of undergraduate students in agricultural engineering.

#### ***Pathways of scaling agricultural innovations for sustainable intensification in the polders of coastal Bangladesh***

1. Two service providers purchased reapers to strengthen mechanized paddy harvest facilities in the community.
2. Established Cluster-Based Farmer Field Schools (CFFS) that is led by the Department of Agricultural Extension (DAE) with technical backing from the Polder project.
3. Published the next issue of Polder Tidings Vol 3, No. 3, June 2022., and four papers in peer-reviewed journals.
4. Developed three maps of the canal catchments to guide in-polder water management.

### Burkina Faso

The ASMC II was also active in Burkina Faso during FY 2022. ASMC II continued to concentrate on scaling up the improved mechanization innovations and techniques created during ASMC’s first phase, including improved oxen yokes and the no-till planter for use by women farmers. Below are the highlighted activities completed in Burkina Faso during FY 2022:

#### ASMC II:

1. Six ASMC technologies were selected to be showcased in the iREACH Technology Park. These included: 1) maize planter; 2) improvement of forage production and silage making using forage chopper; 3) semi-automatic solar drip irrigation system; 4) silage making process using recycled plastic containers for sustainable use; 5) improved yoke using PVC (polyvinyl chloride) tubing and; 6) conservation agriculture by minimum soil disturbance using a ripper.
2. More than 20 forage choppers have been built and are being used in the arid zone of Burkina Faso (Nord and Sahel).

## Cambodia

The S3 Cambodia: Scaling Suitable Sustainable Technologies worked to augment their research project to improve the diffusion and adoption of the innovations created through the first project. ASMC II also continued their activities in Cambodia, in conjunction with various partners, including NUBB (National University of Battambang), RUA (Royal University of Cambodia) and CE SAIN (Center for Sustainable Agricultural Intensification and Nutrition). Below are the highlighted activities completed in Cambodia during FY 2022:

### ASMC II:

1. Completed an impact assessment on the Seed Broadcaster technology to validate the number of estimated areas achieved by the technology. Approximately 5778 hectares of land utilized improved management practices with the seed broadcaster and an impact assessment report was authored and uploaded in the Harvard Dataverse for dissemination.
2. Swisscontact and Smart-Agro signed a partnership agreement amendment to promote cover crop seeds.
3. Approximately 940 hectares of land in Battambang utilized improved Conservation Agriculture (CA) management practices using three technologies: no-till planter, land leveler, and cover crops.

### S3 Cambodia – Scaling Suitable Sustainable Technologies:

1. Graduate Research Assistant Huot presented on "Gender Aspects of Wild Food Plant Production, Utilization, and Scaling in Northwestern Cambodia" at the Annual Meeting of the Rural Sociological Society, Westminster, Colorado, August 2022.
2. Launched a 3-month internship program with Swisscontact and NUBB to provide 8 students with hands-on entrepreneurship and soft skills training.
3. Collaborated with the Farmer-to-Farmer (F2F) project to deliver complementary training on conservation agriculture to vegetable producers and on agricultural education and extension to green lab partners.

## Guatemala/Honduras

### ***Economic impact of improved bean varieties in Central America and the USA:***

The "Economic impact of improved bean varieties in Central America and the USA," a study lead by Michigan State University (MSU) and the International Center for Tropical Agriculture (CIAT), to evaluate and estimate the economic impact of investments made by the former Legume Innovation Lab program, CIAT, and other organizations and universities on bean breeding. The evaluation is focused on the USA (i.e., Michigan), Guatemala, Honduras, Nicaragua, and Haiti, with fields trial being conducted in Guatemala and Honduras. Below are the highlights completed during FY 2022:

1. Collected nursery and weather data.
2. Conducted focus groups and collected data for the impact assessment.
3. Obtained secondary seed production data.
4. Finalized key informant interviews and the data are being processed and will be reported in FY 2023.
5. Collected data for bean yield trials in Michigan.
6. Collaborated with DICTA (Directorate of Science and Agricultural Technology) and University of Zamorano in Honduras and ICTA (Institute of Agricultural Science and Technology) in Guatemala to establish bean nurseries to assess yields of different bean varieties.

## Niger/Senegal

The Senegal project, "Improving food and nutrition security of smallholder agro-pastoral farming systems by integrating crop-livestock-human nutrition in Senegal and Niger" strengthen the research and expanded

its focus to encompass a more regional approach in West Africa. Below are the highlighted activities completed in Senegal during FY 2022:

***Improving food and nutrition security of smallholder agro-pastoral farming systems by integrating crop-livestock-human nutrition in Senegal and Niger:***

1. Results of the cropping season analyzed in December 2021 showed that on average, increased density improved grain yield by 20-60% for all sites.
2. In Niger, the project recruited a master's students who is finalizing the collection of data on the dual-use millet to create his document and support.
3. In Niger, trails were implemented at G-Maigari, Dakoro, and K-Warao to demonstrate the effects of three types of fertilizer on millet, the effect of increased millet sowing density on yield, and for demonstrating/dissemination of dual-use Senegal varieties (SL 28, SL 169, SL 423, and Thialack 2) compared to local varieties.

## **Senegal**

The ASMC II was also active in Senegal during FY 2022. ASMC II continued to concentrate on scaling up the improved mechanization innovations and techniques, including improved oxen yokes and the no-till planter for use by women farmers. Below are the highlighted activities completed in Senegal during FY 2022:

### **ASMC II:**

1. The ASMC team met with Dr. Sidy Ndao, president of DAOUST (Dakar American University of Science and Technology) and discussed plans for working with their engineering students to develop shop drawings and develop improved implements for scaling up.
2. Held an inaugural meeting of the West Africa Mechanization Innovation Hub in Senegal, May 2022. The meeting was attended by the Hub Advisory Committee as well as all of the ASMC-Senegal project members.

### III. Research Program Overview and Structure

#### Digital Tools, Geospatial, and Farming Systems Consortium – Building a New Era of Predictive Agricultural Innovation to Improve the Livelihoods of Smallholder Farmers

The Digital Tools, Geospatial, and Farming Systems Consortium provided high-resolution soil, climate, crop, livestock, nutrition, and socioeconomic data. These datasets are helping to quantify past conditions and inform future changes in the adoption of different management practices to improve the overall resiliency and sustainability of agricultural systems in targeted regions in West Africa and Asia, as well as in the Feed the Future Zones of Influence. The consortium continues to create and promote the following based on their proposed objectives:

- *Modeling tools*: to examine mixed crop-livestock farming systems' suitability and land capability for agriculture productions in targeted regions.
- *Remote-sensing products*: to assess current conditions, trends, and potential future conditions in targeted countries.
- *Connection*: to link agricultural productive capacity and child malnutrition using livestock ownership, field size, use of improved seeds and fertilizer, and climate variability.
- *Resilience*: to examine the potential implications of agricultural innovations on social and biophysical risk and resilience at local test sites in targeted regions.
- *Innovation integration*: develop geospatial products that integrate across project outputs to map biophysical and social risk analysis for the targeted regions and the potential of specific agricultural innovations to increase resilience in the face of climate change.

#### The Appropriate Scale Mechanization Consortium (ASMC II)

The ASMC aims to introduce multifunctional and modular mechanized technologies that are technically, environmentally, economically, and socially appropriate for use by smallholder farmers (including women) with the flexibility to accommodate different power sources. They are currently active in four countries. The specific intervention and entry point will vary by country as determined by the host country partners and needs of the producers. These technologies contribute to enhanced labor productivity and increased land productivity, thus sustainably reducing poverty among smallholders.

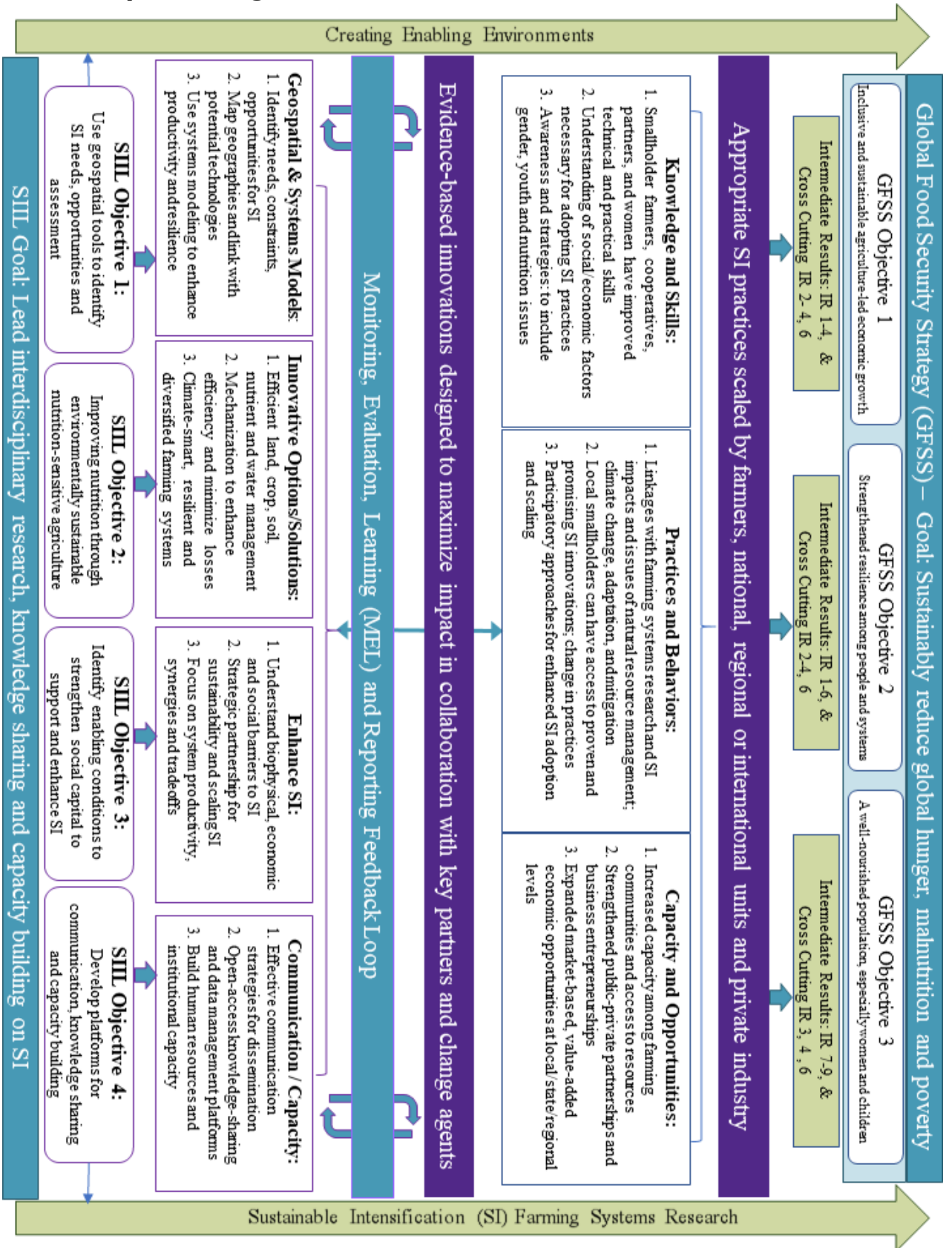
ASMC II worked on scaling its innovations in four countries – Bangladesh, Burkina Faso, Cambodia, and Senegal. The objectives for the consortium focus on the following goals:

- *Scaling*: will work to scale SI innovations and associated technologies to stakeholders (farmers, manufacturers/ blacksmiths, extension, service providers, mechanics, private and public sectors).
- *Capacity Building*: will work to build technical and entrepreneurship capacity of service providers, fabricators and manufacturers, and mechanization experts in the focus countries.
- *Policy*: will work to create and contribute to an enabling policy environment for mechanization among smallholder farmers.

#### Focus Country Research Subawards

The SIIL supported three country subawards (Bangladesh, Cambodia, and Senegal/Niger) in FY 2022. Together, the research project subawards have been investigating a diverse range of sustainable intensification practices and innovations across the SIIL focus countries. The broad focus areas being crop-livestock interaction; better management of crops and livestock to enhance resource use efficiency; diversification (integration of legumes; home gardens; and new crops); and precision and sustainable agricultural practices. The SIIL research subawards are implemented and led by collaborations between U.S. universities, NARES (National Agricultural Research, Extension and Service) centers, NGOs, and CGIAR partners. Summary highlights are shared in Research Project Reports in Section V of this report.

## IV. Theory of Change





## V. Research Project Reports

### Theme I: Geospatial and Digital Tools

#### **Digital Tools, Geospatial, and Farming Systems Consortium (FY2020 – FY 2023)**

1. **Name:** Digital Tools, Geospatial, and Farming Systems Consortium (DGFSC, Principal Investigator (PI): Ignacio Ciampitti, Kansas State University)
2. **Locations:** Global – Due to the nature of the consortium’s research and the incorporation of remote sensing, the projects are often not location-dependent. The locations listed for each subaward report may refer to field work locations, targeted areas for remote sensing work, or a combination of the two. However, the processes and methods can be scaled globally.
3. **Collaborators:** *United States* – aWhere, Corteva Agri-Science, Descartes Labs, Microsoft, Michigan State University, University of Colorado, University of Maryland, University of Minnesota; *Bangladesh* – International Rice Research Institute (IRRI); *Senegal* - Initiative Prospective Agricole et Rurale (IPAR), Centre of Excellence on Dry Cereals & Assoc. Crops, National Centre for Livestock Research, Kolda (CRZ), Senegalese Agricultural Research Institute (ISRA).
4. **Description and Achievements:** The DGFSC will focus its efforts, through a portfolio of research subawards and independent research, on five primary objectives. The achievements listed under each objective refer specifically to the efforts of the DGFSC leadership team at Kansas State University.
  - **Modeling tools:** to examine mixed crop-livestock farming systems' suitability and land capability for agriculture productions in targeted regions. Two review papers on livestock (Senegal and Bangladesh).
  - **Remote-sensing products:** to assess current conditions, trends, and potential future conditions in targeted countries. Assessed impact of climate scenarios in Bangladesh.
  - **Connection:** to link agricultural productive capacity and child malnutrition using livestock ownership, field size, use of improved seeds and fertilizer, and climate variability. Developed modeling framework which is currently under review.
  - **Resilience:** to examine the potential implications of agricultural innovations on social and biophysical risk and resilience at local test sites in targeted regions. Adaptation strategies for water limited conditions identified and reviewed.
  - **Innovation integration:** develop geospatial products that integrate across project outputs to map biophysical and social risk analysis for the targeted regions and the potential of specific agricultural innovations to increase resilience in the face of climate change. Developed modeling framework which is currently under review. Country level data is being collected for Senegal.
5. **Capacity Building:**
  - Trained 19 students in Senegal on the use of LandPKS app to collect descriptive information when soil sampling. Furthermore, crop phenology information is being collected in five locations to improve modal development. This activity requires the capacitation of the students in different crop physiology aspects.
  - Supported the development and creation of a new Youth Symposium for Plant Science with collaboration of two universities in Cambodia, with the goal of continuing this initiative for the coming year in collaboration with funds from a private industry.
  - In collaboration with Senegal and Cambodia partners to train new students on GIS use and data collection through utilization of a mobile application for a benchmark survey.
  - Prepared training materials and lessons and delivered to graduate and advanced undergraduate students in Cambodia summer of 2022 on the LandPKS software for the assessment of soil health.
6. **Lessons Learned:**
  - The consortium has found that significant communication and terminology barriers still exist between the health and agriculture communities, and it requires a broader engagement and discussion. To help alleviate this, they are working toward meeting twice a year as a team to accelerate the development of useful decision support tools.
  - Regarding the livestock modeling, the consortium learned that the need for communication needed to be increased with their partners. These efforts have been largely successful in Senegal as they

collaborated with different local groups to obtain necessary information related to livestock modeling activities.

## 7. **Presentations and Publications:**

### **Journal Articles**

- 1) Carcedo, A. (May 2022). Assessing impact of salinity and climate scenarios on dry season field crops in the coastal region of Bangladesh (pp.103428). *Agricultural Systems*, 200, Amsterdam, Netherlands. doi: <https://doi.org/10.1016/j.agsy.2022.103428>.
- 2) Rasu, E. (July 2022). Current and future challenges and opportunities for livestock farming in West Africa: perspectives from the case of Senegal. *Agronomy*, 12(8), Basel, Switzerland. doi: <https://doi.org/10.3390/agronomy12081818>.
- 3) Brown, M. Integrated modeling framework for sustainable agricultural intensification. *Frontiers in Sustainable Food Systems (Under Review)*.
- 4) Moller, K. Livestock farming in Bangladesh: current and future challenges and opportunities. *Agronomy (Under Review)*.
- 5) Viera, N. Management adaptations for water-limited pearl millet systems in Senegal. *Agricultural Water Management (Under Review)*.
- 6) Carcedo, A. The urgency for investment on local data for advancing options for improving crop productivity and climate resilience assessments in Africa: a review for APSIM crop modeling. *Environmental Modelling and Software (Under Review)*.
- 7) Bastos, L. (September 2022). Variety and management selection to optimize pearl millet yield and profit in Senegal. (pp.126565). *European Journal of Agronomy*, 139, Amsterdam, Netherlands. doi: <https://doi.org/10.1016/j.eja.2022.126565>.

### **Conference/Presentations**

- 1) Burrows, R. (April 2022). Considering soil moisture in models of climate impacts on child health in farming-centric countries (id: 138-2). Population Association of America Annual Meeting, USA.
- 2) Burrows, R. (December 2021). Considering soil moisture in models of climate impacts on child nutrition in farming-centric countries. American Geophysical Union Annual Meeting, New Orleans, USA. 2021AGUFMGC44C..04B.
- 3) Rasu, E. (July 2022). Constraints and Opportunities for Livestock Farming in Senegal. Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 4) Moller, K. (July 2022). Livestock Farming in Bangladesh: Current and Future Challenges and Opportunities. Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 5) Chikafa, M. (July 2022). The Impact of Irrigation Interventions to Improve Food Security in Malawi. Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 6) Rasu, E. (July 2022). Constraints and Opportunities for Livestock Farming in Senegal. Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 7) Burrows, R. (April 2022). Considering soil moisture in models of climate impacts on child health in farming-centric countries (id: 138-2). Population Association of America Annual Meeting, Atlanta, USA.
- 8) Burrows, R. (December 2021). Considering soil moisture in models of climate impacts on child nutrition in farming-centric countries. American Geophysical Union Annual Meeting, New Orleans, USA. 2021AGUFMGC44C..04B.

### **Other**

- 1) Burrows, R. (April 2022). Considering soil moisture in models of climate impacts on child health in farming-centric countries (id: 138-2). Population Association of America Annual Meeting, USA.
- 2) Burrows, R. (December 2021). Considering soil moisture in models of climate impacts on child nutrition in farming-centric countries. American Geophysical Union Annual Meeting, New Orleans, USA. 2021AGUFMGC44C..04B.

## Theme II: Appropriate Scale Mechanization for Smallholder Farmers

### Summary of ASMC II Activities

1. **Name:** Appropriate Scale Mechanization Consortium (PI: Prasanta Kalita, University of Illinois at Urbana-Champaign)
2. **Locations:** Bangladesh, Burkina Faso, Cambodia, and Senegal
3. **Description:** The ASMC facilitates the introduction of multifunctional and modular mechanized technologies that are technically, environmentally, economically, and socially appropriate for use by smallholder farmers. The overall objective of the project is to sustainably intensify smallholder farmers' cropping systems and on-farm operations through mechanization. The ASMC utilizes a user-centric systems approach through an Innovation Hub model in each of their four focus countries. The Hubs identify specific mechanization needs, leverage ASMC resources accordingly, and implement innovative solutions.
4. **Collaborators:** United States - Kansas State University, Michigan State University, and North Carolina A&T State University, ADM (Archer Daniels Midland) Institute for the Prevention of Postharvest Loss (Illinois). Additional international collaborators are listed under country report.
5. **Achievements:**
  - ASMC hosted a two-and-a-half-hour session at the ASABE (American Society of Agricultural and Biological Engineering) Annual International Meeting in Houston, TX. The session featured an overview and progress updates from each innovation hub, with a panel discussion from several thought leaders, including the ASMC Science Advisory Chari, Dr. Gajendra Singh.
  - ASMC held an in-person Fall Symposium on October 28<sup>th</sup>-29<sup>th</sup>, 2021. This meeting provided the opportunity for ASMC leaders and team members to collaborate and to review the status of the ASMC project. It also allowed for all participants to discuss and assess the progress of the project and analyze revised workplans.
  - The Agricultural Mechanization Prioritization Survey was developed and administered to experts in agriculture mechanization in Africa and Asia to identify the current status of mechanization and to identify the major barriers to mechanizing the agricultural sectors. A revised strategy was developed and implemented to acquire more than 1325 responses in Africa and 645 responses in Asia, and a report is being developed based on the findings. ASMC will also hold a Summit in Senegal with key stakeholders in FY 2023 to discuss and prioritize results.
  - ASMC will continue its efforts to develop a database on global agricultural mechanization research. This database will house documents created through work and research that ASMC has conducted, as well as work produced by partner entities. This database will allow ASMC to become the leading entity for resources on agricultural mechanization in their regions of focus.
6. **Capacity Building:**
  - Maria Jones supported regional/country leads in gender integration into existing activities such as ensuring extension materials are gender sensitive, and she will continue to do so.
7. **Lessons Learned:**
  - Although virtual meetings continue to increase the frequency of communication, ASMC benefitted from having in-person meetings, workshops, and field days in their focus countries.
8. **Presentations and Publications:**
  - See individual ASMIH reports for publications and presentation created during FY 2022.

### Journal Articles

- 1) Reyes, M. R., SAR, P., Alrawashdeh, G. S., & Lindgren, S. 2022. Engaging youth at school to advance sustainable agriculture and inspire future farming: evidence from Cambodia. The Journal of Agricultural Education and Extension, USA. doi: <https://doi.org/10.1080/1389224X.2022.2117213>.

### Conference/Presentations

- 1) Jones, M. (July 2022). Developing Gender-Responsive Technologies: Examples from the Appropriate Scale Mechanization Consortium. Presentation at ASABE, Houston, USA.

## ASMC II – Bangladesh

1. **Name:** Appropriate Scale Mechanization Innovation Hub (ASMIH) – Bangladesh
2. **Locations:** Innovation Hub location: Bangladesh Agricultural University, Mymensingh (Bangladesh)  
Field locations: Dumuria and Wazirpur (Bangladesh)
3. **Description:** The goal of the ASMIH – Bangladesh project is promoting appropriate-scale agricultural mechanization for sustainable intensification focusing on smallholder farming systems in Southern Delta region of Bangladesh. The target equipment interventions include Rice transplanters; rice reapers, mini-combine rice harvesters, strip-tillage planters, no-tillage planters, bed planters, and axial flow pumps.
4. **Collaborators:** Bangladesh – Bangladesh Agricultural University (BAU), Bangladesh Rice Research Institute, Bangladesh Agricultural Research Institute, and ACI Motors Ltd.
5. **Achievements:**
  - ASMIH – Bangladesh provided technical assistance to the Department of Agricultural Extension (DAE) in establishing the synchronized cultivation program by providing machine services and training to farmers and mechanics.
  - ASMIH-Bangladesh identified the needs for establishment of a Technology Park in collaboration with private sector partner, ACI Motors Ltd., Conservation Agriculture Park at BARI (Bangladesh Agricultural Research Institute), Gazipur, and assessing efficacy of single, single shed and farmers’ group entrepreneurship incorporating women and youth in Bangladesh.
  - The ASMIH – Bangladesh team established five single shed service points and two Technology Park single shed service points in southern Bangladesh and nearby Bangladesh Agricultural University, Mymensingh.
  - The ASMIH – Bangladesh Virtual Annual Symposium 2021 on “Appropriate Scale Mechanization for Sustainable Intensification in Agricultural Production Systems” was successfully held on November 16, 2021, via the Zoom platform. Research activities of ASMC, ASMIH – Bangladesh, and ASMIH – Cambodia were shared at this symposium. The valuable discussion of the distinguished panelists made the symposium a place of cross-country knowledge sharing platform.
6. **Capacity Building:**
  - Dr. Md. Monjurul Alam gave a virtual presentation on “Climate Change: Agricultural Machinery as Mitigation Measures” on August 22, 2022, under the project “Background Paper and National Stakeholder dialogue on Private Sector Engagement in Climate Actions: Focus on Private Sector Investment in AFOLU Sector” organized by Business Initiative Leading Development (BUILD).
  - A total of 26 trainings were provided to 591 participants (male: 524 and female: 67) of Polder 30 and Botiaghata, Khulna; Wazirpur, Barishal; Kalapara, Patuakhaliupazila; Purbadhala, Netrakona, and Mymensingh of Bangladesh as well as in virtual platforms during the October 2021 to September 2022 reporting period.
  - In addition, 304 farmers (Male: 274 and Female: 30) were demonstrated mechanical transplanting and harvesting of paddy through 10 farmers field day.
  - Collaborations with CIMMYT-Bangladesh, Institute of Engineers (IEB) and the Department of Agricultural Extension (DAE) have been strengthening through training and workshops. As part of the collaboration, the USAID Feed the Future Bangladesh Cereal Systems Initiative for South Asia Mechanization and Extension Activity (CSISA-MEA) in partnership with Bangladesh Agricultural University (BAU) organized a workshop for agricultural mechanization value chain actors on “Agricultural Mechanization in Bangladesh – The Future” at Pan Pacific Sonargaon, Dhaka, on March 21-22, 2022.

## 7. **Lessons Learned:**

- The ASMIH – Bangladesh team learned and identified the nature of entrepreneurship, usage of different agro-machineries, how these machines reach to the entrepreneurs through the marketing channel, and reasons for choosing the different entrepreneurial models.
- Entrepreneurship trainings organized by ASMIH-Bangladesh will certainly enhance both men and women's knowledge and skills on agro-machinery based entrepreneurship. To bring more women in the entrepreneurial career path, an entrepreneurship awareness program, specifically for women, can play a vital role.

## 8. **Presentations and Publications:**

### **Journal Articles**

- 1) Alam, M., Saha, C. K., Ali, M., Hasan, M., & Hossain, M. 2021. Technical performance and benefit of mini-combine harvester in Southern Delta of Bangladesh (pp.45-53). Journal of Agricultural Mechanization in Asia, Africa & Latin America, 52(3), Japan. 00845841.
- 2) Hossain, M., Amin, M., Mottalib, M. A., & Hoque, M. Selection of appropriate conservation tillage-cum-planting machinery for planting of soyabean in the southern region of Bangladesh. Agricultural Engineering International: CIGAR Journal.

### **Conference/Presentations**

- 1) Alam, M., Sarkar, S., & Saha, C. (July 2022). Synchronized paddy cultivation using mechanical rice transplanting technology in Bangladesh. ASABE 2022 Annual International Meeting, Houston, Texas, USA.
- 2) Alam, M. (August 2022). Climate Change: Agricultural Machinery as Mitigation Measures. Department of Farm and Power Machinery Bangladesh Agricultural University, Mymensingh, Bangladesh.
- 3) Alam, M. (January 2022). Fourth Industrial Revolution (4IR) and Agricultural Mechanization in Bangladesh. Presentation.
- 4) Alam, M. (March 2022). Trend of Agricultural Machinery and Spare Parts Manufacturing and Sales in Bangladesh. Presentation.
- 5) Alam, M. (November 2021). Appropriate Scale Mechanization for Sustainable Intensification in Agricultural Production Systems in Bangladesh.
- 6) Alam, M. (September 2021). Emerging Fourth Industrial Revolution (4IR) and Agricultural Mechanization in Bangladesh. Agricultural Economic Forum where State Minister of ICT, Government of the people's Republic of Bangladesh. Presentation.
- 7) Alam, M., Saha, C. K., & Sarkar, S. (June 2022). Zero tillage paddy cultivation in Bangladesh using mechanical rice transplanter. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 8) Hossain, M., Saha, C., Hoque, M., Alam, M., & Alam, M. (July 2022). Investigation of long-term conservation agriculture at BARI and adaptive trials of conservation machinery and water management systems in the southern delta of Bangladesh. Presentation.
- 9) Kalita, P., Alam, M., Ali, M., Sarkar, S., & Saha, C. (July 2022). Appropriate Scale Mechanization for Sustainable Intensification of Paddy Production Systems in Bangladesh. ASABE 2022 Annual International Meeting, Houston, Texas, USA.
- 10) Kalita, P., Kumar Saha, C., Sarkar, S., Alam, M., & Ali, M. (July 2022). Project Highlights and the Importance of Policy Change in Agricultural Mechanization for International Development. Presentation at ASABE 2022 Annual International Meeting, Houston, Texas, USA.
- 11) Kumar Saha, C. & Alam, M. (March 2022). Adoption and Adaptation of Pre & Post harvest Rice Farming Technologies: Bangladesh Experience.
- 12) Kumar Saha, C., Alam, M., Hasan, M., & Ali, M. (June 2022). Assessment of Mechanical Paddy Harvesting Scopes in Selected Areas of Bangladesh Using GIS. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 13) Kumar Saha, C., Alam, M., Hossain, M., Hoque, M., & Alam, M. (July 2022). Establishment of a CA park to investigate long term conservation agriculture practices to improve soil health for sustainable crop



production. ASABE 2022 Annual International Meeting, Houston, Texas, USA. doi: <https://doi.org/10.13031/aim.202200247>.

- 14) Kumar Saha, C., Alam, M., Hossain, M., Hoque, M., Alam, M., & Jahan, N. (June 2022). Conservation Agriculture and Water Management for Sustainable Crop Production in Coastal Region of Bangladesh. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.
- 15) Saha, C. (December 2021). 4IR in Agriculture. <https://www.facebook.com/Mujib100IndustrialExhibition/videos/284815116933499>
- 16) Saha, C. (December 2021). BAU-STR Dryer: A Climate Smart Solution for Farmers and Small Traders. Department of Farm and Power Machinery Bangladesh Agricultural University, Mymensingh, Bangladesh.
- 17) Saha, C. (January 2022). Transformation of Linear to Circular System: Food, Agriculture and Clean Energy Nexus. <https://www.youtube.com/watch?v=MYRGmTnwdNk>. Presentation.
- 18) Saha, C. K., Alam, M., Hossain, M., Hoque, M., & Alam, M. (June 2022). Establishment of Conservation Agricultural Park for Sustainable Crop Production in Bangladesh. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.

#### **Other**

- 1) Alam, M., Saha, C. K., Ali, M., & Hossain, M. Appropriate Scale Mechanization Innovation Hub-Bangladesh. Abstract. (*Under Review*)
- 2) Alam, M., Saha, C. K., Ali, M., & Hossain, M. BAU Reaper: Efficient Cereal Harvester for Marginal Farmers. Magazine Article.
- 3) Ali, M., Saha, C., Alam, M., Ahamed, S., & Sayem, N. S. Brochure of Smart Agro-Technology Innovation Youth Network (SAIYN).
- 4) Ali, M., Sarkar, S., Hasan, M., Saha, C., & Alam, M. Introduction to combine harvester. Leaflet.
- 5) Kalita, P., Alam, M., Saha, C. K., & Sarkar, S. Impact of Appropriate Scale Mechanization in Selected Villages of Southern Delta of Bangladesh. Abstract.
- 6) Kumar Saha, C. & Alam, M. (May 2022). Appropriate Scale Mechanization with Model Entrepreneurships: A Key to Sustainable Paddy Production in Bangladesh. <https://www.agrilinks.org/post/appropriate-scale-mechanization-model-entrepreneurships-key-sustainable-paddy-production?fbclid=IwAR0sHsCEPzxl-u7Cf2BcWYEmZycF1ylFTRQrky-erqlp5QBS0EQc5YnYqd0>. Blog post.
- 7) Nishat, N. Modern agrotechnology, women empowerment and poverty reduction nexus: empirical evidence on BAU-STR dryer. Thesis.
- 8) Saha, C. K., Alam, M., Hossain, M., Hoque, M., & Alam, M. (May 2022). Conservation Agriculture Park at BARI: A Unique Demonstration Place a First of Its Kind in Bangladesh. [https://www.agrilinks.org/post/conservation-agriculture-park-bari-unique-demonstration-place-first-its-kind-bangladesh?utm\\_source=USAID%20Bureau%20for%20Resilience%20and%20Food%20Security%20%2F%20Agrilinks&utm\\_campaign=a9cccbe522-EMAIL\\_CAMPAIGN\\_2020\\_11\\_10](https://www.agrilinks.org/post/conservation-agriculture-park-bari-unique-demonstration-place-first-its-kind-bangladesh?utm_source=USAID%20Bureau%20for%20Resilience%20and%20Food%20Security%20%2F%20Agrilinks&utm_campaign=a9cccbe522-EMAIL_CAMPAIGN_2020_11_10). Blog post.
- 9) Tasnim, N. Patterns and process of agro-machinery-based entrepreneurship in southern delta of Bangladesh. Thesis.

## ASMC 2 – Burkina Faso

1. **Name:** Appropriate Scale Mechanization Innovation Hub (ASMIH) – Burkina Faso
2. **Locations:** Innovation Hub location: Polytechnic University of Bobo-Dioulasso, Bobo-Dioulasso (Burkina Faso); Field locations: Koumbia, Burkina Faso
3. **Description:** The main objective of the project in Burkina Faso was to increase maize productivity through appropriate scale mechanization using animal draft for smallholder farmers. The targeted equipment interventions included: a refined ox yoke, single row ox-driven planter, conservation ripper (chisel plow), and an animal-drawn crop cultivator. Other tools include forage/fodder chopper and solar powered irrigation systems.
4. **Collaborators:** Burkina Faso - Polytechnic University of Bobo-Dioulasso, University Nazi Boni (UNB), Bobo-Dioulasso; United States - Tillers International.
5. **Achievements:**
  - Six ASMC technologies were selected to be showcased in the iREACH Technology Park. The ASMIH-Burkina Faso is in the process of organizing training for artisan from Ghana, Mali, and Niger so that these technologies may be built and showcased in their respective countries.
  - Farmer training in the use of technology is an important part of scaling and uptake. Over 100 planters are in use, and over 1,000 farmers have been trained.
  - The forage chopper developed by the ASMC team has been well received by farmers. Over 20 choppers have been built and are being used in the arid zone of Burkina Faso (Nord and Sahel).
  - One student is authoring a thesis on silage making.
  - The ASMIH – Burkina Faso team trained a group of craftsmen for the reproduction of the ASMCA seeder and chopper.
6. **Capacity Building:**
  - Eleven students have completed their master’s thesis on a project related to ASMC. The ASMIH-Burkina Faso hub plans to admit the first student to the newly established M.S. in Agricultural Mechanization degree program. This will be the first program in the country and may have a long-term impact of agricultural mechanization in Burkina Faso.
  - The ASMC team was able to effectively open the training cycle for a master’s degree in Appropriate Agricultural Mechanization at the Nazi Boni University.
7. **Lessons Learned:**
  - The Hub relayed that travel restrictions to Burkina Faso continues to be an issue and something to work around.
8. **Presentations and Publications:**

### Journal Articles

- 1) Barro, A. (August 2022). The ASMC seeder improves maize sowing in the western region of Burkina Faso(pp.9). International Journal of Environment, Agriculture and Biotechnology, 7 (4) (2456-1878), Daryaganj, New Delhi (Inde). doi: <https://dx.doi.org/10.22161/ijeab.74.1>.
- 2) Manzamasso, H. (February 2022). Demand for agriculture mechanization in the Hauts-Bassins Region(pp.26). Journal of Agribusiness (Agricultural economics association of Georgia), 39(1), Georgia (Etats-Unis d'Amérique). doi: <https://10.22004/ag.econ.317858>.
- 3) Millogo, V. (December 2021). Effects of cereal-legume intercropping and mulching on maize (*Zea mays* L.) productivity in dry season using drip irrigation in South-Sudanian climatic zone of Burkina Faso (pp.7). Global Journal of Science Frontier Research: D Agriculture and Veterinary 21(7), United State of America (USA). 2249-4626.
- 4) Millogo, V. (July 2022). Communication on a technique of silage in recyclable and sustainable plastic drums allowing the resilience of breeders in West Africa. Agricultural Technologies & Innovations: Climate-smart solutions for the transformation of emergency and post-emergency situations, Cotonou (Benin).

## ASMC II – Cambodia

1. **Name:** Appropriate Scale Mechanization Innovation Hub (ASMIH) – Cambodia
2. **Locations:** Innovation Hub location: Royal University of Agriculture, Phnom Penh (Cambodia)  
Field locations: Banan district (Battambang province), Puok district (Siem Reap province), and Stung Chinit (Kampong Thom province)
3. **Description:** The main objectives of the ASMIH – Cambodia include:
  - To design and assess conventional and direct seeding mulch-based cropping systems.
  - To assess the performance of appropriate scale machinery while preserving soil capital.
  - To adapt and train smallholder farmers, service operators, field technicians, and students on the use of ASM and conservation agriculture (CA)-based cropping systems.
  - To support multi-stakeholder initiatives.
  - To initiate a negotiation process between farmers for the individual or collective management of fodder sources or crop diversification after wet season rice.
4. **Collaborators:** *Cambodia* - Institute of Technology of Cambodia (ITC), Royal University of Agriculture (RUA), Conservation Agriculture Service Center (CASC), Ministry of Agriculture Forestry and Fisheries (MAFF), University of Battambang (UBB), Department of Agricultural Land Resources Management (DALRM); *France* – CIRAD; *Philippines* - Southeast Asian Regional Center on Graduates Studies and Research in Agriculture (SEARCA); *United States* – United States Department of Agriculture, Agricultural Research Service National Soil Dynamics Lab (USDA-NSDL)
5. **Achievements:**
  - Approximately 940 ha of Conservation Agricultural (CA) land in Battambang was achieved by three technologies; no-till planter, land leveler, and cover crop.
  - Organized Hub Advisory Committee meeting and field visit to the project sites in Rattanak Mondul, Battambang.
  - Swisscontact and Smart-Agro signed PA amendment to promote cover crop seeds.
  - Completed impact assessment on Seed broadcaster technology to validate the number of estimated areas achieved by the technology. The results showed that an average unit of seed broadcaster reached 32.83 ha. 176 units of seed broadcaster were sold out by Noeurn workshop to farmers and service providers from January 2021 to September 2022. Therefore, approximately 5778.08 ha of land achieved by the seed broadcaster technology.
6. **Capacity Building:**
  - Two capacity building trainings were conducted by Maria Jones for project collaborators, CE SAIN and SwissContact staff, as well as RUA students. The trainings were “Conducting Gender-Sensitive Mechanization Training,” and “Conducting Gender-Sensitive Mechanization Research.” 24 total participants attended the online trainings via the Zoom platform.
7. **Lessons Learned:**
  - The change of crop type in Kompong Thom province affected the number of sales of the seed broadcaster by Noeurn in the region. However, the ASMC project is extending to promote the seed broadcaster to other areas including Battambang.
8. **Presentations and Publications:**

**Conference/Presentations**

  - 1) Tivet, F., Lor, L., Theng, D., Sar, V., Sen, R. (June 2022). Assessing No-till and Conventional Planters for Maize Production: Case Study in Battambang. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference (SAIN3), Siem Reap, Cambodia.
  - 2) Tivet, F., Lor, L., Theng, D., Sar, V., Sen, R. (June 2022). Performance and Impact of Legume Cover Crops on Green Sowing Practice of Maize. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.

- 3) Reyes, M. R., Tivet, F., Lor, L., Theng, D., Leng, V. (June 2022). Performance Testing of Seeders on Growth and Yield of Wet Season Rice in Battambang, Cambodia. Presentation at Third International Sustainable Agricultural Intensification and Nutrition (SAIN3), Siem Reap.
- 4) Tivet, F., Sar, V., Sen, R., Khann, L., Keo, N., & Pheap, S. (June 2022). Seed Production of Sunn Hemp (*Crotalaria Juncea*), Yield, Labour Profitability along Three Cropping Seasons. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference (SAIN3), Siem Reap, Cambodia.
- 5) Tivet, F., Lor, L., Theng, D., Sar, V., Sen, R. (June 2022). The Influences of Cover Crop Species Management on Productivity and Production Cost of Corn: Case Study in Rattanak Mondul. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference (SAIN3), Siem Reap, Cambodia.

**Other**

- 1) Charlise, P. Enhancing Sustainability through Scale-up of Locally Manufactured Technologies. Agrilinks Blog Article.

### Theme III: Rice Fallows and Horticulture – South Asia

#### • **Bangladesh**

1. **Name:** Pathways of scaling agricultural innovations for sustainable intensification in the polders (PI: Krishna Jagadish, Kansas State University; and Sudhir Yadav, IRRI)
2. **Locations:** Polder 30 in the Khulna district of Bangladesh
3. **Description:** The primary objective of the project is to increase farm income and nutrition security by intensifying polder farming systems through implementation of sustainable and economically viable practices. Specifically, the project aims to advocate for high yielding and stress tolerant rice varieties, improve productivity of rice and fish cultivation, and introduce high value rabi crops to increase farm income and improve household nutrition.
4. **Collaborators:** *Bangladesh* – BRAC, Bangladesh Agricultural University, IRRI, IWM, Khulna University, Patuakhali Science and Technology University, Sher-e-Bangla Agricultural University, Shushilan; *United States* - Kansas State University, Arkansas State University
5. **Achievements:**
  - The project team established Cluster-Based Farmer Field Schools (CFFS), an approach that brings together two different models of water management groups and farmer field schools. The CFFS is led by the Department of Agricultural Extension (DAE) with technical support from the SIIL-Polder project.
  - The project established 18 learning hubs and demonstrated the potential of HYV rice-maize and HYV rice-sunflower cropping patterns at the watershed scale with improved water management. Productivity of the improved cropping patterns ranged from 6.7 t/ha despite an unfavorable dry season in 2021-2022.
  - Three leaflets were developed in the local language, Bangla, to impact training on “HYV rice cultivation in the polder zone,” “Terminal drainage in the Aman season: A multi-benefit practice,” and “Climate-resilient maize and sunflower cultivation in the polder zone” to properly document the training’s objectives, approach, assessment, and templates. In addition, flyers and standees were also developed and printed in the local language.
6. **Capacity Building:**
  - The project organized 15 capacity building programs and imparted training to 3, 689 individuals, most of whom were producers (90%). Among those who were trained, 36% were women and 20% were youth.
  - The SIIL-Polder scholarship was awarded to two M.S. students at Bangladesh Agricultural University, Yeasmin Akhter, and Shadia Afrin Joty. Akhter will study gender dimensions in water governance while Afrin will study the agricultural value chain in the polder zone.
7. **Lessons Learned:**
  - Many farmers want to take the risk of cultivating rice and watermelon in the dry season instead of other crops. The main reason is that rice is the main staple, and marketing of watermelon is easy for farmers as the buyers buy it directly from the field.
  - Purposely involving women provides insights on gender dynamics in the polder. For example, women farmers in the new polders feel shy about being identified as “farmer;” instead, they want to put their husband’s name.
  - Water management in the selected polders remains largely traditional, and the polder community often lacks knowledge on how to improve on this issue.
  - Lack of agricultural machinery, mechanics, and local service providers in the polder zone are the documented challenges in attracting more farmers to use farming machines. It is difficult to transport machines from one place to another due to poor roads and intensive canal networks in the polder zone.



## 8. **Presentations and Publications:**

### **Journal Articles**

- 1) Jagadish, K., Yadav, S., & Mondal, M. (March 2022). Evaluation of gravity-led and energy-fed drainage for sustaining food security in the polders of the coastal zone of Bangladesh(pp.1-14). Irrigation and Drainage. doi: <https://doi.org/10.1002/ird.2698>.
- 2) Carcedo, A. (May 2022). Assessing impact of salinity and climate scenarios on dry season field crops in the coastal region of Bangladesh (pp.103428). Agricultural Systems, 200, Bangladesh. doi: <https://doi.org/10.1016/j.agsy.2022.103428>.
- 3) Ahmed, Z. (July 2022). Climate risk perceptions and perceived yield loss increases agricultural technology adoption in the polder areas of Bangladesh (pp.274-286). Journal of Rural Studies, 94, Bangladesh. doi: <https://doi.org/10.1016/j.jrurstud.2022.06.008>.

### **Conference/Presentations**

- 1) Yadav, S. (June 2022). Pathways of scaling agricultural innovations for sustainable intensification in the polders of coastal Bangladesh. Presentation at SILL Annual Meeting, Himawari Hotel in Phnom Penh, Cambodia.

### **Others**

- 1) Team, S. P. (June 2022). Life in the Polders: Understanding the Past, Constructing the Future. Magazine.
- 2) Team, S. P. (October 2021). SILL-Polder newsletter No. 3 October 2021. Newsletter.
- 3) Team, S. P. (April 2022). SILL-Polder newsletter No. 4 April 2022. Newsletter.

## • **Cambodia**

1. **Name:** S3-Cambodia: Scaling Suitable Sustainable Technologies (PI: David Ader, University of Tennessee, UT)
2. **Locations:** Siem Reap, Kampong Thom, Battambang, Kampong Cham and Phnom Penh, Cambodia
3. **Description:** The Scaling Suitable Sustainable Technologies (S3-Cambodia) project will support agents to scale suitable and sustainable technologies in Cambodia. By employing the gender and ecologically sensitive impact pathways mapped during the 2015-2020 WAgN-Cambodia project, S3-Cambodia will advance the capacity and roles of scaling agents in technology diffusion through applied research, technical assistance, curricula development and organizational strengthening. This process will demonstrate the potential for and provide critical information on scaling technology through local, national, and regional networks and for uptake of sustainable intensification (SI) technologies by rice-based farmers and others, serving as a regional model for self-reliance.
4. **Collaborators:** *Cambodia:* Royal University of Agriculture / Center of Excellence on Sustainable Agricultural Intensification, University of Battambang; *Switzerland/Cambodia:* Swiss Foundation for Technical Cooperation (Swisscontact); *France/Cambodia:* Centre de coopération internationale en recherche agronomique pour le développement (CIRAD); *Thailand:* ECHO Asia; *Philippines:* Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA); *USA:* University of Pennsylvania, Tennessee State University
5. **Achievements:**
  - Completed a SWOT analysis of scaling agricultural technologies through the private sector to guide future scaling efforts. The analysis focused on four case studies from Cambodia of promoting agricultural technologies: hybrid vegetable seeds, drip irrigation, a seed broadcaster, and post-harvest handling technologies.
  - Established green lab gardens at five new secondary schools. S3-Cambodia is now working with a total of eight schools to promote agricultural education.
  - Collaborated with Farmer-to-Farmer project to deliver complementary training on Conservation Agriculture to vegetable producers, and on agricultural education and extension to green lab partners.

#### 6. **Capacity Building:**

- S3-Cambodia onboarded four graduate students that will support research on the S3-Cambodia project.
- The project enrolled six farmers in new business development program for plant nurseries, which will specialize in Wild Food Plants and grafted vegetables.
- S3-Cambodia launched a three-month internship program with Swisscontact and NUBB to provide eight students with hands-on entrepreneurship training working with plant nursery businesses.

#### 7. **Lessons Learned:**

- Coordinating activities across S-3 partners in Cambodia have proven to be difficult. For example, NUBB and RUA report to different government ministries (MOEYS and MAFF), so organizing joint-activities across their various mandates can be challenging.
- It has also been challenging to mobilize partner Swisscontact to take a wholistic view of scaling agricultural technologies beyond their specific activities, and to appreciate the need to develop evidence-based recommendations through research.

#### 8. **Presentations and Publications:**

##### **Journal Articles**

- 1) Ader, D. R. & Pekarcik, G. (August 2021). Evaluation of school gardens as a method of scaling up sustainable agriculture technologies (pp.26-36). International Journal of Environmental and Rural Development, 12(2), Tokyo, Japan. ISSN 2433-3700.
- 2) Bates, R., Ader, D. R., Ngang, C., & Hav, K. (December 2021). Suitability of tomato (*Solanum lycopersicum*) grafting onto eggplant rootstocks for production in Cambodia. Asian Journal of Agricultural and Environmental Safety, 2. (pp.41-44). Asian Journal of Agricultural and Environmental Safety, 2(2021), Battambang, Cambodia. ISSN: 2575423.
- 3) Bates, R., Ader, D. R., Ngang, C., Srean, P., & Seav, S. (December 2021). Wild world of wild food plants in Cambodia: the utilization, challenges, and opportunities to scaling up the use of wild food plants. (pp.102-113). Agritropica: Journal of Agricultural Sciences, 4(2), Bengkulu, Indonesia. doi: <https://doi.org/10.31186/jagritropica.4.2.102-113>.

##### **Book Chapters**

- 1) Jensen, L. & Huot, S. (2022). Gender implications of COVID-19, Cambodia, Gender, Food and COVID-19 Global Stories of Harm and Hope (pp.11-19). Routledge, Pennsylvania State University. 9781032055985.

##### **Conference/Presentations**

- 1) Ader, D. R., Gill, T., Goertz, H., & Pekarcik, G. (August 2022). Scaling Suitable, Sustainable Technologies for Smallholder Farmers in Cambodia. 31st International Horticultural Congress, 2022, Angers, France.
- 2) Huot, S. (October 2021). Gender Aspects of Wild Food Plant Production, Utilization, and Scaling in Northwestern Cambodia. Presentation at 8th Annual Rural Studies Conference, organized by Rural Sociology Graduate Association at Penn State, October 22, 2021., State College, PA.
- 3) Pekarcik, G. (June 2022). Assessing the Impact of Parental Involvement on the Scaling of Agricultural Technologies from School Garden to Home Farm through Experiential Learning. Presentation at Third International Sustainable Agricultural Intensification and Nutrition Conference, Siem Reap, Cambodia.

##### **Other**

- 1) Huot, S. (October 2021). COVID-19 Impacts on Cambodian Smallholder Farmers. <https://sites.psu.edu/geareblog/2020/10/21/covid-19-impacts-on-cambodian-smallholder-farmers/>. Blog post.

## Theme IV: Crop-Livestock Interactions - West Africa

### • **Senegal and Niger**

1. **Name:** Improving food and nutrition security of smallholder agro-pastoral farming systems by integrating crop-livestock-human nutrition in Senegal and Niger (PI: Doohong Min, Kansas State University; and Aliou Faye, ISRA)
2. **Locations:** Louga, Diourbel, Kaffrine, Kédougou, Kolda and Sedhiou regions in Senegal; Niamey and surrounding areas in Niger
3. **Description:** This project focuses on large-scale dissemination of three innovations (dual-purpose millet line stover for livestock feeding, best agronomic management practices for sustainable intensification of millet cropping systems, and fortifying millet-based products to create more awareness and enhance human and animal food and nutrition while generating further income and nutritional outcomes for smallholder farmers in the targeted regions of Senegal and Niger. If a farming systems approach is used, then this will guide the dissemination of technologies and improve overall crop-livestock integration.
4. **Collaborators:** *Senegal* - Institut Sénégalais de Recherches Agricoles (ISRA) – Centre National de Recherches Agronomiques de Bambey (CNRA/Bambey), University of Thiès - ENSA, Institut de Technologie Alimentaire (ITA), Agence Nationale de Conseil Agricole et Rural (ANCAR), Le Réseau des Organisations Paysannes et Pastorales du Sénégal (RESOPP), Bureau d'Analyse Macro Economiques (BAME), Peace Corps Senegal; *Niger* - Institut National de la Recherche Agronomique du Niger (INRAN/ CERRA-Maradi).
5. **Achievements:**
  - In Niger, trials were implemented at G-Maigari, Dakoro, and K-Warao to demonstrate the effects of three types of fertilizer on millet, the effect of increased millet sowing density on yield, and for demonstrating/dissemination of dual-use Senegal varieties (SL 28, SL 169, SL 423, and Thialack 2) compared to local varieties.
  - At least 15% of women working on millet flour improvement are young girls, and 20% of farmers demonstrating the agronomic package to improve millet yield using dual-purpose millet are below 30 years old.
6. **Capacity Building:**
  - 2 Ph.D. students and two M.S. students are engaged with the project, and one Ph.D. student is continuing.
  - There were 10 dual-purpose millet flour improvement training sessions with ANCAR during the reporting period.
7. **Lessons Learned:**
  - The more millet flour that is produced and the more women's organizations producing millet flour has increased the interest from both supermarkets and district sanitation departments.
8. **Presentations and Publications:**

#### **Journal Articles**

- 1) Araya, A., Jha, P.K., ...Faye, A., Prasad, P.V.V. (May 2022). Evaluating crop management options for sorghum, pearl millet and peanut to minimize risk under the projected midcentury climate scenario for different locations in Senegal. *Climate Risk Management*, 36, 100436. doi: <https://doi.org/10.1016/j.crm.2022.100436>.
- 2) Rasu, E., Nedjashemi, A.P., Faye, A., Min, D., Prasad, P.V.V., Ciampitti, I. A. (June 2022). Current and future challenges and opportunities for livestock farming in West Africa: perspectives from the case of Senegal. *Agronomy*, 12(1818), Switzerland. doi: <https://doi.org/10.3390/agronomy12081818>.
- 3) Bastos, L., Faye, A., Stewart, Z. P., Min, D., Prasad, P.V.V., Ciampitti, I. A. (September 2022). Variety and management selection to optimize pearl millet yield and profit in Senegal. (pp. N/A). *European Journal of Agronomy*, 139, N/A. doi: <https://doi.org/10.1016/j.eja.2022.126565>.

## VI. Associate Award Research Project Reports and Initiatives

### Haiti Agricultural University Partnership (HAUP): Center of Excellence on Mitigation, Adaptation, and Resilience to Climate-Change in Haiti (CE MARCH)

1. **Name:** Haiti Agricultural University Partnership (HAUP): Center of Excellence on Mitigation, Adaptation, and Resilience to Climate-Change in Haiti (CE MARCH)
2. **Location:** Haiti
3. **Description:** The Haiti Agricultural University Partnership (HAUP): The CEMARCH initiative was developed to provide training for agricultural professionals and others involved in agriculture, and to train new individuals in agricultural practices. This training will produce agricultural professionals better able to adapt to Haitian crop and animal production systems in a changing climate. They will also be able to understand the role climate plays on Haitian soil resources, water supplies, and their interaction.
4. **Collaborators:** Kansas State University-Sustainable Intensification Innovation Lab (SIIL), the University of Quisqueya, Faculté d'Agronomie et de Médecine Vétérinaire (FAMV), Campus Henri Christophe de Limonade (UEH) (CHCL), Université Chrétienne du Nord d'Haïti (UCNH) (NORD), American University of the Caribbean (AUC), and the University Notre Dame of Haiti (UNDH). These universities represent the south, north and west departments of Haiti.
5. **Achievements:**
  - Live meetings were conducted with all the university partners. These took place at two locations and meeting dates: one meeting in Les Cayes on May 30<sup>th</sup> - June 1<sup>st</sup>, 2022, and the second in Cap Haitian from June 12<sup>th</sup>-June 16<sup>th</sup>, 2022. Four of the university sites were visited during these meetings: UCNH (Cap Haitian), CHCL (Cap Haitian), AUC (Les Cayes), and UNDH (Les Cayes). These visits included tours of classrooms and laboratories used for teaching.
  - Initiated and secured Memorandum of Understanding (MOU) agreements between Kansas State University and all the Haiti Agriculture University partners (all six universities).
  - The anchor university, Quisqueya, advertised for and, with a selection committee, hired a Chief of Party.
6. **Capacity Building:**
  - Due to the ongoing challenges occurring in Haiti, there is no capacity building to report on for FY 2022.
7. **Lessons Learned:**
  - Communication is key to the success of this initiative, and due to accessibility issues, e-mail is likely not the best method for contact partners.
  - Progress on revenue generating activities is largely stalled until unrest in the country can be alleviated. Safety issues, coupled with fuel shortages, have left the universities unable to function.
8. **Presentations and Publications:**
  - None to report for FY 2022.

## Innovation Research, Extension and Advisory Coordination Hub (iREACH)

9. **Name:** Innovation Research, Extension and Advisory Coordination Hub (iREACH)
10. **Locations:** Asia: Locations will be developed in partnership and collaboration with the respective USAID host country missions; West Africa (WA): Burkina Faso, Ghana, Mali, Niger, and Senegal; East Africa (EA): Locations will be developed in partnership and collaboration with the respective USAID host country missions; and Latin America and/or Caribbean (LAC): Guatemala
11. **Description:** An iREACH in each of these regions will serve as a platform to focus on targeted programs such as climate mitigation, adaptation, resilience and focus on producing nutritious and safe food while sustaining natural resources (climate smart agriculture, CSA). There has been much research, capacity building efforts and extension projects from the multiple United States Government (USG) and other international donors in these regions. Most of these activities are dispersed and not easy to keep track due to involvement of multiple actors and lack common platform that brings them together. Therefore, there is need for a central institution, organization or university that coordinates these activities or has the capacity to do so. iREACH's three core objectives are: a) improve coordination, alignment, and integration of relevant activities, b) build human and institutional capacity c) establish agricultural technology parks to showcase proven climate-smart agricultural technologies that will address food and nutritional security and build resilience of systems and people.
12. **Collaborators:** Asia and EA: to be coordinated with key stakeholders in the region. LAC: USAID/Guatemala. WA: West and Central African Council for Agricultural Research and Development (CORAF); National Institute for the Environment and Agricultural Research (INERA); The Fruit and Legumes Regional Center hosted by the Center for National Research on Science and Technologies (IRSAT) – Bobo Dioulasso, Burkina Faso; Council for Scientific and Industrial Research (CSIR); The Roots and Tubers Center hosted by the Crops Research Institute (CRI) – Accra, Ghana; Rural Economy Institute (IER); Rice Regional Center of Specialization hosted by the Regional Center for Agricultural Research (CARRA) – Niono, Mali; Agricultural Research Council of Niger (INRAN); The Livestock Regional Center – Niamey, Niger; and the Senegalese Institute of Agricultural Research (ISRA); The Dry Cereals Regional Institute of Excellence hosted by the Center for the Improvement of the Adaptation to Drought (CERAAS) – Thies, Senegal; multiple Feed the Future Innovation Labs (e.g. Fish, Food Processing, Legume, Peanut, Poultry); and International Fertilizer Development Center (IFDC) and Africa RISING.
13. **Achievements:**
  - LAC: On August 8<sup>th</sup> and 9<sup>th</sup> and 11<sup>th</sup> and 12<sup>th</sup>, 2022, the SIIL hosted 2 two-day key stakeholder meetings in Quetzaltenango, and Antigua, Guatemala. The meetings were attended by USAID-DC, USAID-Guatemala, universities, private sector, and non-governmental organizations. These meetings facilitated the potential development of a center/hub to support Guatemala's climate smart agriculture priorities to address food insecurity.
  - WA: The Advisory Committee (AC) oversaw the review and approval (March 15<sup>th</sup> and August 18<sup>th</sup>, 2022) for the annual work plan, including the AC's Terms of Reference, the Agricultural Technology Park (ATP), and communication protocols, and the specific technologies and innovation to be demonstrated in the (6) ATPs for 2022 and 2023.



- ATP Allocation: In Burkina Faso, at least 11 hectares of land were allocated in Bobo-Dioulasso by the Environmental Institute for Agricultural Research (INERA), the headquarters of the CORAF Regional Center of Specialization on Fruits and Legumes. In Ghana, at least 11 hectares of land were allocated in Tamale by the Council for Scientific and Industrial Research Savanna Agricultural Research Institute (SARI) and at least 5 hectares of land were allocated in Kumasi by the Council for Scientific and Industrial Research (CSIR) – Crops Research Institute (CRI), the headquarters of the CORAF Regional Center of Excellence on Roots and Tubers. In Mali, at least five hectares of land were allocated in Sotuba-Bamako by the Institute of Rural Economy (IER), the headquarters of the CORAF Regional Center of Specialization on Rice. In Niger, up to 95 hectares of land can be allocated in Ndounga-Niamey by the National Institute of Agronomic Research (INRAN), the headquarters of the CORAF Regional Center of Specialization on Livestock. In Senegal, 2 hectares of land were allocated by to iREACH by CERAAS (Centre d'Etude pour l'Amélioration de l'Adaptation à la Sécheresse), the headquarters of the CORAF Center of Excellence on Dry Cereals and Associated Crops.
- iREACH, in partnership with ISRA/CERAAS hosted its second annual Open Day at Bambey, Senegal. The ATP also hosted several Farmer Field Days and USAID Innovation Labs at Bambey from July through September, with over 350 participants, including farmers, private sector organizations, government agencies, researchers, non-governmental organizations, development workers, and others. iREACH, in partnership with CRI, IER, and INERA launched ATPs with Open Days in Burkina Faso, Ghana, and Mali, showcasing technologies in demonstration plots of improved crop varieties, prototypes of processing/post-harvest machinery, and fertility management were established.
- The activity tracker maintained projects for over 100 activities for 16 Innovation Labs, releasing four quarterly subscriptions to over 250 personnel from the Innovation Labs, USAID Washington, Missions, and Agreement Officer's Representatives, and other stakeholders. iREACH began expansion of the tracker to all 21 Feed the Future countries and the 21 Innovation Lab and associated projects.

#### 14. **Capacity Building:**

- Approximately 500 individuals visited the six ATPs in Burkina Faso, Ghana, Mali, Niger, and Senegal. The groups represented farmers, academics, USG partners, Innovation Lab teams, civil sector, researchers, extension agencies, and high-ranking government officials (Ministry of Agriculture).
- Five iREACH representatives attended the 2022 SIIL Annual Meeting, visiting the Center of Excellence on Sustainable Agricultural Intensification and Nutrition and ATPs at the university, high school, and conservation agriculture sites.

#### 15. **Lessons Learned:**

- Coordinate with USAID Missions early and often.
- Regional and/or partner organization facilitation is necessary for streamlined seed delivery between countries in West Africa as well as other regions of the world. NARES (National Agriculture Research Extension Services) research institutes do not often have DHL accounts; therefore, Innovation Labs used partners to send and/or receive seeds.

#### 16. **Presentations and Publications:**

- None to report for FY 2022.

**A. Feed the Future Policy Impact Study (Policy Research Consortium),  
Award # 7200AA18LA0003 – Kansas State University**

1. **Name:** Feed the Future Policy Impact Study (Policy Research Consortium) (Subaward PI: Carl Pray, Rutgers University)
2. **Locations:** Mainly global locations due to the nature of the policy work, including country level programs and collaborators in Rwanda, Senegal, Nigeria, and Malawi.
3. **Program Description:** The Feed the Future Policy Impact Research Study is a multi-institutional Consortium led by Rutgers University (RU) and operates as an associate award of the USAID funded SILL. This consortium supports the achievements of the U.S. Government Global Food Security Strategy objectives through contributing to the improvement of policy approaches and outcomes. It also supports the learning agenda on policy, systems analysis, and implementation and assists the initiative to report on the success of its efforts. The aims of the consortium are to develop a clearer understanding of contemporary agricultural and structural transformation, to develop and utilize a specific set of indicators to quantify the impact or progress of key Global Food Security goals, and to understand how agricultural and food policies help to enable and contribute to agricultural transformation.
4. **Collaborators:** Collaborators for the Policy Research Consortium include the Ahmadu Bello University, International Fertilizer Development Center (IFDC), Michigan State University, Montana State University, Northwestern University, Tufts University, University of Florida, African Economic Research Center, University of Ibadan, University of Rwanda, and Université de Gaston-Berger.
5. **Subprojects:**
  - *Agricultural transformation and nutrition policy* (PI: William Masters, Tufts University) – Ended December 6, 2021.
  - *Effect of Supply Chains on Agricultural Profitability and Household Well-Being in Rwanda and Senegal* (PI: Charles Moss, University of Florida) – Ended December 6, 2021.
  - *Global Security Act: Policy Analysis and Measurement* (PI: Lori Post, Northwestern University) – Granted a new subaward, ended June 30<sup>th</sup>, 2022.
  - *How does household water insecurity relate to household water quality, food security, and COVID-infections: health, agriculture, and policy implications* (PI: Sera Young, Northwestern University) – Ended December 6, 2021.
  - *Indicators of Agricultural Transformation* (PI: Eric Raile, Montana State University) – Ended December 6, 2021.
  - *Nigeria Data Collection Analysis* (PI: Thomas Reardon, Michigan State University) – Ended December 6, 2021.
  - *Proposal to Support CMAAE Thesis and Faculty Research* (PI: Njuguna Ndung'u, African Economic Research Consortium) – Ended December 6, 2021.
  - *Research on the Impacts of Food, Agricultural and Nutrition Policies in Rwanda* (PI: Niyitanga Fidele, University of Rwanda) – Ended December 6, 2021.

## 6. **Key Achievements:**

- 1) November 2021, a no-cost extension was requested and granted due to issues related to COVID-19 delays and the need to successfully complete the dissemination efforts of the subawardees. In addition, SIIL received approval to add a subaward with Northwestern University to support the requested research by USAID for surveillance and modeling of COVID-19 for the Feed the Future countries and zones of influence.
- 2) Northwestern University (*Global Security Act: Policy Analysis and Measurement*; PI: Lori Post) Biweekly meetings were held with USAID staff and reports were also shared with other stakeholders. The reports were usually 32-40 pages long and were supplied every two weeks to the USAID-COVID taskforce, the PRC program officers, KSU, and Rutgers. The briefing reports also responded to special requests from USAID for more information on specific countries. From there the information is communicated regularly to the Missions. In addition, the Dashboard group has responded to requests from the Nigeria health minister for access to the Dashboard.
- 3) Northwestern published seven manuscripts that were 100% funded by the SIIL/KSU subaward, and four manuscripts that were jointly funded by SIIL and NIH.
- 4) There were papers published in The Lancet which has a “Journal Impact Factor” of 202. The Northwestern subaward also published two project papers in the #1 Journal of Medical Informatics Research– JMIR. JMIR Public Health and Surveillance has an impact factor of 14.56.
- 5) On April 30, 2022, the Northwestern subaward project was selected as one of Northwestern’s funded studies to share with Northwestern Alumni. To that end, Lori Post gave a one-hour presentation on the SIIL/KSU project to an auditorium full of Alumni, and then held a question-and-answer session for a second hour.
- 6) Northwestern created an analogous surveillance system on COVID-19 vaccines for over 200 countries on vaccination rates, percentage of population partially vaccinated, and percentage of population fully vaccinated plus at the subnational level for countries specified. In addition to the Feed the Future countries that was tracked for USAID, there were also track countries in the region so that can be modeled data for each country. It requires a regional data to provide some of the metrics necessary for the models. You can view the Vaccination Data Dashboard at: <https://sites.northwestern.edu/covidglobalsurveillance/vaccine-data-dashboard/>
- 7) To better respond to USAID needs, the Northwestern subaward project built out a dashboard for COVID-19 facts and questions. Questions are collected that the public submits to NPR radio station on COVID-19 and the answers are published on the GASSP website. These questions and answers support USAID bureaus, missions, and membership countries. The data, briefs, and Q&A is also published on Devex.
- 8) Based on requests from Dr. James Oehmke, the Northwestern subaward project was able to provide information on food insecure countries who depended on Ukraine and Russia for food exports. Many low-income countries are 100% dependent on Ukraine and Russia for wheat and fertilizer imports. This information was provided to USAID in the form of a report.

## 7. **Dissemination Efforts:**

- 1) Final Conference: The consortium held their final conference – *Policy Systems for Transforming Agriculture: Research, Implementation, and Impact* on November 2-3, 2021. This conference marked the completion of the consortium members’ activities. Members presented the results of their research activities, important lessons learned, and the

- implications for USAID's policy related work. [http://ru-fff.rutgers.edu/Final\\_Conference.htm](http://ru-fff.rutgers.edu/Final_Conference.htm).  
<https://www.youtube.com/watch?v=jE4bPGMXG6w>.
- 2) Brown Bag Presentations with USAID: Consortium members had individualized times to present their work and research to member of USAID who were interested in the topic. Each of the presentations from those meetings can be found on the SIIL website at this link: [https://www.k-state.edu/siil/knowledge\\_sharing/prc\\_presentations.html](https://www.k-state.edu/siil/knowledge_sharing/prc_presentations.html).
  - 3) SIIL Annual Meeting: Lori Post attended the 2022 SIIL Annual Meeting in Cambodia, June 26-28, 2022. During the first day, she presented her research on the COVID-19 Dashboard and how it relates to policymakers in Feed the Future countries. You can view her presentation here: <https://www.dropbox.com/s/09w5289qxxk038rx/SIIL%20%20June%202022%2C%202022%20Lori%20Post.pptx?dl=0>.
  - 4) Agrilinks: Eric Raile, subproject of the consortium, had a blog post written and published on the Agrilinks website for a broad audience. You can access the blog post here: <https://www.agrilinks.org/post/climate-smart-government-climate-smart-agriculture-0>. This link was shared with SIIL networks, social media channels and the SIIL newsletter as well.
  - 5) SIIL Newsletters: Throughout the time of the consortium, the SIIL would share and highlight relevant information in newsletters that are sent to a broad audience across the world. You can view these newsletters on the SIIL website at this link: <https://www.k-state.edu/siil/resources/newsletter/newsletter.html>.

## 8. **Presentations and Publications:**

### **Journal Articles**

1. Agarwal DK, Hunt AC, Shekhawat GS, Carter L, Chan S, Wu K, Cao L, Baker D, Lorenzo-Redondo R, Ozer EA, Simons LM, Hultquist JF, Jewett MC, Dravid VP. Rapid and Sensitive Detection of Antigen from SARS-CoV-2 Variants of Concern by a Multivalent Minibinder-Functionalized Nanomechanical Sensor. *Anal Chem*. 2022 Jun 14;94(23):8105-8109. doi: 10.1021/acs.analchem.2c01221. Epub 2022 Jun 2. PMID: 35652578; PMCID: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9211039/>
2. Anderson, J. R., Birner, R., Nagarajan, L., Naseem, A., & Pray, C. (2021). Private Agricultural R&D: Do the Poor Benefit? *Journal of Agricultural & Food Industrial Organization*, 19(1), 3-14. <https://doi.org/doi:10.1515/jafio-2021-0007>
3. Headey, D., & Masters, W. (2021). Agriculture and undernutrition. In K. Otsuka & S. Fan (Eds.), *Agricultural development: New perspectives in a changing world* (pp. 321-358). IFPRI. [https://doi.org/https://doi.org/10.2499/9780896293830\\_10](https://doi.org/https://doi.org/10.2499/9780896293830_10)
4. Ke, R., Martinez, P. P., Smith, R. L., Gibson, L. L., Achenbach, C.J., McFall, S., Qi, C., Jacob, J., Dembele, E., Bundy, C., Simons, L. M., Lorenzo-Redondo, R. (2022). Longitudinal Analysis of SARS-CoV-2 Vaccine Breakthrough Infections Reveals Limited Infectious Virus Shedding and Restricted Tissue Distribution. In *Open forum infectious diseases* (Vol. 9, No. 7, p. ofac192). Oxford University Press.
5. Liverpool-Tasie, L. S. O., Reardon, T., & Belton, B. (2021). "Essential non-essentials": COVID-19 policy missteps in Nigeria rooted in persistent myths about African food supply chains. *Applied Economic Perspectives and Policy*, 43(1), 205-224. <https://doi.org/https://doi.org/10.1002/aep.13139>
6. Lundberg, A.L., Lorenzo-Redondo, R., Hultquist, J. F., Hawkins, C. A., Ozer, E. A., Welch, S. B., Prasad, P. V., Achenbach, C. J., White, J. I., Oehmke, J. F., Murphy, R. L., Post, L. A. (2022). Overlapping Delta and Omicron Outbreaks During the

- COVID-19 Pandemic: Dynamic Panel Data Estimates. *JMIR Public Health and Surveillance*. 3;8(6):e37377.
7. Lundberg, A. L., Lorenzo-Redondo, R., Ozer, E. A., Hawkins, C. A., Hultquist, J. F., Welch, S. B., Prasad, P. V., Oehmke, J. F., Achenbach, C. J., Murphy, R. L., White, J. I., Post, L. A. (2022). Has Omicron changed the evolution of the pandemic? *JMIR Public Health and Surveillance*. 8(1):e35763.
  8. Meemken, E.-M., Barrett, C. B., Michelson, H. C., Qaim, M., Reardon, T., & Sellare, J. (2021). Sustainability standards in global agrifood supply chains. *Nature Food*, 2(10), 758-765.
  9. Miller, J. A.-O. X., Frongillo, E. A.-O., Weke, E., Burger, R., Wekesa, P., Sheira, L. A., Mocello, A. R., Bukusi, E. A., Otieno, P., Cohen, C. R., Weiser, S. A.-O., & Young, S. A.-O. (2021). Household Water and Food Insecurity Are Positively Associated with Poor Mental and Physical Health among Adults Living with HIV in Western Kenya. *Journal of Nutrition* (1541-6100 (Electronic)).
  10. Miller, J. D., Workman, C. L., Panchang, S. V., Sneegas, G., Adams, E. A., Young, S. L., & Thompson, A. L. (2021). Water Security and Nutrition: Current Knowledge and Research Opportunities. *Advances in Nutrition*.  
<https://doi.org/10.1093/advances/nmab075>
  11. Nagata, J. M., Miller, J. D., Cohen, C. R., Frongillo, E. A., Weke, E., Burger, R., ... & Young, S. L. (2022). Water insecurity is associated with lack of viral suppression and greater odds of AIDS-defining illnesses among adults with HIV in western Kenya. *AIDS and Behavior*, 26(2), 549-555.
  12. Nsabimana, A., Niyitanga, F., Weatherspoon, D. D., & Naseem, A. (2021). Land Policy and Food Prices: Evidence from a Land Consolidation Program in Rwanda. *Journal of Agricultural & Food Industrial Organization*, 19(1), 63-73.  
<https://doi.org/doi:10.1515/jafio-2021-0010>
  13. Oehmke, J. F., Young, S. L., Heinemann, A. W., Rukuni, M., Lyambabaje, A., & Post, L. A. (2022). A novel measure of developing countries' agricultural and food policy readiness. *World Development*, 158, 105920.
  14. Ozer, E. A., Simons, L. M., Adewumi, O. M., Fowotade, A. A., Omoruyi, E. C., Adeniji, J. A., Olayinka, O. A., Dean, T. J., Zayas, J., Bhimalli, P. P., Ash, M. K. Lorenzo-Redondo, R. (2022) Multiple expansions of globally uncommon SARS-CoV-2 lineages in Nigeria. *Nature communications*. 13(1):1-3.
  15. Post, L., Boctor, M. J., Issa, T. Z., Moss, C. B., Murphy, R. L., Achenbach, C. J., Ison, M. G., Resnick, D., Singh, L., White, J., Welch, S. B., & Oehmke, J. F. (2021). SARS-CoV-2 Surveillance System in Canada: Longitudinal Trend Analysis. *JMIR public health and surveillance*, 7(5), e25753. Retrieved 2021/05//, from  
<http://europepmc.org/abstract/MED/33852410>
  16. Post, L., Culler, K., Moss, C. B., Murphy, R. L., Achenbach, C. J., Ison, M. G., Resnick, D., Singh, L. N., White, J., Boctor, M. J., Welch, S. B., & Oehmke, J. F. (2021). Surveillance of the Second Wave of COVID-19 in Europe: Longitudinal Trend Analyses. *JMIR Public Health Surveill*, 7(4), e25695. <https://doi.org/10.2196/25695>
  17. Post, L. A., & Lorenzo-Redondo, R. (2022). Omicron: fewer adverse outcomes come with new dangers. *The Lancet*, 399(10332), 1280-1281.
  18. Post, L., Ohiomoba, R. O., Maras, A., Watts, S. J., Moss, C. B., Murphy, R. L., Ison, M. G., Achenbach, C. J., Resnick, D., Singh, L. N., White, J., Chaudhury, A. S., Boctor, M. J., Welch, S. B., & Oehmke, J. F. (2021). Latin America and the



- Caribbean SARS-CoV-2 Surveillance: Longitudinal Trend Analysis. *JMIR Public Health Surveill*, 7(4), e25728. <https://doi.org/10.2196/25728>
19. Post, L. A., Argaw, S. T., Jones, C., Moss, C. B., Resnick, D., Singh, L. N., Murphy, R. L., Achenbach, C. J., White, J., Issa, T. Z., Boctor, M. J., & Oehmke, J. F. (2020). A SARS-CoV-2 Surveillance System in Sub-Saharan Africa: Modeling Study for Persistence and Transmission to Inform Policy [Original Paper]. *J Med Internet Res*, 22(11), e24248. <https://doi.org/10.2196/24248>
  20. Post, L. A., Benishay, E. T., Moss, C. B., Murphy, R. L., Achenbach, C. J., Ison, M. G., Resnick, D., Singh, L. N., White, J., Chaudhury, A. S., Boctor, M. J., Welch, S. B., & Oehmke, J. F. (2021). Surveillance Metrics of SARS-CoV-2 Transmission in Central Asia: Longitudinal Trend Analysis [Original Paper]. *J Med Internet Res*, 23(2), e25799. <https://doi.org/10.2196/25799>
  21. Post, L. A., Issa, T. Z., Boctor, M. J., Moss, C. B., Murphy, R. L., Ison, M. G., Achenbach, C. J., Resnick, D., Singh, L. N., White, J., Faber, J. M. M., Culler, K., Brandt, C. A., & Oehmke, J. F. (2020). Dynamic Public Health Surveillance to Track and Mitigate the US COVID-19 Epidemic: Longitudinal Trend Analysis Study. *J Med Internet Res*, 22(12), e24286. <https://doi.org/10.2196/24286>
  22. Post, L. A., Lin, J. S., Moss, C. B., Murphy, R. L., Ison, M. G., Achenbach, C. J., Resnick, D., Singh, L. N., White, J., Boctor, M. J., Welch, S. B., & Oehmke, J. F. (2021). SARS-CoV-2 Wave Two Surveillance in East Asia and the Pacific: Longitudinal Trend Analysis [Original Paper]. *J Med Internet Res*, 23(2), e25454. <https://doi.org/10.2196/25454>
  23. Raile, E. D., Young, L. M., Kirinya, J., Bonabana-Wabbi, J., & Raile, A. N. W. (2021). Building Public Will for Climate-Smart Agriculture in Uganda: Prescriptions for Industry and Policy. *Journal of Agricultural & Food Industrial Organization*, 19(1), 39-50. <https://doi.org/doi:10.1515/jafio-2021-0012>
  24. Reardon, T., Liverpool-Tasie, L. S. O., & Minten, B. (2021). Quiet Revolution by SMEs in the midstream of value chains in developing regions: wholesale markets, wholesalers, logistics, and processing. *Food Security*. <https://doi.org/10.1007/s12571-021-01224-1>
  25. Yan, B., Leah, C., Alissa, E., Sarah, L., Yurika, U., Natalie, V., Maya, Z., & William, M. (2022). *Nature Portfolio*. <https://doi.org/10.21203/rs.3.rs-710555/v1>

#### **Other Publications and Presentations**

1. Agada, B. I. (2021, November 2-3, 2021). Linking research to policy and beyond: Evidence from Nigeria Policy Systems for Transforming Agriculture: Research, Implementation, and Impact, Virtual.
2. Feed the Future Policy Research Consortium. (2021). *Concluding Session of Policy Research Consortium Final Conference* <https://youtu.be/jE4bPGMXG6w>
3. Masters, W., Martinez, E. M., Greb, F., Herforth, A., & Hendriks, S. (2021). Cost and affordability of preparing a basic meal around the world. In *Food Systems Summit Brief*.
4. Liverpool-Tasie, L. S. O. (2021, November 2-3, 2021). *Research for Policy and Beyond: Evidence from Nigeria Policy Systems for Transforming Agriculture: Research, Implementation, and Impact, Virtual*.

5. Pray, C., & Anderson, J. R. (2021). *Is Food Policy Analysis Capacity an Issue in the Developing World in the Time of COVID-19?* Feed the Future Policy Research Consortium. [http://ru-fff.rutgers.edu/Policy\\_Briefs/Pray%20and%20Anderson.pdf](http://ru-fff.rutgers.edu/Policy_Briefs/Pray%20and%20Anderson.pdf)
6. Roosevelt, M., Raile, E., & Anderson, J. (2021). *Resilience and Its Applications in Food Systems*. Feed the Future Policy Research Consortium. <http://ru-fff.rutgers.edu/Outputs%20for%20webpage/Roosevelt%20Raile%20and%20Anderson%202021.pdf>

### **Policy Briefs**

1. Report # 2022-1-V3, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
2. Report # 2022-2-V2, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
3. Report # 2022-3-V4, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
4. Report # 2022-4-V5, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
5. Report # 2022-5-V3, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
6. Report # 2022-6-V2, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD
7. Report # 2022-7-V5, COVID-19 Transmission & Policy Briefing Report, Prepared for the USAID, US DoS, US CDC, US DoD

## VII. Human and Institutional Capacity Development

### Short-term Training

Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Bangladesh	Field training on transplanting	Producers	15	6	21
Bangladesh	Field training on entrepreneur development	Producers	15	6	21
Bangladesh	Field training on harvesting	Producers	15	6	21
Bangladesh	Bangladesh annual symposium	Producers, Government, Private Sector, Civil Society	140	33	173
Bangladesh	Field day to demonstrate mechanical harvesting	Producers	35	2	37
Bangladesh	Field day to demonstrate mechanical harvesting	Producers	21	10	31
Bangladesh	Field day to demonstrate mechanical transplanting	Producers, Government, Private Sector	28	7	35
Bangladesh	Field training on seedling growing	Producers	12	0	12
Bangladesh	Field day to demonstrate mechanical harvesting	Producers	43	0	43
Bangladesh	Field day to demonstrate mechanical harvesting	Producers	39	0	39
Bangladesh	Field day to demonstrate mechanical transplanting	Government, Private Sector	40	0	40
Bangladesh	Field training on transplanting	Producers, Government	20	0	20
Bangladesh	Field day to demonstrate mechanical transplanting	Producers, Government	20	0	20
Bangladesh	Field day on transplanting	Producers	12	0	12
Bangladesh	Field day and demonstration on transplanting at Baratia, Khulna	Producers, Government, Private Sector	10	2	12
Bangladesh	Maintenance and repair of rice transplanter	Producers, Government, Private Sector, Civil Society	19	1	20
Bangladesh	Demonstrate benefits of rice transplanter	Producers	40	0	40
Bangladesh	Training on operation and maintenance on combine harvester	Producers	11	0	11
Bangladesh	Training on power tiller operated seeder	Producers	30	0	30
Bangladesh	Training on operation and maintenance of power tiller operator seeder	Producers	30	0	30
Bangladesh	Training on conservation agriculture	Producers, Civil Society	23	2	25
Bangladesh	Training on operation and maintenance of combine harvester	Producers	29	0	29
Bangladesh	Training on manufacturers and effective managing of workshops	Private Sector	21	0	21
Bangladesh	Training on manufacturers and effective managing of workshops	Private Sector	19	0	19
Bangladesh	Training on sustainable agricultural machineries	Producers, Private Sector, Civil Society	252	183	435

Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Bangladesh	Gender capacity building	Civil Society	12	5	17
Bangladesh	Gender capacity building	Civil Society	13	6	19
Bangladesh	Training on conservation agriculture and irrigation machineries of BARI	Producers, Civil Society	17	8	25
Bangladesh	Training on conservation agriculture and irrigation machineries of BARI	Producers, Civil Society	13	2	15
Bangladesh	Training on conservation agriculture and irrigation machineries of BARI	Producers, Civil Society	11	14	25
Bangladesh	Training on conservation agriculture and irrigation machineries of BARI	Producers, Civil Society	13	2	15
Bangladesh	Training on manufacturers and effective managing of workshops	Private Sector	30	0	30
Bangladesh	Training on operation and maintenance of power tiller operated seeder	Producers	17	0	17
Bangladesh	Training on mechanics and maintenance of combine harvester	Producers	30	0	30
Bangladesh	Gender capacity building training	Civil Society	15	9	24
Bangladesh	Gender capacity building training	Civil Society	12	12	24
Bangladesh	Training for nutritional awareness and daily diet	Producers, Government, Private Sector, Civil Society	0	318	318
Bangladesh	Training on operations and demonstration of sprayer	Producers, Government, Private Sector, Civil Society	97	0	97
Bangladesh	Training on benefits of terminal drainage and pest control	Producers, Government, Private Sector, Civil Society	172	18	190
Bangladesh	Seminar studying polders during growing season	Producers, Government, Private Sector, Civil Society	703	432	1135
Bangladesh	Management of polder water and gate operation for water management	Producers, Government, Private Sector, Civil Society	404	103	507
Bangladesh	Improving cropping systems in polder	Producers, Government, Private Sector, Civil Society	44	8	52
Bangladesh	Improved planting of rabi crops on the cropping system in early harvest	Government	21	2	23
Bangladesh	Trouble shooting for operations of agricultural machinery	Government, Private Sector	18	6	24
Bangladesh	Training on importance on nutritional diets and rabi crops	Producers, Private Sector, Civil Society	199	47	246
Bangladesh	Training on benefits of reaper when harvesting rice	Producers, Private Sector, Civil Society	76	53	129

Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Bangladesh	Training on operation of battery-operated sprayer	Producers, Private Sector, Civil Society	34	6	40
Bangladesh	Fertilizer management by mini-power tiller of rabi crops	Producers	30	1	31
Bangladesh	Training on rabi crops management	Producers, Government, Civil Society	202	82	284
Bangladesh	Field training on the productivity of rabi crops by semi-mechanized cultivation	Producers, Government, Civil Society	240	220	460
Bangladesh	Production procedure and nutrition from climate resilient rice	Producers, Civil Society	120	33	153
Burkina Faso	Training to extend ASMC farming equipment throughout country	Producers, Government	8	0	8
Burkina Faso	Training to show accessibility of tools for women	Producers, Government	0	10	10
Cambodia	Gender capacity building training	Private Sector, Civil Society	8	7	15
Cambodia	Gender capacity building training	Civil Society	3	6	9
Cambodia	Promotion of new technology to local service providers	Producers, Government, Private Sector, Civil Society	37	4	41
Cambodia	Practicing conservation agriculture practices	Producers, Government, Private Sector, Civil Society	42	15	57
Cambodia	Field visit to project sites in Battambang province	Producers, Government	45	9	54
Cambodia	Technical training to promote CA adaptation	Producers, Private Sector, Civil Society	22	13	35
Cambodia	Training on rice sowing with cover crops for soil fertility	Producers, Government, Private Sector, Civil Society	21	7	28
Cambodia	Briefing on project progress of agriculture mechanization in Cambodia	Producers, Government, Private Sector, Civil Society	17	3	20
Cambodia	Demand creation event to promote CA adaption	Producers, Private Sector, Civil Society	19	7	26
Cambodia	Demand creation event to promote CA adaption	Producers, Private Sector, Civil Society	22	10	32
Cambodia	Demonstrate CA cropping system and provide planting service and leveling	Producers, Private Sector, Civil Society	26	9	35
Cambodia	Study tours and research development for local scholars	Government, Private Sector, Civil Society	34	10	44
Cambodia	Project implementation and field visit in Battambang	Government, Civil Society	14	5	19
Cambodia	Field trials for new target village in Krapeu	Producers, Government, Private Sector	36	16	52
Cambodia	Training on preparation of grafting materials	Civil Society	21	16	37
Cambodia	Training on suite conservation agricultural practices	Civil Society	20	15	35
Cambodia	Intern orientation and soft skills training	Civil Society	3	2	5
Cambodia	Assessing fresh biomass and scoring on qualitative data	Producers, Private Sector	6	0	6



Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Cambodia	Student training on foundations of agriculture	Civil Society	16	24	40
Cambodia	Training on basic operation of LandPKS soil information system	Producers	11	1	12
Cambodia	Training on standardized soil sampling protocol	Producers	11	1	12
Cambodia	Symposium on various agricultural topics surrounding Cambodia	Producers	62	73	135
Cambodia	To integrating the school-plus-home garden cum biodiversity enhancement enterprise in ATPs and mini-ATPs in Cambodia	Civil Society	21	8	29
Cambodia	To share knowledge to farmers on local feed and commercial feed for swine and poultry at Siem Reap Province	Farmers	4	9	13
Cambodia	To share knowledge to farmers on local feed and commercial feed for swine and poultry at Battambang province	Farmers	2	20	22
Cambodia	To learn how to prepare SAO by setting objectives and setting indicators	Civil Society	4	8	12
Cambodia	To train about principle and practices on sustainable agricultural intensification	Civil Society	16	22	38
Cambodia	To implement the planting technology and maintenance	Civil Society	77	155	232
Cambodia	To train on map development and data arrangement and analysis	Government, Civil Society	6	4	10
Cambodia	To train on land KPS and Avenza app	Government, Civil Society	7	3	10
Cambodia	To train on CA in Battambang, Cambodia	Government, Civil Society, Producers	36	18	54
Niger	Introduction of new dual-purpose millet varieties	Producers, Government	50	8	58
Senegal	Training women on poultry millet grain sub residue based	Producers	12	63	75
Senegal	Capacity building on dual-purpose millet cropping	Producers, Government	110	15	125
Senegal	Promotion and dissemination of improved millet flour	Producers, Government, Private Sector, Civil Society	60	16	76
Senegal	Capacity building for agropastoral on dual millet for animal feeding	Producers, Government	36	1	37
Senegal	Promotion and dissemination of improved millet flour	Producers, Government	3	114	117
Senegal	Capacity building of women in under nourished areas	Producers, Government	1	24	25
Senegal	Scaling and dissemination of improved millet flour	Producers, Government, Private Sector	3	253	256
Senegal	Peace Corps training on dual-purpose millet crop production	Producers, Government	4	0	4

Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Senegal	Capacity building on financial and organization management	Producers, Government, Private Sector	55	3	58
Senegal	Training on basic operation of LandPKS soil information system	Producers	1	1	2
Senegal	Training on manure applicator fabricator	Producers, Government, Private Sector, Civil Society	10	2	12
<b>Total</b>	<b>96 total trainings were held during FY 2022</b>		<b>4504</b> (63%)	<b>2655</b> (37%)	<b>7159</b>

## Long-term Training

The following table reports all U.S. citizens/permanent residents and third country nationals that are currently receiving SILL funds through consortia, research subaward projects, associate award, or buy-in awards. The total number of degree-seeking students is 61 with 51% females. There are 19 Ph.D. students (32% female), 28 M.S. students (54% female), and 14 B.S. students (71% female).

Coded Name	Sex	University	Degree	Major	Program End Date (year/month)	Degree Granted (Y/N)	Home Country
1	F	Bangladesh Agricultural University	Ph.D.	Agricultural Economics	2022, June	Y	Bangladesh
36	M	Bangladesh Agricultural University	Ph.D.	Water Management	2022, June	Y	Bangladesh
78	F	Bangladesh Agricultural University	M.S.	Rural Sociology	2022, March	Y	Bangladesh
80	F	Bangladesh Agricultural University	M.S.	Rural Sociology	2022, March	Y	Bangladesh
32	M	Bangladesh Agricultural University	Ph.D.	Agricultural Engineering	2023, March	N	Bangladesh
17	M	Bangladesh Agricultural University	Ph.D.	Agricultural Engineering	2022, June	Y	Bangladesh
53	M	Bangladesh Agricultural University	Ph.D.	Agricultural Engineering	2022, November	N	Bangladesh
55	M	Bangladesh Agricultural University	M.S.	Agricultural Engineering	2022, December	N	Bangladesh
2	M	Bangladesh Agricultural University	M.S.	Agricultural Engineering	2022, December	N	Bangladesh
79	M	Bangladesh Agricultural University	M.S.	Farm Power and Machinery	2022, December	N	Bangladesh
22	M	Bangladesh Agricultural University	M.S.	Agricultural Engineering	2022, December	N	Bangladesh
94	M	Bangladesh Agricultural University	M.S.	Farm Power and Machinery	2023, March	N	Bangladesh
92	F	Bangladesh Agricultural University	M.S.	Gender Research	2023, March	N	Bangladesh
93	F	Bangladesh Agricultural University	M.S.	Agricultural Economics	2023, March	N	Bangladesh
159	M	University of Norbert ZONGO	Ph.D.	Agronomy	2023, December	N	Burkina Faso

Coded Name	Sex	University	Degree	Major	Program End Date (year/month)	Degree Granted (Y/N)	Home Country
162	F	University Joseph KI-ZERBO	Ph.D.	Agronomy	2023, January	N	Burkina Faso
160	F	University Saint Thomas d'Aquin	B.S.	Agronomy	2022, June	Y	Burkina Faso
98	F	University Saint Thomas d'Aquin	B.S.	Agronomy	2022, July	Y	Burkina Faso
161	M	University Joseph KI-ZERBO	Ph.D.	Agronomy	2023, October	N	Burkina Faso
99	F	University Saint Thomas d'Aquin	B.S.	Agronomy	2022, May	Y	Burkina Faso
100	M	University of Nazi Boni	Ph.D.	Animal Science	2024, December	N	Burkina Faso
101	F	University of Nazi Boni	M.S.	Rural Development	2022, October	N	Burkina Faso
102	M	University of Nazi Boni	M.S.	Nutrition	2023, February	N	Burkina Faso
157	M	Royal University of Agriculture	M.S.	Crop Science	2023, June	N	Cambodia
103	F	Royal University of Agriculture	M.S.	Agricultural Extension	2023, December	N	Cambodia
95	M	National University of Battambang	M.S.	Sustainable Agriculture	2024, May	N	Cambodia
97	F	Royal University of Agriculture	M.S.	Agricultural Sciences	2023, December	N	Cambodia
104	M	National University of Battambang	M.S.	Soil Science	2024, May	N	Cambodia
96	F	National University of Battambang	M.S.	Sustainable Agriculture	2023, May	N	Cambodia
119	F	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
120	F	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
121	M	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
122	F	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
123	M	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
124	F	Royal University of Agriculture	BSc	Agro-industry	2022, October	N	Cambodia
125	F	Royal University of Agriculture	BSc	Agronomy	2022, October	N	Cambodia
126	M	Royal University of Agriculture	BSc	Agronomy	2022, October	N	Cambodia
127	F	Royal University of Agriculture	BSc	Agricultural Engineering	2022, October	N	Cambodia
128	M	Royal University of Agriculture	BSc	Agricultural Engineering	2022, October	N	Cambodia
129	F	Royal University of Agriculture	BSc	Veterinary Medicine	2022, October	N	Cambodia

Coded Name	Sex	University	Degree	Major	Program End Date (year/month)	Degree Granted (Y/N)	Home Country
130	F	Royal University of Agriculture	MSc	Aquatic Biology	2024, February	N	Cambodia
131	F	Royal University of Agriculture	MSc	Agricultural Extension	2023, January	N	Cambodia
132	M	Royal University of Agriculture	PhD	Agricultural Sciences (Agricultural Extension and Communication)	2024, December	N	Cambodia
133	M	Royal University of Agriculture	PhD	Agricultural Sciences (Agricultural Extension and Communication)	2024, December	N	Cambodia
134	F	Royal University of Agriculture	PhD	Agricultural Sciences (Agricultural Extension and Communication)	2025, July	N	Cambodia
158	M	Michigan State University	Ph.D.	Agriculture, Food, and Resource Economics	2025, May	N	Columbia
105	F	Michigan State University	M.S.	Biosystems and Agricultural Engineering	2022, December	N	Malawi
106	F	Michigan State University	M.S.	Biosystems and Agricultural Engineering	2022, December	N	Malawi
85	M	University of Thies	Ph.D.	Animal Science	2023, March	N	Senegal
107	F	University of Thies	M.S.	Agricultural Engineering	2023, March	N	Senegal
108	M	University of Thies	M.S.	Forage Biomass Production	2023, January	N	Senegal
87	M	University of Thies	M.S.	Animal Science	2022, January	Y	Senegal
110	M	University of Gaston Berger, St. Louis	Ph.D.	Agricultural Mechanization	2023, April	N	Senegal
111	M	University of Dakar	M.S.	Agricultural Mechanization	2023, March	N	Senegal
113	M	Michigan State University	Ph.D.	Biosystems and Agricultural Engineering/Computer Science	2025, August	N	Togo
89	F	University of Tennessee	M.S.	Agricultural Leadership and Education	2022, May	Y	United States
114	F	University of Minnesota	Ph.D.	Geography, Environment, and Society	2023, September	N	United States
115	F	Michigan State University	M.S.	Biosystems and Agricultural Engineering	2021, December	Y	United States
116	F	University of Colorado Boulder	Ph.D.	Environmental Studies	2023, December	N	United States
117	M	Michigan State University	M.S.	Biosystems and Agricultural Engineering	2023, August	N	United States
118	F	Kansas State University	Ph.D.	Agronomy	2023, April	N	United States



## Institutional Development

**CE SAIN Institutional Development:** The CE SAIN continues to build human and institutional capacity at the Royal University of Agriculture in Cambodia. The CE SAIN implements its scholarship and research grant program to increase faculty teaching, research, and extension capacity through long-term training and degree enhancement. The Center, through its seven Agricultural Technology Parks, has also played a key role in linking RUA faculty and students and the private sector, NGOs, Innovation Labs, and other networks. These partnerships support the promotion of information dissemination and serve as a catalyst for new innovations.

*Partnerships: Cambodia* – Conservation Agriculture Service Center (CASC); Ministry of Agriculture Forestry and Fisheries (MAFF); Ministry of Education, Youth, and Sport (MoEY); Department of Agricultural Engineering (DAEng); Royal University of Agriculture – Phnom Penh; University of Battambang; and multiple Feed the Future Innovation Labs (e.g., Horticulture; Livestock Systems; Integrated Pest Management); and Swisscontact. Additional collaborators due to the ASA-CAST (Commercialization of Aquaculture for Sustainable Trade) project include American Soybean Association, World Vision, and Auburn University.

**Institutional Sustainability:** The regional coordinators funded in Senegal and Burkina Faso have also helped with continuing some of the critical research initiated by the NARS (ISRA and INERA) and supported institutional capacity building to sustain long-term research. They have and will continue to collaborate with national and regional organizations, specifically as the iREACH initiative has matured and is being more widely implemented.

*Partnerships: Senegal* – Mathematica (project on Sustainable Agricultural Decision Tools, AICCRA (Accelerating Impacts of CGIAR Climate Research for Africa) with International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) on climate resilient technology dissemination; *Cambodia* - Texas A&M University, University of Virginia, Royal University of Phnom Penh, WorldFish Malaysia, Cleber (private company, manufactures Oggun tractors), USDA-ARS National Soil Dynamics Lab, Danfoss Hydraulics, SEARCA, Institute of Technology – Cambodia, Swiss Federal Institute of Aquatic Science and Technology (EAWAG).

## VIII. Innovation Transfer and Scaling Partnerships

### Plan of Action

The SILL supported the creation, testing and scaling of 31 technologies during FY 2022, six of which were made available for uptake (Phase 3) and 13 that have already shown adoption by the public and private sectors (Phase 4). During this reporting period, SILL's project partners have worked with numerous organizations, institutions, farming groups and local artisans to create, scale up, and extend their various innovations.

#### Steps Taken:

- ASMC continues to collaborate with the private sector motor companies, the Department of Agricultural Extension, the BARI, and the BAU to create, fund, and extend their rice harvesters and transplanters. They also work with CIRAD, Smart-Agro, and Swisscontact to support scale-up.
- CE SAIN continues to work to develop various improved conservation agriculture practices in conjunction with the University of Tennessee and several Feed the Future Innovation Labs. Additionally, they demonstrated these practices to the government, the public and private sectors, as well as high school and college students at the Royal University of Agriculture supported tech parks in Cambodia.
- The Polder project continues to work with local universities, the IARC and NARES to create an innovate cropping pattern for more sustainable rice production in the polder region. Using virtual field days, trainings and workshops, the project was able to refine the planting techniques for wider uptake.

#### Partnerships:

- ASMC: Bangladesh Agricultural University (BAU), ACI Motors Ltd., Metal Pvt Ltd., Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Department of Farm Power and Machinery, Department of Agriculture Extension (DAE) subsidy program, CASC/DALRM, CIRAD, Smart-Agro, Swisscontact, RUA, International Agricultural Research Center (IARC)
- CE SAIN: Livestock Systems IL (University of Florida), Project Everest, University of Tennessee
- Pathways of Scaling Agricultural Innovations for Sustainable Intensification in the Polders: BARC, International Rice Research Institute (IRRI), local public universities
- Improving Food and Nutrition in Senegal and Niger: ANCAR, Local Food Processing Institute, ISRA – CERAAS, Peace Corps, ENSA, Agropastoralists of the Senegal peanut basin

#### Technology Ready to Scale (Phase 3):

- ASMC – Cambodia: 1) Cover Cropping
- CE SAIN – Cambodia: 1) Living Fence, 2) Permaculture, 3) Vermicompost
- Pathways of Scaling Agricultural Innovations for Sustainable Intensification in the Polders: 1) Rice-Maize Cropping System in Polders; 2) Rice-Sunflower Cropping System

#### Technologies Transferred (Phase 4):

- ASMC – Bangladesh: 1) Combine Harvester; 2) Rice Reaper; 3) Rice Transplanter; 4) Two-Wheel Tractor Based Seed Planter
- ASMC – Burkina Faso: 1) Mechanized Maize Planting System with ASMC Planter; 2) ASMC Forage Chopper
- ASMC – Cambodia: 1) No-Till Planter; 2) Seed Broadcaster; 3) Land Leveler
- ASMC – Senegal: 1) Biomass Chopper
- Improving Food and Nutrition Security in Senegal and Niger: 1) Dual-Purpose Pearl Millet Grain and Fodder Biomass Production; 2) Enriched Millet Flour for Pregnant Women and 3) Undernourished Children and Pearl Millet Seed Sub-Residues for Chicken Feed-Making; Improved Dual-Purpose Pearl Millet Stover for Livestock Feed

## IX. Environmental Management and Mitigation Plan (EMMP)

An annual environmental mitigation activity review was conducted by the SIIIL management entity across all subawards. The review entailed an evaluation of all activities outlined in the EMMP. Given the previous year's focus providing subawardees' with greater knowledge and tools to improve EMMP compliance and reporting, there were no issues to highlight during this reporting period. Mitigation and monitoring activities took place in accordance with the EMMP. In cases of fertilizer and pesticide purchase and use, project partners provided appropriate personal protective equipment and training for the safe use of the materials. The SIIIL ME conducted a site visit to Ethiopia and verified that safety guidelines, training, and signage were addressed in accordance with the concerns raised in the previous year.

In addition, the Piestar DPx system, which the SIIIL utilizes for reporting and project monitoring, underwent significant revisions of the EMMP module to support SIIIL's compliance enforcement. The Piestar DPx updates included a new fertilizer, pesticide, and microbial inoculant purchase request/approval system. The annual environmental mitigation activity review also is incorporated into the DPx system to ensure that project monitoring is streamlined and to optimize knowledge sharing within the SIIIL management entity.

## X. Open Data Management Plan

The SIIIL management entity established the SIIIL Dataverse to store and curate all SIIIL subaward datasets and serve as a data repository and access hub for the SI community in general. During this reporting period, SIIIL subawards and consortia reported that 58 separate complete datasets have been uploaded representing 510 files. The complete datasets can be found in the SIIIL's Dataverse (<https://dataverse.harvard.edu/dataverse/SIIIL>), hosted by Harvard Dataverse.

Each complete dataset is required to, at a minimum, include: codebooks; metadata; data dictionaries; forms, templates, and data gathering tools; explanations of redactions, when applicable (e.g., anonymization, removal/redaction/masking of personally identifiable information); notes on data quality, data limitations, or data context; and data gathering methodologies, dates, points of contact, geolocation(s).

The SIIIL is in continual discussions with USAID's Data Development Library (DDL) staff to resolve issues related to the Geospatial and Farming Systems Research Consortium and the Precision Agricultural project on how to submit datasets given the excessive size of these geospatial datasets.

The SIIIL also has continued to utilize CGSpace as a repository for sharing informal publications and outputs from SIIIL funded work. SIIIL established this repository with CGSpace in 2017 to share SIIIL funded outputs that otherwise did not have formal publishing platforms for public sharing. To date, 44 communications materials such as presentations, videos and other media, management documents, reports, training materials, newsletters and stories, and other communications materials have been shared on the SIIIL CGSpace repository for open access.

Finally, all previous SIIIL annual reports (2015-2021) have been uploaded into the USAID Development Experience Clearinghouse (DEC), the SIIIL website, and are available to the public.

## XI. Governance and Management Entity Information

### Regional and Country Coordinator Activity

The SILL coordinators in Burkina Faso, Cambodia, and Senegal to monitor in-country activities, represent various capacities, and organize SILL-funded events. The coordinators in West Africa also conduct research to address gaps or expand the scope of in existing in-country SILL subawards. Descriptions of the research and accomplishments are below:

- a) **Burkina Faso:** Dr. Hamidou Traoré, the SILL Burkina Faso Coordinator and Director General of INERA, works with graduate students, research scientists, and government delegates to move the food and agricultural security agenda forward. Here are some highlights from his work in FY 2022:
- Attended a virtual conference on the evolution of iREACH in countries' technology parks in collaboration with CORAF on August 18, 2022.
  - Evaluation of organic fertilizers to control *Striga hermonthica* in sorghum growth in screen-house conditions. This is an on-going activity at the Kamboinse research station of INERA.
  - Lab screening was performed to eluate the 42 M5 rice lines for their tolerance to water deficit induced by Polyethylen Glycol (PEG 6000) in petri dish conditions.
  - Attended and participated in the 2022 SILL Annual Meeting in Cambodia on June 23<sup>rd</sup>-25<sup>th</sup>, 2022.
  - Assessment of cowpea mutant lines for their tolerance to *Striga* genericides in natural infested field. This is an on-going activity in a farmer's field located near Zorgho and Fada N'Gourma.
  - Screen-house experiment was conducted from September 2021 to December 2021 at Kamboinse research station to compare in pot conditions 22 and 20 M5 rice lines, respectively, generated from FKR45N and FKR47N varieties to their parent and one control Niercica for *Striga* resistance.
  - Screen-house experiment was conducted from August to November at Kamboinse research Station to compare in pot conditions 30 M4 line generated from Sorghum RSOE15 and 20 M5 lines with parent Sorghum S29 to their parent and one control N13 for *Striga* resistance.

### Publications

- 1) Barro, A., Yonli, D., Prasad, V. P., Koumben, M., Pale, S. 2022. Assessing the effect of tillage and fertilization on the accumulation of minerals in pearl millet stover. *World Journal of Advanced Research and Reviews*. doi: <https://doi.org/10.30574/wjarr.2022.15.2.0826>.
- 2) Coulibaly, S. Z. C. T., Palé, S., Noufe, T., Yonli, D., Prasad, P.V.V. 2022. Economic performance of soil and water conservation practices in Burkina Faso. *Research in Agriculture*. doi:10.22158/ra.v4n1p38.
- 3) Pale, S., Traore, H., Barro, A., Yonli, D., Prasad, P.V.V. 2022. Evaluation of the effect of tillage and fertilization on the accumulation of mineral elements in grains of purely cultivated millet. *International Journal of Innovation Scientific Research and Review*. 15(02), 606–615.
- 4) Middendorf, B.J, Traore, H., Middendorf, G., Jha, P.K., Yonli, D., Palé, S., Prasad, P.V.V. 2022. Impacts of the COVID-19 pandemic on vegetable production systems and livelihoods: Smallholder farmer experiences in Burkina Faso. *Food and Energy Security*. doi: 10.1002/fes3.337
- 5) Jha, P.K., Araya, A., Stewart, Z. P., Faye, A., Traore, H., Middendorf, B. J., Prasad, P.V.V. 2022. Projecting potential impact of COVID-19 on major cereal crops in Senegal and Burkina Faso using crop simulation models. *Agricultural Systems*. doi: <https://doi.org/10.1016/j.agsy.2021.103107>.
- 6) Palé, S., Yonli, D., Mason, S. C., Noufe, T., Fofana, S. 2022. Typology of farms and farmers' perception of the effects of soil and water conservation practices in Northern Burkina Faso. *Journal of Agriculture and Crops*. doi: <https://doi.org/10.32861/jac.512.251.265>.
- 7) Traore, H., Barro, A., Yonli, D., Stewart, Z., & Prasad, P.V.V. Water conservation methods and cropping systems for increased productivity and economic resilience in Burkina Faso. *Water*. doi:10.3390/w12040976.

### Conference/Presentation

- 1) Jha, P.K., Middendorf, B. J., Traore, H., Middendorf, G., Yonli, D., Pale, S., & Prasad, P.V.V. (November 2021). Impacts of the COVID-19 pandemic on vegetable production system and livelihoods: small holder farmer experiences of Burkina Faso. 2021 ASA-CSSA-SSSA International Annual Meeting, Salt Lake City, Utah
- b) **Cambodia:** Dr. Manny Reyes continues his work as the SILL Country Coordinator for SILL, working primarily with CE SAIN and the ASMC-Cambodia teams, but also continuing SILL's regional work in South Asia by cultivation partnerships in the Philippines, Bangladesh, and other countries in the area. Here are a few of the highlighted accomplishments from FY 2022:
- Assisted in the development of the Mini-Agricultural Technology Parks located across three high school campuses. Staff of the Mini-ATP's, together with agricultural teachers and administrators in the high schools, received training from the Southeast Asian Regional Center of Graduate Studies in Agriculture, on establishments of School plus Home Garden cum Biodiversity Enhancement Enterprise (SHGBEE) as an experiential learning laboratory for K-12 students to engage in Science, Technology, Engineering and Math as it applies to agriculture and biodiversity. In the Mini-ATPs over 800 students are engaged.
  - Continues to engage to further establish Cambodia's niche on Conservation Agriculture. He facilitates the engagements of CE SAIN and KSU, in the CE SAIN, CIRAD, Swisscontact and Kansas State University (C2SK) project which is the back end for the Provincial Development of Agriculture, Forestry and Fisheries (PDAFF) MetKasekor Extension Model. MetKasekor is a unique Cambodian innovative extension model that focuses on opening the market for private sector investments with Conservation Agriculture technology as the first application of MetKasekor.
- c) **Senegal:** Dr. Aliou Faye continues his work as the West Africa Regional Coordinator. Here are a few highlights:
- Organization of the Open Day of the Technology Park on October 6, 2022.
  - Innovation submission to the iREACH advisory committee.
  - Participated in the American Society of Agronomy in Salt Lake City, Utah. Gave an oral presentation of the main results from SILL and LSRIL (Legumes Systems Research Innovation Lab) in Senegal.
  - Implementation of dual-purpose crop (cowpea and peanut) demonstrative lot in the Technology Park.
  - Shared innovations and improved millet and cowpea seeds with the West Africa Technology Parks in Niger, Burkina Fast, Mali, and Ghana.
  - Coordination of the Bambey women's group visit to the Technology Park.
  - Hired a female MSC to evaluate the benefit of the Technology Park implemented innovations.
  - The collaboration with Mathematica group resulted in the development of Decision Support Tool for Sustainable Dissemination of Dual-Purpose crop (millet and cowpea) in Senegal.

### Publications

- 1) Jha, P.K., Araya, A., Stewart, Z.P., Faye, A., Traore, H., Middendorf, B.J., Prasad, P.V.V. (October 2021). Projecting potential impact of COVID-19 on major cereal crops in Senegal and Burkina Faso using crop simulation models(pp.1-12). *Agricultural Systems*, 103107(190 (2021)), United States. doi: <https://doi.org/10.1016/j.agry.2021.103107>.
- 2) Faye, A., Stewart, Z. P., Diome, K., Eward, C. T., ... Prasad, P.V.V. (October 2021). Single Application of Biochar Increases Fertilizer Efficiency, C Sequestration, and pH over the Long-Term in Sandy Soils of Senegal(pp.1\_19). *Sustainability MDPI* 2021, 13(11817), Suisse. doi: <https://doi.org/10.3390/su132111817>.

- 3) Hernandez, C.M., Faye, A., Ousseynou L, Stewart, Z.P., Prasad, P.V.V., ... Ciampitti, I. A. (October 2021). Soil and Climate Characterization to Define Environments for Summer Crops in Senegal. (pp.1-17). Sustainability MDPI, 13, Suisse. doi: <https://doi.org/10.3390/su132111739>.

### **SIIIL Personnel Highlights**

- The SIIIL successfully held its 2022 Annual Meeting on June 23-25, 2022, in Phnom Penh, Cambodia with over 130 participants from around the world
- Dr. Elizabeth Guertal was hired with SIIIL in February 2022 as the Program Director for the CE MARCH associate award.
- Three new undergraduate students were hired as Student Research Assistants.

### **Policy Research Impact Study Consortium Closeout**

The Policy Research Impact Study Consortium, supported through an associate award with Rutgers University, has completed their closeout procedures. This included a final performance report that was submitted to USAID on September 30<sup>th</sup>, 2022. The Rutgers University subaward for the Consortium officially ended in December 2021, and SIIIL extended the Consortium until June 30<sup>th</sup>, 2022.

### **Expanding the Sustainable Intensification Assessment Framework**

SIIIL worked with its partners to continue to expand the effectiveness of the Sustainable Intensification Assessment Framework (SIAF) by updating current indicators and adding new ones, especially those related to the nutrition and social domains.



## XII. Other Topics

### Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) at the Royal University of Agriculture

1. **Name:** The Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN)
2. **Locations:** Cambodia
3. **Description:** CE SAIN – housed in Cambodia’s Royal University of Agriculture (RUA) – helps improve food and nutritional security in Cambodia by supporting agricultural research and education while fostering innovation. CE SAIN’s goal is to foster private sector innovation, agricultural research, education and training, and public sector capacity building through improved collaboration and knowledge sharing that is focused on improving food and nutritional security while enhancing quality of soil, water, and biodiversity. CE SAIN’s three core objectives are: a) coordinate and leverage Innovation Labs and other USAID-funded SAIN activities, b) build human and institutional capacity of the RUA, and c) establish Technology Parks to showcase high-potential technologies and strategies to sustainably intensify smallholder farming systems.
4. **Collaborators:** Cambodia - Cambodian Agricultural Research and Development Institute (CARDI), Conservation Agriculture Service Center (CASC); Ministry of Agriculture Forestry and Fisheries (MAFF); Ministry of Education, Youth, and Sport (MoEY); Department of Agricultural Engineering (DAEng); Provincial Department of Agriculture, Forestry and Fisheries (PDAFF), Royal University of Agriculture - Phnom Penh; University of Battambang; and multiple Feed the Future Innovation Labs (e.g. Horticulture; Livestock Systems; Integrated Pest Management); and Swisscontact. Additional collaborators due to the ASA-CAST (American Soybean Association-Commercialization of Aquaculture for Sustainable Trade) project include American Soybean Association, World Vision, and Auburn University.
5. **Achievements:**
  - Finalizing the two ATP locations in Mondulkiri and Preah Vihear Province by partnership with Cambodian Agricultural Research and Development Institute (CARDI) and Provincial Department of Agriculture, Forestry and Fisheries (PDAFF).
  - CE SAIN has strengthened their partnerships and engagements with the private sector by supporting the Cambodia Conservation Agriculture and Sustainable Intensification Consortium (CASIC) and the Provincial Department of Agriculture, Forestry and Fisheries (PDAFF) led by the MetKasekor Extension Model. The model has resulted in private entrepreneurs being engaged in providing machinery services for farmers on improved land management.
  - 328 individuals have implemented improved management practices on 871 ha with imported cover crop seeds produced by farmers and sold by a private company.
  - SolidWorks, USA provided 30 licenses to RUA and Corteva sponsored a symposium at RUA focused on youth.
  - CE SAIN held its first international CA training with international attendees paying \$1,250.
  - CE SAIN also held its 3rd International Conservation Agriculture and Sustainable Intensification and Nutrition Conference reinforcing Cambodia’s niche as a Center of Conservation Agriculture in Southeast Asia.
  - Twenty-five unique technologies are being showcased in the five of the Agricultural Technology Parks (ATPs), 22 are in Phase III and 3 are in Phase IV of development.
  - CE SAIN is engaged with the Digital Tools, Geospatial and Farming Systems Consortium (DGFSC) at Kansas State University to link farming systems with geospatial approaches and provide training to strengthen the Royal University of Agriculture’s geospatial department.
  - CE SAIN has also partnered with AgriFoSe-Cambodia on Digital Extension Services Project to support a master’s student to conduct research related to leveraging digital technologies and ecosystems

## 6. **Capacity Building:**

- CE SAIN has grown to 39 staff member (38% females), with an additional Agricultural Technical Office in the organizational structure. The leadership and staff serve as powerful role models for the students at RUA.
- CE SAIN provided 18 long-term degree granting opportunities of which 61% were females.
- Individuals participating in USG food security programs through CE SAIN plus partners short term trainings conducted by CE SAIN had 698 participants, (49% female), which included representation from farmers, private sector, government agencies, students, professors, researchers, NGO partners, development workers, and others.
- The ATPs showcase innovations and technologies to promote sustainable development and extended learning through the various visitations (1,639 visitors in FY2022) and the trainings.

## 7. **Lessons Learned:**

- Due to COVID-19 issues and the local government strictly monitoring gatherings, some planned activities were postponed, and the Agricultural Technology Parks scaled down activities during this time to minimize the engagement of people visiting.

## 8. **Presentations and Publications:**

### **Journal Articles**

- 1) Alrawashdeh, G., Lindgren, S., Reyes, M., Pisey, S. Developing youth's capacities as active partners in achieving sustainable global food security through education. *Environ. Sci. Proc.* 2022, 15, 28. <https://doi.org/10.3390/environsciproc2022015028>.
- 2) Chakriya, N., Erlinda, D.I., Francisco, E.B., et al. Quality improvement of fermented young muskmelon through inoculation with different starter cultures of lactic acid bacteria. *Microbiol Infect Dis.* 2022; 6(3): 1-8.
- 3) Ouk, C., Tho, K., Ro, S., Seang, S., Leng, T., Ly, P. Effect of different mulching types on Insect and disease infestation and yield of onions (*Allium cepa* L.) in loamy sand. *Journal of Environmental Science and Engineering B10* (2021) 151-156 doi:10.17265/2162-5263/2021.04.003.
- 4) Sokol, Y., Socheth, O., Hong C., Sophal V., Sreynich E., Bunseng L. Management of tomato leaf curl virus disease transmission by whiteflies vector. *Asian Journal of Agricultural and Environmental Safety*, 2021 (1): 28–34 ISSN: 2575423. <https://www.ajaes.org>.
- 5) Sourn, T., Pok, S., Chou, P., Nut, N., Theng, D., Prasad, P.V.V. Assessment of land use and land cover changes on soil erosion using remote sensing, GIS and RUSLE Model: A Case Study of Battambang Province, Cambodia. *Sustainability* 2022, 14, 4066. <https://doi.org/10.3390/su14074066>.
- 6) Sourn, T., Pok, S., Chou, P., Nut, N., Theng, D., Rath, P., Reyes, M., Prasad, P.V.V. Evaluation of land use and land cover change and its drivers in Battambang province, Cambodia from 1998 to 2018. *Sustainability*. 2021, 13, 11170. <https://doi.org/10.3390/su132011170>.

## Gender Integration Highlights:

During the FY 2022 reporting period, the SIIL requested the consortia and subawards to provide additional information on how their projects were integrating gender into their research. All of them are actively integrated gender into their programs. Below are the highlights from few selected projects:

Maria Jones, with the Appropriate Scale Mechanization Consortium (ASMC), reported that with the Bangladesh Hub she conducted a two-part capacity building training on “Conducting Gender Sensitive Mechanization Training” and “Conducting Gender Sensitive Mechanization Research” for 48 participants for faculty and students at Bangladesh Agricultural University. The three-hour training included gender frameworks and participatory online activities.

The Bangladesh Polder project had a total of 1,329 (36%) female individuals that participated in capacity building on different aspects of agricultural development in the polder zone. Among the participants, 106 women directly engaged in the demonstration of improved cropping practices in different learning hubs of the polder zone. Three women service providers were directly engaged in harvesting paddy by reapers and earned a total of \$1,728 USD during the reporting period, which they spent on the most productive and income-generating purposes.

The Bangladesh Polder project was also able to mobilize additional funds for its gender component. The CGIAR Gender Platform through its Evidence module invested \$190,516 USD to generate evidence on the gender dynamics and women’s empowerment in the water governance of the polders. In partnership with Shushilan, a study called GENERATE is being implemented in the eight polders of the south-west and south-central coastal zones of Bangladesh.

## Nutrition Integration Highlights:

During the FY 2022 reporting period, the SIIL also requested the consortia and subawards to provide additional information on how their projects were addressing nutrition as a cross-cutting theme into their research activities. Below are the highlights from few selected projects:

The S3-Cambodia project promotes the diversification of food systems by integrating Wild Food Plants (WFP) perennial species into home gardens, producing rainy season grafted tomatoes, and growing post-rice secondary crops. In partnership with NUBB, graduate student, Huot, organized a training for agricultural groups on producing confectionary products that extend the shelf-life of WFP species.

The Bangladesh polder project continued its regular Nutritional Awareness Program involving the mothers of school children and female schoolteachers, in which 318 women participated during this reporting period. The farming community was also included in the Nutritional Awareness Program while empowering them on the production of zinc-enriched rice, maize, and sunflower. A total of 399 men and women participated in the training.

## **XIII. Issues**

### **Anticipated No-Cost Extensions for our Consortia and Focus Country Subawards**

As the COVID-19 pandemic travel issues improved in FY 2022, SIIIL's projects still faced related challenges, including the reduction of travel and ability to meet with partners face to face. As time passed, these issues were improved, and our projects were able to increase activities and continue with full implementation of their research and work. After consultation with our consortia and focus country subawards, the SIIIL anticipates a need to allow no-cost extensions from June 30, 2023 to September 30, 2023 with USAID's approval. This will allow our partners to finish out their research and reporting. The SIIIL Management Entity will continue to work with USAID and its various partners in their target countries and regions to ensure that programmatic functions continue as best as possible during this time.

### **Challenges related to implementation in Haiti**

Due to the on-going unrest in the country, there is major concern of safety issues, which has made progress with the CE MARCH associate award limited. As a result of accessibility issues, means of communication with the partner universities have proven to be difficult and it has taken patience to work through these problems.

## **XIV. Future Directions and Activities**

### **SIIL Management Entity**

FY 2023 will be the final year for SIIL's focus country projects and consortia. Therefore, the project researchers, leaders, and SIIL Management Entity will be working to finish and close out all country activities during the scheduled time frame.

In FY 2023, SIIL will also develop a request for proposal to secure a communication entity to capture the decade of research accomplishments and highlight the importance and impact of the SIIL portfolio.

The SIIL will continue to build their presence in Latin American and the Caribbean by implementing the HAUP-CEMARCH Associate Award in Haiti and strengthen their partnership with the USAID Guatemala Mission to build on our successes of replicating innovation, research, extension, and advisory coordination center/hub.

### **iREACH Coordination Hubs Implementation and Expansion**

The goal of this initiative is to create regional innovation, research, extension, and advisory coordination hubs (iREACH) in the Feed the Future target and resilience focus region, and countries that will foster private sector innovation, agricultural research, education, extension and training, and public-sector capacity building through improved collaboration, communication and knowledge sharing on aspects related to CSA (climate smart agriculture) and food and nutritional security in the various regions (Asia, West Africa, East Africa, and Latin America and the Caribbean). In FY 2023, SIIL will expand the iREACH Activity Tracker by including all 20 of the Feed the Future target countries, as well as select project with IFDC and other CGIARS.

### **CE SAIN Institutionalization at the Royal University of Agriculture**

The Center for Sustainable Agricultural Intensification and Nutrition (CE SAIN) is currently funded by SIIL and house at the Royal University of Agriculture in Cambodia and has seven Agricultural Technology Parks located around the country. During FY 2023, SIIL will continue to support CE SAIN's efforts to be institutionalized at RUA, which will take over complete management of the initiative.

## XV. Appendices

### Appendix A – List of Awards Given to U.S. Universities

#### Consortiums:

**Title:** Appropriate Scale Mechanization Consortium – Phase II

**Awarded institution:** University of Illinois at Urbana-Champaign

**Dates:** July 1, 2020 - June 30, 2023

**Current year funding:** \$750,000

**Total funding:** \$2,249,991

**Title:** Digital and Geospatial Tools Consortium

**Awarded institution:** Kansas State University

**Dates:** July 1, 2020 - June 30, 2023

**Current year funding:** \$1,000,000

**Total funding:** \$2,000,000

#### Focus Country Projects (Bangladesh, Cambodia, Senegal & Niger):

**Title:** Unlocking the Production Potential of “Polder Communities” in Coastal Bangladesh through Improved Resource Use Efficiency and Diversified Cropping Systems

**Awarded institution:** Kansas State University

**Dates:** July 1, 2020 - June 30, 2023

**Current year funding:** \$258,448

**Total funding:** \$547,468

**Title:** Cambodia: S3 Scaling Suitable Sustainable Technologies

**Awarded institution:** University of Tennessee

**Dates:** July 1, 2020 - June 30, 2023

**Current year funding:** \$222,243

**Total funding:** \$750,000

**Title:** Scaling Dual-Purpose Pearl Millet-Based Technologies for the Resilience of Small-Holder Farmers in Senegal and Niger

**Awarded institution:** Kansas State University

**Dates:** July 1, 2020 - June 30, 2023

**Current year funding:** \$250,000

**Total funding:** \$499,999

#### Initiatives and Associate Awards:

**Title:** Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) in Cambodia

**Awarded institution:** Royal University of Agriculture

**Dates:** July 1, 2016 – September 30, 2026

**Current year funding:** \$412,088

**Total funding:** \$3,261,676



**Title:** Innovation Research, Extension and Advisory Coordination Hub (iREACH)

**Awarded institution:** Kansas State University

**Dates:** September 24, 2021 – September 23, 2026

**Current year funding:** \$800,000

**Total funding:** \$5,000,00

**Title:** Haiti Agricultural University Partnership (HAUP): Center of Excellence on Mitigation, Adaptation, and Resilience to Climate-Change in Haiti (CE MARCH)

**Awarded institution:** Kansas State University

**Dates:** September 30, 2021 – September 29, 2026

**Current year funding:** \$4,500,000

**Total funding:** \$12,000,000

**Title:** Economic Impact of Improved Bean Varieties in Central America and USA

**Awarded institution:** Michigan State University and International Center for Tropical Agriculture (CIAT)

**Dates:** January 1, 2021 – December 31, 2022

**Current year funding:** \$150,000

**Total funding:** \$300,000

**Title:** Association of Research Directors Research Symposium

**Awarded institution:** Delaware State University

**Dates:** February 1, 2022 – August 30, 2022

**Current year funding:** \$241,250

**Total funding:** \$241,250

## Appendix B – Success Stories

# SUCCESS STORIES

## Success Story #1: Significant Changes in the Livelihood of SIIL-mentored Agripreneurs

The rapid growing economy of Bangladesh has fueled the demand for labor in non-agricultural sectors, resulting in a scarcity of rural agricultural workers. This has driven up labor wages and is affecting farm profitability. Although Bangladesh has made great strides in mechanizing many aspects of agricultural production, it is almost absent in the coastal zone, except for two-wheel tractors in land preparation. Commonly, impoverished, and landless men and women are engaged in manual rice harvest as wage-earning day laborers. The growing labor costs and shortages of supply, particularly during the rice harvest period, are pushing a demand for mechanized harvesting services. But the main challenge is that the rural farmers are poor and unable to buy machines.

Therefore, the Government of Bangladesh has taken initiatives to promote agricultural mechanization through the provision of 50%-70% subsidy on the sale price for procuring machines by the farmers and service providers. The Government of Bangladesh declared more subsidies (up to 70%) for the haor areas and coastal zones of the country.

Recognizing the importance of, and challenges, in agricultural mechanization in the polders of the coastal zone, the Sustainable Intensification Innovation Lab (SIIL) Polder project has taken initiatives to develop local service providers in harvesting paddy by using a reaper in 2017. Initially, the project purchased one reaper and organized demonstrations and trainings that involved men and women farmers to create awareness on mechanized harvesting of paddy, and to attract women and youth in agriculture. Another involved group was wage-earning laborers to ease the physical burden on women during manual harvesting and to increase their contribution to household earnings. Harvesting rice usually required 12-22 days and laborers earn BDT 3,600-6,000 (USD 45-75) a year; however, after the SIIL-Polder team held trainings on harvesting paddy by a reaper, trainees were able to earn the same income but in 4-5 days.

Due to the increases in income and decreases in human drudgery seen in 2017, the project purchased an additional reaper in 2018. It has been working closely with five women and four young men who have shown a strong interest in learning about being service providers.

Ripon and Antara Mondal, husband and wife, have achieved great success within the past year by using reapers while strengthening mechanized rice harvest facilities in the community. They mostly worked as wage laborers in different project activities ever since 2016, because Antara's husband owns a power tiller and earned money rendering land preparation services to the community. After learning about the subsidy program of the Government of Bangladesh from the SIIL-Polder project, they decided to expand their agricultural mechanization services to the community by buying a reaper in 2021 for the family's welfare.



*Antara Mondal and family with their new reaper*

After purchasing the new reaper, Antara and Ripon Mondal began harvesting paddy with their new reaper. Their income in a cropping year (aman-boro) was BDT (Bangladesh Taka) 35,704 (USD 425). This income is projected to increase with more experience over the coming years.

Being landless, Antara and Ripon Mondal leased-in some agricultural land and invested most of their income in purchasing inputs for rice cultivation and in repairing their own power tiller. Like other service providers, Antara also purchased some household items, spent some money for family's health care, and purchased a few dresses for herself using some of the income.

These mechanization services that the SIIL-Polder project has been able to provide and train on, not only helped improve the livelihood of agripreneurs like Antara and her husband but has also helped the polder community as a whole harvest their paddy with less cost and in a short time, which reduces potential production loss.

## Success Story #2: Sustainable Intensification Innovation Lab Holds 2022 Annual Meeting in Cambodia with Representation from Across the Globe

The Feed the Future Lab on Collaborative Research for Sustainable Intensification (SIIL) at Kansas State University held its 2022 Annual Meeting, June 23-25, in Phnom Penh, Cambodia. There were over 100 participants in attendance including research partners and funding recipients of the SIIL, along with nine representatives from distinct United States Agency for International Development (USAID) Missions and D.C.

In addition, there was leadership from the Ministry of Cambodia, Royal University of Agriculture (RUA), private sector entities, and other projects including the American Soybean Association, as well as the SIIL External Advisory Board (EAB). Participants included individuals from 13 countries across the globe.

During the first day, each project and consortium had a promotional video and a presentation highlighting their research on sustainable agriculture innovations followed by a question-and-answer session. This provided time for engagement and multidisciplinary collaboration between the various projects and consortia.

The second day was called the “International Delegation Day and Knowledge Sharing,” hosted at the RUA. There were multiple panel discussions that included delegates from external partners of the Center of Excellence on Sustainable Agriculture Intensification and Nutrition (CE SAIN), faculty and students of RUA, West Africa, and various USAID Mission from Guatemala, Haiti, and West Africa. These discussions reflected on the development and success of CE SAIN from these various perspectives.

Additionally, the last day of the meeting included traveling to visit different Agricultural Technology Parks, where participants could view several innovations that are being showcased in Cambodia while having time to engage and collaborate with other partners in SIIL’s other focus countries.



*Participants at the 2022 SIIL Annual Meeting at the Royal University of Agriculture in Cambodia*

The President of K-State, Richard Linton, provided welcome remarks on the “International Delegation Day and Knowledge Sharing,” day of the meeting. He expressed gratitude to USAID and SIIL for their commitment to making positive impacts on the environment.

“Through our continued partnership with USAID, the Sustainable Intensification Innovation Lab will forge a path that utilizes innovative research and extension approaches to secure a better future for small holder farmers,” Linton said.

Charles Taber, provost and executive vice president of K-State, spoke about the importance of the innovations and research that the SIIL executes.

“New innovations and discoveries in research and policies are needed to improve production and access to nutritious food to all,” Taber said. “The SIIL has contributed many innovations which are relevant and needed, and many are shared during this annual meeting and field visits.”

David Rosowsky, vice president for research commented on the dedication of SIIL at K-State to its goals.

“The Sustainable Intensification Innovation Lab is a strong example of K-State’s commitment to high quality research and innovation, providing tangible, positive impacts to smallholder farmers,” Rosowsky said.

“The activities of the SIIL fit the mission and values of the College of Agriculture at K-State,” said Ernie Minton, Dean, College of Agriculture and Director, K-State Research and Extension. “We will continue to support the work being done by the SIIL and look forward to the ways in which our partnership will continue to yield positive results around the globe.”

Vara Prasad, University Distinguished Professor and Director of the SIIL, highlighted the collaboration and commitment of SIIL’s goals across the globe.

“We have the ability to identify problems, solutions and options through research and translate those into appropriate innovations for smallholder farmers.” Prasad said. “The SIIL has formed networks and established, partnerships and collaborations with different organizations in host-countries around the world to identify innovations and technologies that will have positive impacts on livelihoods of people, and also helps to build human, institutional and social capital.”

Comments from USAID partners included appreciating the immensity of the SIIL portfolio, the positive engagement through the meeting and the dedicated work to find innovative ways to combat global food and nutritional security.

The SIIL was fortunate to have a face-to-face meeting again after having last year’s meeting virtual due to the COVID-19 pandemic.



## Success Story #3: CE SAIN in Collaboration with Reaksmeay Sophanna High School

The collaboration between the Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) and Reaksmeay Sophanna High School started in 2016. Under the guidance of H.E Dr. Touch Visal Sok, Secretary of State, Ministry of Education, Youth and Sports. And Dr. Hok Lyda, Center Director of CE SAIN who did a site visit at the Reaksmeay Sophanna High School, they decided to choose Reaksmeay Sophanna High School as the Agriculture Technology Park (ATP) site in the collaboration with CE SAIN.

On September 22, 2016, Mr. Soth Vicheka, Reaksmeay Sophanna's principal, was able to sign a Memorandum of Understanding (MOU) with CE SAIN.

"I was invited to the Royal University of Agriculture to sign the MOU together with CE SAIN representative, Dr. Hok Lyda, and under the witnesses from H.E Veng Sokhorn, the Minister of the Ministry of Agriculture, Forestry and Fisheries, H.E William A. Heidt, the U.S Ambassador to Cambodia, and USAID representatives," said Vicheka.

Following this MOU signing, the high school has collaborated with CE SAIN to build the ATP at the school ground including school home gardening and agriculture technology that were also introduced; thus, the students can have an opportunity to learn new experiences at the technology park. Through this MOU collaboration between CE SAIN and Reaksmeay Sophanna High School, the school principal has noticed significant changes that benefits the school, teachers, and most importantly, the students.

First, CE SAIN is able to provide training to the students on agricultural technology for them to be able to experience using ecological and natural agriculturally based without chemical use fertilizer but even more hygiene. Secondly, teachers, students, and the communities started to love home school gardening and natural cultivation in the agricultural sector. Thirdly, everyone there has a chance to receive more lessons learned shared among the CE SAIN staff through good practices with handout slides presentation.



Reaksmeay Sophanna High School students engaging with SIIL visitors about the agricultural technology park (ATP)



Additionally, thanks to the infrastructure set up by the CE SAIN technical team, including net house and gardening preparation, the school has an improved image and has even received a chance to welcome some honorable guests to visit the school; so far, the school appreciated the hosted of USAID visit, Sustainable Intensification Innovation Lab delegation team, and SAIN3 conference field visits among various nationalities.

Despite all of these remarkable improvements, Vicheka expresses that there is still work to be done and challenges to overcome.

"We still have some minor challenges in terms of the student's engagement with the Agricultural Technology Park that we need to improve on," said Vicheka. "In my six years of observation through the CE SAIN collaboration, the students do not have enough time to really be involved in the gardening project, since the school can provide only one hour per week for them to engage in the areas of agriculture curriculum."

However, as a response to this challenge, Vicheka said that the school has discussed the challenges with the CE SAIN team and decided to host students to engage closely with the project, while at the same time providing the benefits from the harvesting to the students.

"I believe that both teachers and students will be remaining in support, as well as community engagement, as it is very beneficial for them to learn more about conservation agriculture, cultivation and animal husbandry," said Vicheka. "In addition, we also want some poor students to gain additional knowledge that benefits their present and future vision from this collaboration."

"On behalf of the school, I would like to express my gratitude to CE SAIN, SIIL, and USAID donors for the positive continuous support to our school in terms of grant and technical knowledge; especially, for always helping to improve the Agricultural Technology Park and to provide the students with more chances in scholarship opportunities for a higher level education, particularly for the poor students who are unable to afford the school fee to have the grant access to study in Royal University of Phnom Penh and other universities," said Vicheka.