POSTER ABSTRACTS  
(in alphabetical order by last name of first author)

Establishing cassava as an agro-industrial crop through the scaling-out of proven technologies and innovations for the production, processing, and marketing of value-added products in Africa

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Cassava (*Manihot esculenta* Crantz) is an important source of calories in the tropics. The crop remains one of the most consumed food crops in Africa. While Africa dominates global cassava production, the yields remain well below the world average owing to many factors such as disease pandemic, the low adoption of available technologies. TAAT Cassava Compact seeks to scale-out proven technologies and innovations that raise farm-level productivity, improve the efficiency of processing, increase market opportunity for the smallholders, and catalyze private-sector investments. The Compact works with national institutions responsible for technology development and dissemination, NGOs and other partners to introduce to farmers high yielding, disease tolerant, and nutritious biofortified varieties; integrated soil fertility management approaches, and innovative approaches for mechanized production and weed control to derive the productivity increases that benefit the smallholders; technologies for the processing of cassava-based industrial raw materials such as starch and novel food products (bread, strips, biscuits, etc), including the processing of cassava waste into quality animal feed ingredients. The ultimate goals are to improve food and nutrition security, reduce rural household poverty and improve livelihoods in Africa.

(TAAT – Technologies for African Agricultural Transformation)

Production and marketing of horticultural seeds and seedling of Africa indigenous vegetables and fruits in Benin

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Seed Services

The quality of seeds was recognized to be of paramount importance in crop production. Quality seeds available permanently and at an accessible cost will enable smallholders to increase their production, especially when it comes to horticultural crops such as vegetables and fruit trees. Unfortunately, in Benin there was no specialized company in the production of indigenous
horticultural seeds (IHS). The existing companies were rather specialized in exotic vegetables (e.g. cabbage, carrot,) seeds production, and those of them trying to supply IHS faced environmental adaptability problems. This situation obliged farmers to use seeds from their year production, a practice that resulted in drastic yield decrease over years. Our company “Seed Services” propose to take this challenge by providing Beninese smallholders farmers specialized in endogenous horticultural crops production with high yielding seeds at a competitive price. Our current production stressed on vegetables and fruits that have the potential to improve the nutritional profile of our local population especially children and women at reproductive age. We postulated that permanently accessible high yielding seeds will result in larger production that will in turn promote an increased consumption of nutrient rich indigenous vegetables that will ultimately result in an improved nutritional status of our population.

Scaling up proven wheat technologies and innovations for achieving a wheat self-sufficiency in Africa

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Today, Africa as a whole produces less than half of the wheat it consumed, and the chasm between demand and domestic production is widening because of increased population, income and change in food preferences.

Compared to the global average wheat productivity (3.3 tons/ha), the average wheat productivity in SSA very low, about 1.7 tons/ha due to several biophysical and socio-economic constraints. The development of high yielding, heat tolerant and widely adaptable wheat varieties with integrated management packages has proved a breakthrough that opened up new opportunities to produce wheat competitively in the vast heat stressed agro-ecologies of Africa.

The TAAT wheat initiative (2018-2020) aims to scale up proven wheat technologies involving over 2 million farmers to enhance food and nutritional security, job creation, economic growth and contributing to poverty alleviation across Africa. The Innovation platform is an effective approach for transferring proven technologies at scale by fostering a paradigm shift through facilitating interaction, buy-in, negotiation and collective action amongst beneficiaries and policy makers. Youth and women groups actively engage in various wheat agri-businesses along the value chain. Within the IP framework, all stakeholders operate in a commercial mode and economically benefit from the platform, which ensures their continued interest and sustainability.

The TAAT clearinghouse: coordinating technology delivery at scale
The “Technologies for African Agricultural Transformation” (TAAT) program funded by the African Development Bank is a bold plan to boost the productivity of African agriculture which is currently a fraction of what obtains in other regions of the world. The program’s goal is to increase food production to reduce reliance on food imports, reduce poverty and create jobs, especially for women and youth. In 2018, the program has prioritized interventions targeting 11 commodities in 29 countries. Interventions are organized along the entire value chain of each commodity and involve actors from the public and private sectors, who act in partnership to deliver proven technologies and know-how, inputs, financing and market access to millions of farmers. These partnerships are led by CGIAR centers with mandate over each commodity.

The TAAT Clearinghouse was established as an independent unit and honest broker to assess technologies selected for scaling up, evaluate and approve the plans of work. It monitors implementation and is responsible for impact assessment. It fosters partnerships between the various actors and facilitates linkages with other development initiatives for African agricultural transformation. The TAAT Clearinghouse is partially funded by a grant of the Bill and Melinda Gates Foundation to IITA.

Willingness to pay for maize moisture detection devises in Kenya

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This study describes an experimental auction conducted amongst 600 maize traders and farmers in Western Kenya to measure adoption for two low-cost technologies that can measure grain moisture content. Willingness-to-pay auctions (WTP) were combined with a risk preference lottery, allowing an opportunity to study the impact of risk preferences on technology adoption. We also randomized two variations of the BDM method for collecting WTP data to examine the impact of the method on valuation data. We find some evidence that risk aversion increased willingness to pay. Another result with implications in implementation of field experiments in the developing world is that farmers were very sensitive to the method in which the auction was method, whereas the traders in our sample were not.

A field-tested, low-cost, locally-produced, multi-crop thresher

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As a response to challenges related to postharvest loss, labor requirements, and seed and grain quality issues, SIL developed, tested and scaled a locally produced and locally serviced low cost
multi-crop thresher with development partners in Ghana and Malawi at Compatible Technologies International (CTI), the ADVANCE project, MEDA, Catholic Relief Services (CRS), and the Agricultural Diversification Project of Malawi. Mechanized threshing greatly reduces post-harvest loss in grains and cereals because it allows for quicker removal of the crop from the field, reducing losses from shattering or disease and reducing exposure to birds, rodents and adverse weather. Mechanized threshing also addresses problems common to hand threshing including grain spillage, grain breakage, and incomplete separation of the grain from the chaff while also reducing heavy labor requirements for farmers. The transfer of this SIL technology to development partners exemplifies the U.S. Government’s Feed the Future research-for-development strategy of equipping in-country partners with evidence-based tools and technologies to enable successful soybean development programs.

A tool for assessing and improving the scaling potential of agricultural technologies

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MSI worked with USAID’s Bureau for Food Security to develop an Agricultural Scalability Assessment Toolkit (ASAT) to assess the scalability of agricultural innovations. Building on recent case studies of successful scaling up of agricultural innovations through commercial pathways in developing countries, the ASAT provides a qualitative appraisal of an innovation’s scalability. The ASAT examines an innovation’s strengths and weaknesses relative to scaling; the most promising scaling up pathways (e.g., commercial/public/donor-driven); and the extent to which target contexts currently facilitate scaling. The tool is intended to inform decisions about whether, and where, to invest in the scaling up of specific innovations, or for further investment in research and development.

The ASAT consists an Agriculture Scaling Decision Tree and an Agricultural Scalability Assessment Matrix, as well as a guide to using the ASAT. A dashboard also summarizes the results of the tools and provides recommendations based on that analysis. The Decision Tree is applied first, to help select the appropriate scaling up pathway. The Assessment Matrix includes 6 sections, each focusing on one essential issue for scaling, and includes 39 total criteria scored from 1 to 3.

Pan-African trials: fast-tracking the delivery of new soybean varieties

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Transferring SIL technologies to the private sector through public-private partnerships (PPP) is a key structural component of SIL’s research-for-development (R4D) strategy. To date, SIL engages in 55 different public-partnerships across 15 countries. These partnerships serve multiple essential roles to assure SIL’s research is appropriate and scalable. The private sector
increasingly shoulders more of the load in bringing key technologies to farmers and other target recipients as public research and extension dollars continue to decline. SIL transferred its successful Pan-African Soybean Variety Trial program, an initiative that drastically increases the scale and pace of new variety introduction, evaluation, registration and release, to the private sector in Malawi, where partners have the unique ability to interpret market forces, maintain the correct incentives to meet market demand and have critical networks of customers and extension providers. This research-for-development partnership matched SIL’s research expertise and deep technical knowledge of soybean seed systems with a diverse set of private sector partners, some who were interested in evaluating their soybean varieties through a transparent, third-party testing platform and others who were interested in licensing and bringing to their producer networks new, high-yielding and disease resistant soybean varieties.

The scaling scan: a practical tool to determine the potential to scale

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Scaling aims to increase the use of innovations to impact many people. At the same time, scaling should also lead to sustainable system change in which the impact remains, or even accelerates, without further project interventions. Successful scaling of innovations requires that at least as much attention is paid to the complementary non-technical requirements. These non-technical requirements form the basis for the Scaling Scan, a tool built around 10 “Scaling Ingredients” necessary for an innovation to thrive.

The Scaling Scan helps to:
• Understand the multiple dimensions of scaling
• Develop more realistic scaling ambitions
• Reflect (in teams) if a scaling approach makes sense, and monitor progress
• Check whether your project proposals and implementation plans are “scale-proof”
• Identify bottlenecks for scaling and find openings to tackle these
• Approach (future) interventions with a scaling mind-set

The Scaling Scan is designed for anyone involved in pro-poor and sustainable development programs. It fills the niche between having a general idea and having a detailed scaling strategy ready for implementation. The tool was tested in workshop settings in multiple countries with project managers, scientists, agricultural extension agents and other development practitioners and has proven to be useful in developing realistic and practical approaches to scale.

New tools for maize lethal necrosis virus in Africa: CIMMYT and Corteva Agriscience collaborate on plant breeding innovations
The high-tolerance maize lethal necrosis qualitative trait loci (MLN QTL) on chr 6L, identified by CIMMYT, has been narrowed to a small region via positional cloning. Through this collaborative effort involving custom marker development and coordinated cycles of mating and high quality phenotyping, the MLN QTL has been narrowed over 100-fold. Analysis of recombinants continues to further narrow the interval. Full genome optical mapping, sequencing, and assembly is on-going and analysis will help define a genome editing strategy for CRISPR-edits to provide MLN tolerance in four CIMMYT elite parent lines, all of which show promising responses in early transformation testing. We will do controlled environment phenotyping to confirm phenotypes in edited materials. The whole genome sequence approach is now feasible and a valuable tool for exploring genetic diversity, especially for specific traits (e.g. MLN); and for informing important tropical and sub-Saharan diversity for future solutions.

Precision agriculture for African development

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INVESTIV is an Ivorian start-up specialized in precision agriculture. Pioneers in the use of unmanned aerial vehicles (UAVs) in agriculture in West Africa, we provide our customers with efficient tools that enable them to reduce losses linked to phytosanitary problems, to know with precision the state and dimensions of their land, to follow the evolution of their agricultural activities through an online monitoring platform, and to know the least hydrated areas and the least fertile areas of their plots. We work with several categories of customers including: professionals in the agricultural sector, producers themselves, cooperatives, institutions that finance agricultural projects, government institutions, agricultural enterprises, and NGOs supporting the agricultural sector. We are aware that African agriculture is undergoing real change, but for these changes to be effective, technological means must be made available to small and medium farmers and that is why we work every day.

Renewal and delivery of spatially explicit soils information in Western Kenya

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Older soils information, collectively known as ‘legacy data’ lies idle in libraries or in the personal collections of retired soil scientists. The probability of this legacy data being lost or
destroyed is very high. We demonstrate the process of bringing legacy data ‘back to life’ using the Reconnaissance Soil Survey of the Busia Area in western Kenya. Careful interpretation of the information available within the survey report allowed us to produce ten land quality maps and nineteen crop suitability maps that were not available originally. We have made some of these maps available in the Soil Explorer app and SoilExplorer.net website. As cell phone and internet connectivity in sub-Saharan Africa increases, delivery of spatially explicit, easily updatable information to end users becomes more practical. Even if soil maps are not available, agronomists and extension educators likely provide different recommendations based on location. For example, cropping recommendations for floodplains with wet, level soils are likely to be different than for steep adjacent hillsides with shallow, eroded soils. If this expert knowledge can be imbedded in a map, it can be delivered to end users, either farmers themselves or information providers such as extension educators or NGOs, using the approach we demonstrate here.

University of Eldoret food processing training and incubation center

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The Food Processing Training & Incubation Centre (FPTIC) is a project funded by USAID, FPL and University of Eldoret. The aim of the project is to contribute towards “sustainable reduction of postharvest losses in feed the future countries, through technologies and innovations that link farmers to markets. This particular project is focused on Kenya. The project seeks to breach the gap between the large scale centralized fortifying model which is supported by government policy and small – scale milling processes of cereals such as maize and sorghum which a large proportion of African populations depend on.

Youth mainstreaming in climate smart agriculture as a means to achieving zero hunger in African by 2025

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Rising levels of greenhouse gasses (GHGs) has resulted in climate change as evidenced by melting of glaciers, increasing global temperatures, shifting seasons, changes in rainfall patterns, biodiversity loss, increasing frequency and intensity of extreme weather conditions. Meanwhile agriculture (employing 65% and accounting for 32% of GDP in Africa3) significantly contribute GHG emissions. There is lack of youths motivation to engage in farming because

they perceive it as an unprofitable high risk business, labor intensive, time consuming to get returns\textsuperscript{4}. Thus, young people abandon agriculture leaving an ageing rural population\textsuperscript{5}.

Climate-smart agriculture techniques help to transform and reorient agricultural systems by sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing GHG emissions. Change requires accurate real time climate data, changing negative perceptions of youth towards agriculture and supporting their active participation in CSA activities also increase the resilience of the agricultural sector to climate change. CSAYN had been domesticating the global Sustainable Development Goals in local languages in 30 countries to ensure that youths and women are well informed.

**Processing of yam for export**

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I am a research scientist in National Root Crops Research Institute Umudike (NRCRI). I work as a postharvest processor to add value and develop new products from food crops. Most farmers and entrepreneurs that deal on crops suffer huge postharvest losses and this food loss and waste have many negative economic and environmental impacts. Currently my research activities are focused on reduction of postharvest loses in yam. Nigeria is the major producer of yam in Africa. Over the years attempts has been made to make yam one of the export crops to gain foreign exchange in Nigeria. However due to short shelf life and poor packaging, this has not been achieved. My research is focused on how to delay Postharvest physiological deterioration in yam long enough to survive shipping and still retain the quality. This is being done in collaboration with famers, stakeholders and entrepreneurs. So far, the research is still on the Market evaluation stage where the study is being conducted by experts to know the possibility of export. I also advocate for “Agri-Park” where SMEs that cannot afford processing factory can go and process their products until they are able to acquire theirs.

**Transforming cassava peel into high quality animal feed ingredients**

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Processing Africa’s annual cassava roots output of 150 million tons (Mt) results in nearly 36 Mt

\textsuperscript{4}http://www.fao.org/docrep/019/as290e/as290e.pdf
\textsuperscript{5}high levels of poverty and inequality, rapid population growth, underdeveloped markets, poor infrastructure and service provision, and weak governance systems
of incremental cassava peels waste that litter the environment and pollute underground water. Attempts to dispose by burning equally pollutes the air. Human population and incomes are growing faster than animal source food (ASF) supply while there is a critical shortage of high-quality animal feed and feed resources. To meet this ever-increasing demand for ASF and with a fixed land base; research, development and use of alternative sources of feed in animal production is imperative. Cassava peels, previously limited by long drying time and fear of deadly hydrocyanide and aflatoxins, have a huge potential to contribute.

Scientists at IITA have developed an innovation that drastically reduces drying time, eliminates aflatoxins and brings hydrocyanide levels within safe limits (see http://bit.ly/2j7bRu3). The innovation has potential to create new products (12 Mt of safe and hygienic feed ingredients with two-thirds the energy value of maize and worth US$1.8 billion annually); lead to a new industry in the cassava value chain (that employs 500,000 persons annually, 80% women); and reduce competition between animal and human for cereals while cleaning up the environment.

**Determinants of the involvement of extension agents in the dissemination of climate smart agriculture initiatives: Implication for scaling up**

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Globally, the role of extension agents in scaling up the utilization of climate smart agriculture initiatives (CSAI) by farmers remains very crucial. This study examined the determinants of the involvement of extension agents in the dissemination of CSAI to farmers. A two-staged random sampling technique was used to elicit information from 277 extension agents in South West Nigeria using a structured questionnaire. Data were analysed using frequency count, percentage and linear regression analysis. The findings revealed that prominent initiatives the extension agents were involved in disseminating were cover crops planting, minimum tillage practices among others. However, extension agents had low involvement in the dissemination of irrigation practices, use of soil amendments and Agro-forestry initiatives which are also very crucial for adapting and mitigating the effect of climate change in the study area. Significant factors influencing extension agents’ involvement in the dissemination of CSAI are their educational level, years of experience, job level and numbers of community covered. The study concludes that although extension agents are involved in the dissemination of some CSAI, there are still a wide range of initiatives that are not adequately disseminated to the farmer. It was therefore recommended that extension agents should be trained especially on CSAI thus enhancing sustainable agricultural productivity and food security for all.

**Scale up of climate smart maize technology package for transformation of the maize value chain and livelihoods in Africa**
The technology-package being promoted consists of climate-smart maize hybrids and customized proven farming practices. Piecemeal attempts on the maize value chain don’t work! The game-changer to drive adoption is ensuring a vibrant maize value chain. The current initiative intervenes to enable both, push for quality seed and pull mechanisms for grain generated by the target 2 million farm households across 12 nations in Africa. The tech-packages have been proven over the last decade; indeed 5 tons/ha of grain is a modest average compared to the barely single ton mean harvested by farmers. Knowledge and availability of elite hybrids has increased; harmonized regulations offer wider geography for seed marketing; public sector - national and international institutions of excellence - and private sector, including the African Development Bank (AfDB) have joined hands to ensure an enabling policy environment for technology dissemination. Indeed, the last mile is a completely functional maize value chain. Transformation indicators must be evidenced by a commercially driven quality maize seed production, utilization; and marketing of grain harvests, linking with off-takers and processors. The AfDB’s TAAT Maize Initiative sparks and nurtures the emergence of profitable business oriented farming system for target communities. Indeed, the time for transformation is now!

What factors constrain the efficient scaling up of cocoa value chain technologies among cocoa farmers under the commercial agriculture development project? - - Insights from Cross River State, Nigeria

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One of the major constraints to the efficient production of cocoa in Nigeria is the low adoption and usage of cocoa technologies among farmers. In order to improve this trend, the Commercial Agriculture Development Project (CADP) facilitators, as part of its initiative, disseminated new technologies on cocoa production, processing and marketing to farmers in Cross Rivers State. However, the CADP survey report noted that the productivity of cocoa farmers under the project had not grown sufficiently. Hence, multistage sampling procedure was employed in eliciting responses from 120 cocoa farmers across the State. The production technologies mostly adopted by the respondents was the use of superior improved hybrid seedling, among others; processing technologies adopted mostly was breaking of pods with blunt object to reduce damages to cocoa beans through indigenous knowledge, among others; and marketing technologies was the use of moisture testing kits called “aqua boy” to detect excess moisture due to improper drying, among others. Perceived constraints to their use of the technology were insufficient information, difficulty in acquiring land, institutional bottlenecks, etc. The project should develop and strengthen their ICT systems to provide timely and reliable information to farmers to enable them adopt the entire technology package.
Orange-fleshed sweet potato drinks commercialization towards a healthy population, Nigeria

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Dietary transitions and nutrition awareness informed decisions to choose healthy drinks which appeals to consumers’ tastes and preferences. The demand has risen to an unprecedented high. Orange-fleshed sweet potato (OFSP) drink is one of such products and now has been processed into nutrient-dense drinks, developed with so many flavors and acceptable by consumers. OFSP drink is rich in beta carotenoid, vitamins and essential minerals. Empirical studies reveal that OFSP is known to have an excellent amount of β–carotene, converted into vitamin A (retinol) in the human body, which is critical to alleviating vitamin A malnutrition in Sub Saharan Africa, which is the cause of at least one third of all child deaths and 20% of maternal mortality every year. It has the potential of eliminating the major impact of hidden hunger (malnutrition) particularly in women and children within the first 1000 days of conception. This market is huge and the potential impact is enormous. Seasonality of production, low economic value for fresh roots and fast post-harvest deterioration of potatoes roots led to post harvest losses. This innovation, poised to curb post-harvest losses, ensure access to healthy food and ready market for farmers’ thereby providing agribusiness opportunities should be scaled-up.

P-Solubilizing inoculants

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In the low-input cropping systems of Sub-Saharan Africa (SSA), phosphorus (P) deficiency in crops is common due to the tendency of P to complex with iron and aluminum oxyhydroxides in acidic tropical soils. While applying high rates of P fertilizer and intercropping with crops that exude P-solubilizing organic acids (most notably pigeonpea) can increase P uptake, the scale-up potential of these two options is limited. Certain microorganisms, however, also release P-solubilizing organic acids. If applied as inoculants, these microorganisms could increase crop P uptake throughout SSA. Most research conducted on these microorganisms has been lab-based; this has limited applicability to field conditions as it is not known which of the microorganisms isolated in the lab in active in the field. Moreover, inoculants currently on the market are not financially feasible for most farmers in SSA. The proposed project seeks to quantify the crop response to a P-solubilizing inoculant via field experiments in Western and Central Kenya and determine which of the applied microorganisms are actively solubilizing P via bioinformatics. The project aims to evaluate the potential of P-solubilizing inoculants to increase P uptake in SSA and use genomics to further optimize their production and reduce their cost.
The ICT4Scale initiative: Harnessing ICT to scale up agricultural solutions

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Information and communication technologies (ICTs) can play a significant role in enhancing the uptake and impact at scale of agricultural solutions. The speed of diffusion of mobile phones, their declining costs, the increased reach of wireless broadband, and the broader access to technologies by smallholder farmers, indicate the potential of ICTs to give large numbers of people access to timely and relevant agricultural information, financial services, and input and output markets. ICTs also contribute to strengthening social networks while facilitating participation and interactivity through innovation platforms that can support scaling-up initiatives. The ICT4Scale project, funded by the International Development Research Centre in Canada, aims at developing, testing and sharing a conceptual framework for implementing and assessing gender-responsive ICT-for-scale initiatives in sub-Saharan Africa. Implemented by Farm Radio International, Canada, and Farm Radio Trust, Malawi, the project investigates the use of different combinations of ICTs across past and current scaling-up initiatives to identify best practices and challenges, with an emphasis on gender-related issues. In Malawi, a scaling-up model based on mobile technology and interactive radio platforms that brings together key stakeholders from the public and private sectors while giving women and men farmers a voice, is also being tested.

DryCard™

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The DryCard™ is a low-cost and simple tool for resource poor farmers and traders to determine whether their dried products are dry enough for safe storage. Drying is a method that farmers can use to preserve and store their harvest, but knowing if their products are dry enough can be difficult. When products are not dried sufficiently they are susceptible to mold contamination resulting in postharvest losses and harmful toxins such as aflatoxin. The DryCard indicates dryness by utilizing a strip of cobalt chloride paper that changes color as humidity changes. The card includes a corresponding color scale that indicates the level of relative humidity and simple instructions that can be translated into different languages or pictures. The DryCard can be manufactured using locally sourced materials costing 10 cents per card and have been sold for around US$1 each. The Horticulture Innovation Lab is partnering with in-country businesses and entrepreneurs to increase the awareness and
adoption of the DryCard technology by setting up local production and marketing of the DryCard. Partners are provided all the resources needed to produce a started set of DryCards, and in return report back on sales, customer feedback, and success stories.

**Do improved drying and storage practices reduce aflatoxin contamination in stored maize?**

*Experimental evidence from smallholders in southern Senegal*

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Consuming food infected with Aflatoxins, a class of fungi, has negative consequences on the health and economic productivity of millions of people in developing countries. We design a randomized control trial with nearly 2,000 smallholder farm households in southern Senegal to see which interventions can reduce the incidence and accumulation of aflatoxins in maize, the local staple crop. The interventions include training on recommended post-harvest practices, providing tarps to reduce maize drying on the ground, providing low-cost moisture meters to detect when maize is dry enough for safe storage, and providing a hermetic bag to store maize after it has been dried. We find that households use the provided inputs, but training and hermetic bags were the only interventions that significantly reduce aflatoxins levels in maize after 3-4 months of storage. This suggests that smallholder farmers connect grain drying and storing directly, and aflatoxins-reducing strategies need to address drying and storage issues in a comprehensive manner.

**GEM parboiled domestic rice in urban markets: a promising future in Nigeria**

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Multi-stakeholder innovation platforms (IPs) are hypothesized to facilitate collective action for the generation, adoption and scaling of agricultural innovations that improve productivity and income. This study demonstrates the process through which positive changes were induced in the Bukan-Sidi Lafia rice IP in Nigeria, through technical and institutional innovation. The Lafia IP was established around domestic parboiled rice as entry point using the Grain quality enhancer, Energy- efficient and durable Material (GEM) rice parboiler. Assessment conducted using rapid appraisal methods revealed that GEM-parboiled domestic rice competes with imported rice in urban markets. Added market value of GEM-parboiled domestic rice was $0.2 over sub-optimally parboiled rice. Consumer-preferred attributes of domestic parboiled rice over imported rice included swelling, cleanliness and taste. In addition, GEM is less time-consuming and safer to operate, and requires less fuelwood. As a result, local parboilers have
adopted good parboiling practices in their businesses. Collective action using the IP enhanced the skills of IP actors through information and experience sharing. To further expand opportunities for the IP, there is a need to engage other key stakeholders mainly microfinance institutions to access credit, facilitate contractual arrangements beyond the IP, and improve capacity in business plan development and financial management.

**Scaling up food security innovations:**

*Lessons from the Canadian International Food Security Research Fund*

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Scaling up innovations to ‘achieve impact at scale’ is increasingly embraced by researchers, development agencies, donors and governments as an effective strategy to generate wider benefits from development investments. Over the last nine years, the Canadian International Food Security Research Fund (CIFSRF), a CA$ 124 million program jointly funded by the International Development Research Center and Global Affairs Canada, supported the development, testing and scaling-up of promising innovations that aim to improve food security and nutrition in the global south. This poster presents an overview of the experience and lessons derived from CIFSRF program’s efforts to scale up a large portfolio of agricultural innovations. It describes how different scaling up approaches and pathways were used for different types of innovations, discusses key outcomes of the program and offers insights into key factors that enabled or constrained the sustainable spreading and adoption of agricultural innovations at a large scale. It considers projects that: i) deployed successfully pilot-tested innovations to reach and benefit a maximum number of beneficiaries; ii) used innovations as an entry point to catalyze long-term systematic change in the food and agricultural sector through capacity building efforts. CIFRSF’s scaling up initiatives provide valuable insights for agriculture research for development.

**Mobile phone-based dairy feeding support tool**

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In Nepal, the dairy sector contributes 8% to the Gross Domestic Product, but average dairy animal milk yield is one-third of that of many developing countries. This is because of inadequate feeding, poor genetics and diseases.

This study aimed to increase milk production of dairy cattle and buffalo through proper feeding management. The project collected locally available feeds (forage, fodder, crop
residues, agro-industrial by-products), analyzed their nutritional quality and entered the data as well as animal nutrient requirements in an app, a Feeding Support Tool (FST), it developed for formulating least cost, nutritionally balanced rations and predicting milk yield.

Animal feeding trials were conducted in three districts of Nepal in collaboration with the Department of Livestock Services (DLS) and Nepal Agricultural Research Council to examine the efficacy of the app. The data, analyzed as paired T-Test, showed that using the FST increased milk yield by cows and buffalo by 15% in one month and 7.7% in two months, respectively. Ninety five percent of farmers who tried the app reported an increase in milk yield. Heifer International Nepal, DLS and NDDB are working on scaling the FST to all DLS technicians and 1600 dairy cooperatives in Nepal.

Postharvest processing enterprises for African smallholders

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African agriculture, the millions of smallholder farmers at its foundation, and the service providers that serve them are caught in a productivity and investment trap. Smallholder farmers account for the vast majority of agricultural production on the continent. Mid-sized processors and farmer groups, often with the support of NGOs and government-funded development programs, have emerged to try and close the gap between scale and profitability. Cooperatives, farmer groups, hubs, etc. all have at their core the hope of aggregating demand for inputs and services, supply of outputs to create economies of scale for producers and lower transaction costs. There are few examples where these models have reached commercial sustainability and scale. A principal (but not the only reason) is that the range of goods and services provided by hubs and like models are narrow. CTI has a range of post-harvest processing solutions that reduce required labor, losses, and cost and increase yields, quality, and profits that are properly scaled to service 25 – 100 smallholder farming households. Priced in the $400 - $1,000 range, manually operated, with throughputs of under a ton per day, they can serve as the core of profitable service businesses at the village level. Our solutions offering includes technologies, yes, but of equal importance are technical support, training and advisory services on how to use them to establish a profitable business.

The Purdue Utility Project: transportation and power solutions for Africa

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Improving transportation and providing agricultural power through appropriate mechanized solutions can significantly increase agricultural production and reduce food insecurity in sub-Saharan Africa (SSA). Many people in SSA primarily rely on manual methods of transportation and farming which limit capabilities and consume significant amounts of time and effort. The
AgRover, developed by the Purdue Utility Project team (PUP) is an off-road multipurpose utility vehicle designed to provide affordable transportation while acting as a mobile platform for attachments and implements that increase farm production efficiency. The AgRover’s sustainable design allows it to be built and serviced using resources that are commonly found in SSA. This utility vehicle has two models, a larger model (AgRover) and a smaller, lower cost, model (field testing underway). Both models power multiple attachments and implements such as water pumps, maize grinders, cultivators, planters, and generators. Mobile Agricultural Power Solutions (MAPS) is a startup company that is scaling up the AgRover and bringing it to market in developing countries. Still in early stages, MAPS is focused on the Nigerian market, where they are locally manufacturing and selling the AgRover.

Scaling agricultural mechanization world-wide, the case of the 2-wheel tractor (2WT)

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Smallholders in the tropics increasingly look to agricultural mechanization to speed farm operations, reduce drudgery, and to respond to mounting labor shortages. Questions however remain as how to most efficiently scale what is typically-capital intensive agricultural machinery. Based on North American and European farm models, numerous development programs have popularized four-wheel tractors, though with little sustained success. Two-wheel ‘hand’ tractors (2WTs) are arguably more appropriate to the small field sizes and limited investment capacities that characterize smallholder agriculture. Relatively inexpensive, light-weight and easy to repair, a wide range of equipment can be attached to 2WTs, including precise seed and fertilizer applicators, harvesters, and irrigation pumps. These options offer users a broad and integrated set of services, and can increase the timeliness of farm operations. 2WT owners can also act as scale catalysts – reaching many additional fields and farmers beyond their own – by offering farmers mechanized land preparation, seeding, irrigation, and harvesting on an affordable fee-for-service basis. This case study review’s experiences in Latin America, Sub-Saharan Africa, and South Asia in scaling-out 2WT-based farm machinery services to benefit smallholder farmers’ livelihoods. We review crucial considerations in small-scale farm mechanization – with particular emphasis on multiple farm services provision, adaptable business models, and the facilitation of value chain and private sector ‘push and pull’ to catalyze adoption. The ways in which government subsidies can support or work for or against machinery scaling, and the role of policy and technology targeting in avoiding labor displacement, will reviewed