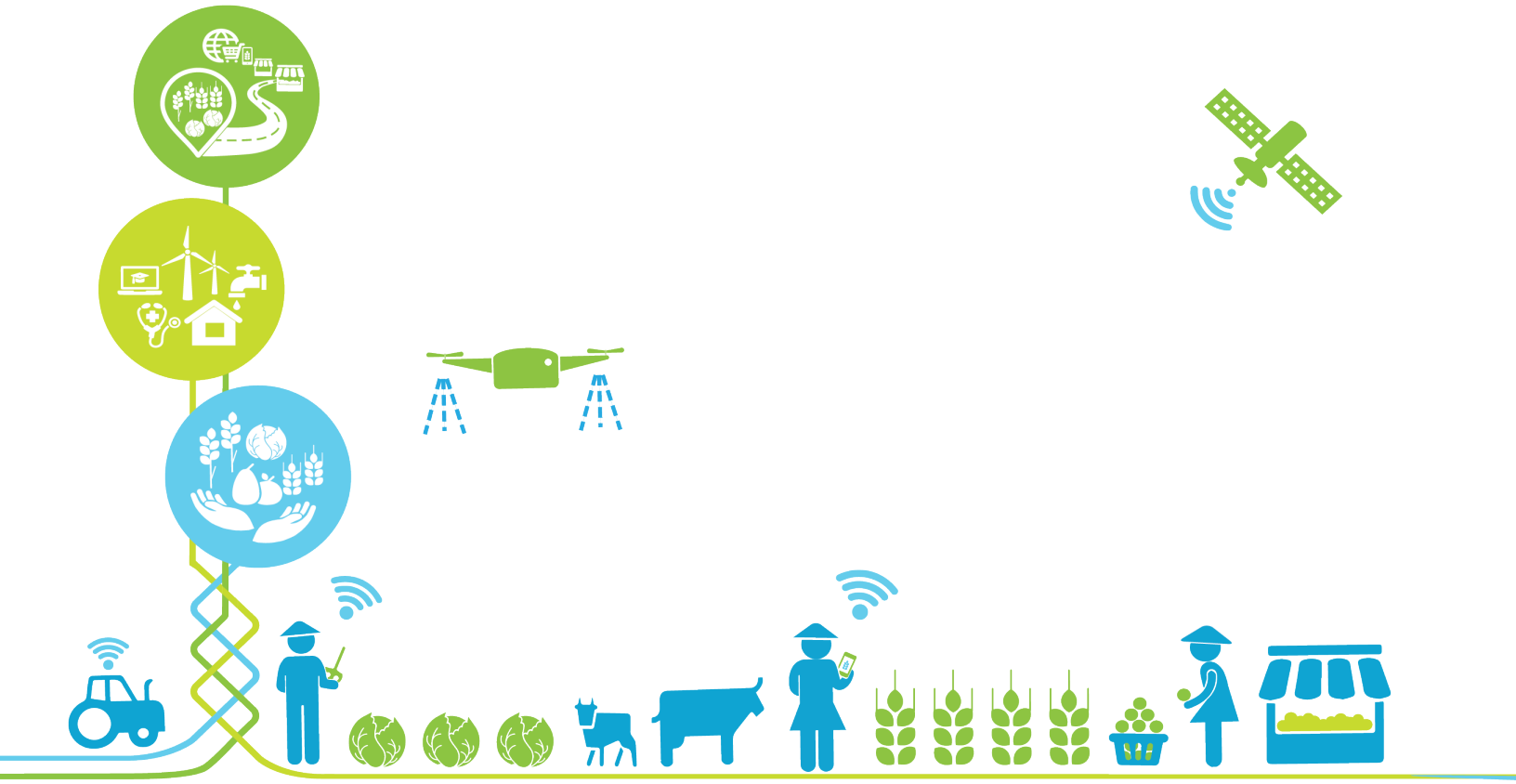

RURAL DEVELOPMENT AND FOOD SECURITY FORUM 2019 PROCEEDINGS

DECEMBER 2020

ASIAN DEVELOPMENT BANK

ADB

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Notes:
ADB President Takehiko Nakao stepped down as President on 16 January 2020.
In this publication, "$" refers to United States dollars.
ADB recognizes "China" as the People's Republic of China.
All photos are by ADB.
Cover design by Rodel Valenzuela.

Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
AWD	alternate wet and drying system
CIRAD	French Center for Research and Agricultural Development
CO_2	carbon dioxide
DMC	developing member country
DSR	directly seeded rice
EBRD	European Bank for Reconstruction and Development
EU	European Union
FAO	Food and Agriculture Organization
FDI	foreign direct investment
FPC	farmer-producer company
FPO	farmer-producer organization
GDP	gross domestic product
GIS	geographic information system
GMS	Greater Mekong Subregion
IAEA	International Atomic Energy Agency
ICT	information and communication technology
IFPRI	International Food Policy Research Institute
IRDP	Integrated rural development program

IRRI	International Rice Research Institute
IT	information technology
KMUTT	King Mongkut University of Technology, Thonburi
LAO PDR	Lao People's Democratic Republic
NATCO	National Confederation of Cooperatives in the Philippines
NGO	nongovernment organization
OECD	Organization for Economic Cooperation and Development
O&M	operation and maintenance
OTOP	One Tambon One Product
PGP	Carrageenan plant promoter
PNRI	Philippine Nuclear Research Institute
PRC	People's Republic of China
PPP	public–private partnership
PSOD	Private Sector Operations Department
RDFS	Rural Development and Food Security
R&D	research and development
SDG	Sustainable Development Goal
SME	small and medium-sized enterprises
STEAM	Science and Technology, Engineering, Arts and Mathematics
UK	United Kingdom
UNCDF	United Nations Capital Development Fund
US	United States
USAID	United States Agency for International Development
WHO	World Health Organization

Emergent technologies as solution to agricultural challenges. New technologies and services offer many positive benefits that can uplift people's lives, improve agricultural production, and be good for the planet.

Technology and Innovation Marketplace

International research institutions and technology firms were invited to showcase their modern technologies and services to support rural development and food security. There were 10 booths set up in the ADB cafeteria hallway leading to the Auditorium, and nine exhibitors presented on Day 1 in the plenary.

Presentations

1. International Rice Research Institute by Fergie Ann Quilloy, Assistant Scientist-Molecular Genetics

At the International Rice Research Institute (IRRI), our work is directed at achieving the following Sustainable Development Goals (SDGs), which are: (1) No Poverty; (2) Zero Hunger; (3) Good Health and Well-Being; (5) Gender Equality; (6) Clean Water and Sanitation; (7) Affordable and Clean Energy; (8) Decent Jobs and Economic Growth; (9) Industry, Innovation, and Infrastructure; (13) Climate Action; and (17) Partnerships for the Goals.

In 2020, we are celebrating 60 years of excellence in rice research. Rice, as we know, is a staple crop in most countries in Asia. It is even becoming an important crop in some parts of Africa. Here are some statistics to show you the importance of rice as an agricultural commodity and as an economic driver:

i. Rice feeds 4 billion people, which is 56% of the world population.
ii. It is grown by 144 million families reflecting 25% of world farmers.
iii. The annual value is estimated at $204 billion, which is 13% of world crop value.
iv. Rice crop covers 10% of total crop land.
v. It uses 15% of the world's fertilizer.
vi. Rice uses 35% of the world's irrigated water.

However, with its relevance comes the emerging challenges to rice cultivation that threaten sustainable production and the livelihood of smallholders. In response, IRRI has accelerated its efforts to promote climate-smart technologies and sustainable practices to help alleviate the negative impacts of these challenges.

Some of the technologies developed by IRRI that have helped transform agriculture are:

i. introduced varieties tolerant to flood, drought, and salt;
ii. promoted water management and decision-making tools;
iii. advanced healthier rice research;
iv. enabled women with rice production technologies;
v. mechanized technologies for increasing productivity; and
vi. reduced the use of pesticides by 20% in Viet Nam.

We have also sequenced the genome of 3,000 rice varieties and offered scholarships to help blossoming rice scientists. Among the projects that have helped test these technologies is an ADB-funded project, the Climate-Smart Practices for Intensive Rice-Based Systems in Bangladesh, Cambodia, and Nepal.[7] IRRI leads the Direct Seeded Rice Consortium and Hybrid Rice Development Consortium, which focus on expanding the access of direct seeded and hybrid rice varieties, technologies, and best practices to public and private sector partners. We are looking for more research partners and collaborators to help us expand the impact of these technologies to other areas.

2. Philippine Nuclear Research Institute by Lucille Abad, Career Scientist and Chief, Atomic Research Division

The Philippine Nuclear Research Institute (PNRI) under the Department of Science and Technology is the only institute mandated to promote as well as regulate the peaceful use of science and technology. We collaborate with the International Atomic Energy Agency (IAEA), which is the world's center for collaboration in the field of nuclear science and technology. This collaboration aims at developing technologies that can help in food security as well as the sustainable development of agriculture. One of the outcomes of this collaboration is a Cobalt-60 gamma irradiation facility established in 1987, primarily for research and development purposes, which is now upgraded to a semi-commercial irradiation facility to benefit local manufacturers and exporters of the country. Exporters of fruits and vegetables use the facility to increase the shelf-life of their products.

Similarly, in 2014, with support of IAEA, an electron beam irradiation facility was inaugurated. Both facilities are central to the radiation processing technology that helped develop the Carrageenan Plant Growth Promoter or PGP. PGP comes from a natural polymer carrageenan that is extracted from seaweed that grows abundantly in the Philippines. The large molecule carrageenan is substantially reduced to tiny

[7] ADB. 2019. *Climate-Smart Practices for Intensive Rice-Based Systems in Bangladesh, Cambodia, and Nepal*.

fragments by electron beam irradiation, which then can easily be absorbed by the plants. Carrageenan PGP solution is used as foliar fertilizer that is sprayed at certain stages in the rice plant's life. Multi-locational trials have shown consistent increase in harvest yield by about 20%, increased number of tillers, resistance to tungro virus, and extensive root growth and sturdy stems.

In 2015, Typhoon Lando battered the Philippines with a highest wind speed of 241 kilometers per hour. The experimental field demonstrated the lodging resistance of PGP-treated rice plants. In a field trial in the University of the Philippines in Los Baños, the PGP-treated field showed no signs of tungro virus infestation while grown between two tungro-infested rice fields. PGP has been tested not only in rice but in corn, peanut, mungbean and other food crops as well. The results from field trials showed that the yield for peanut increased by 40%–60% and mungbean by 30%–40%. PGP, when used together with more efficient farming methods and proper timing, can help farmers achieve better crop yield. Farmers can maximize the potential yield of their crops when using PGP in conjunction with more efficient farming methods and proper timing. The product, now registered with the Fertilizer and Pesticide Authority, has been commercialized through a technology transfer agreement between PNRI and two private companies. This marvel of radiation processing of carrageenan by electron beam is now available in the market.

3. SatSure by Sarvesh Kurane, Vice-President, Value Engineering

We are a satellite imagery-based analytics company. Imagine we have access to data by which you can answer three important questions: where a crop is growing; what is the condition of the crop; and what is the intensity of the crop? Using this information, one can get an analysis of data at a farm, barangay, regional, and country level. It will not be just current real-time monitoring data. You can move into historic data analytics, and get an understanding on creating prescriptive, predictive, and diagnostic signals across the entire agricultural value-chain.

How do we do it? We try to solve data problems across developing countries. We know that data, specifically agriculture data, is a core problem that leads to the entire agricultural inefficiency. We are building a robust data platform to generate critical solutions for problems of climate change, crop diversification, and financial inclusion. We generate decision intelligence, which is sourced from different datasets such as satellite imagery, drones, and weather data alerts. Data is then used by various organizations. For instance, government agencies use data for policy decisions. Banks use it for credit and risk assessment or controlling delinquency. Insurance agencies use the data. Agri-input companies use the data for optimizing their operational cycles. Data is used by commodity traders. Thus, the entire value chain uses this data.

As an organization, we started off in India and are currently working globally. The solutions we generate are targeted specifically toward developing countries. Our team consists of space scientists, space engineers, and agriculture specialists. Most of the

core team comes from the Indian Space Agency. We have received recognition for our work from the Ministry of Agriculture, the Government of India, Reserve Bank of India, ADB Ventures, and the Massachusetts Institute of Technology.

4. Grainpro by Allan Quintos, Regional Manager for Southeast Asia

Grainpro is a company involved in the development and production of postharvest solutions. Our head office is based in Washington, DC, but our manufacturing facilities are located at Subic, Philippines.

In the agriculture sector, institutions have given importance to production, yield through better seeds, improved fertilizer applications, proper pesticide applications, and innovations in farm machineries like tractors, trans planters, and harvesters. But the question is what happens after harvest? It is crucial that after harvest, grains and seeds are dried immediately to prevent spoilage through mold growth and insect infestation. Hence, the quality of grains degrades when these are not dried immediately, causing loss in its nutritional value.

The biggest concern about drying is that it depends heavily on climatic conditions. After drying, the next challenge occurs during storage. Proper storage is necessary to ensure that grains are available year around, safe for consumption because it is free from toxic chemicals, not contaminated with infestation, diseases, or pathogens that insects transfer to our food. There should be no or minimal losses in nutritional value throughout the storage period. Given that grains pass through long and different channels before it reaches the final consumer, efficient transport and packaging solutions are crucial to ensure quality grains for consumers.

Our company develops drying, storage, and transport solutions. For instance, we have developed a solar bubble drier in collaboration with IRRI and the University of Hohenheim, Germany. Our storage and transport solutions address concerns of humidity as well as insects and micro toxin problems.

5. King Mongkut University of Technology, Thonburi by Lerwen Liu, Founding Director, STEAM Platform

When I was a kid growing up in the PRC, I remember being bitten by leeches when I was helping my cousin plant rice. My cousins moved to Australia and started growing vegetables, still working under the hot sun 15 hours a day. Life was tough in Australia, but the economic returns were good. While my cousins were working as farmers in the 1950s, their children are engineers, who were not interested in farming. So, I was wondering who was going to grow our vegetables.

Recently, as I was working in Thailand at King Mongkut University of Technology in Thonburi (KMUTT), I see the future of farmers emerging. Inspired by my students and faculty members working in technology to empower the next generation of

farmers. What is unique about KMUTT is its problem-based, technology-driven innovation to address sustainable development.

We have three platforms that we work on. One is the rural development platform with the social lab that links the university education, research, innovation, and entrepreneurship to help rural areas toward sustainable development. The second platform is the knowledge exchange and innovation center located in the city, linking urban resources to develop an ecosystem and use education and research to help address problems. The third platform is the youth empowerment platform called STEAM—Science and Technology, Engineering, Arts, and Mathematics—a youth leadership platform where we train young people to adopt convergence of technology to train mindset toward critical thinking, lifecycle thinking, and entrepreneurship practices to achieve the SDGs and circular economy. One of our students together with our colleagues at the Robotics Institute at KMUTT has developed a precision drone for rice seed sowing and many other autonomous vehicles that will help farmers to improve their productivity and lives.

6. Eaglesensing by Tark Bartlema, Managing Partner Asia

SatSure has already done a portion of my presentation because we are active in the same area. We are a Dutch start-up in aerial surveying and data analytics. We all are aware of the massive challenges that agriculture is facing. We must feed more people. We must minimize and reduce our carbon and water footprint. We must deal with depleting soil fertility. At the same time, we must become circular while providing a fair income for the farmers and agripreneurs. I am a realistic optimist or an optimistic realist and I believe with the help of technology we can meet these challenges—and data is going to be an important part of that.

But what is data? It is a big concept. Some say there are five "V"s to data; others say there are seven "V"s to describe data: volume, velocity, variety, veracity, variability, visualization, and value. This is the whole concept for data surrounding agriculture. We believe that at times this can be a bit overwhelming. As a farmer or agripreneur what can you do with all these data points? We decided to specifically focus on V for visualization.

We are active in data collection and diagnostics, which can be through satellite, manned aircraft, or drone depending on the size and scope of the project that we are involved in. Subsequently, the data we process and we put on our platform outputs in the form of deliverables like individual plant health, planting densities, projected yields, elevation models, waterlogging, erosion risk and focus on object recognition such as early disease detection.

We have pictures of with-and-without early detection of Panama disease in banana. Early detection helps avoid massive damage by applying control measures while neighboring plantation that did not use early disease detection services showed infestation of Panama disease.

Our idea is to make this affordable, actionable, and accessible. Through scale and automation, affordability comes closer to fruition. We provide management information for decision-making to do more with less. We have seen typical input use reductions of 10%–15%—less fertilizer being used, less chemicals while maintaining similar production levels. That does not only have a positive bottom-line effect but is also good for our planet. We work together with Wageningen University in the Netherlands where we are based to further develop our toolkits. Typical clients are the big plantation operators as well as through co-ops and input suppliers. We also work with smallholders and I want to make this technology more available as we go along.

7. Netatech Pte Ltd by David Tan, CEO

You must be wondering why a Singaporean is standing here and what a small city-state like Singapore has to do with agriculture. How many of you know how big Singapore is? We cannot even provide for 10% of our food requirements and we are only 700 square kilometers. We need land two times the size of Singapore to produce food for our population. So, in the last 50 years, we have lost a generation of agritech entrepreneurs in terms of education. What are we going to do in the next 50 years?

We have built up our country as a financial hub so that we have enough money to buy food. We focus on economics that we have foregone the ability in education to promote food production. So about 11 years ago we at Netatech realized that we had created a water miracle in terms of sufficiency but in the next 50 years we may run out of food because of geopolitical reasons and climate change. What do we need to do in the next 50 years?

We need to create food miracles. We do not have horizontal space in Singapore so what we need to do is utilize any available space—vertical walls on high-rise apartment buildings (we have 10,000 units of housing in Singapore) and one part of the wall facing the west is empty. Currently, we are looking at planting the western wall of the apartment high-rise blocks, which comprises a space of 1 million square meters. If we can get a farm output of 2 kilograms (kg)–3 kg per square meter per month, we could generate 2 million–3 million kg of vegetables for our population.

We have a key performance indicator to achieve 30% whereas currently we are reaching 5% of the target in terms of farming. By 2030, we are supposed to reach the target of 30%—which is a tall order. Five years ago, we built a farm cradle in Singapore to attract young generations from ASEAN countries—Filipinos, Thai, Malays, Indonesians, and even from the PRC outside the ASEAN, to come to Singapore and learn agriculture. That is ironic, isn't it? We have invited specialists from the Netherlands, Israel, and other countries in Europe to help us build an academy on a 1 ha plot of land in the north of Singapore to train young people. Farming may be unsophisticated and unattractive, but we are going to make it sophisticated and attractive for the young generation. We have the Internet of Things, ICT, blockchain, and we want to invite our partner countries to sit on our platform and bring their branded products and sell to Singapore as well as globally. Our company is called

Netatech and we have a platform called CrowdfarmX to enable the whole cold and supply chain.

8. Georа by Bridie Ohlsson, CEO

Georа is a tech company based in Sydney and Singapore, and I am one of the founders. We build solutions across agricultural supply chains. Our mission is to bring low cost, digital technology with the aim of finding new ways to provide finance and trade solutions.

We just had introductions to the power of data analytics—what happens when we have all this data where we are all working in dispersed supply chains? For example, in this room if we are moving products and all of us touch the product and keep our data to ourselves in our own little silos, how will it be useful?

One of the ways we are trying to overcome this problem is by using blockchain technology. We are trying to solve the challenge of trust across supply chains. Only about 50% of supply chain participants can trust their counterparts. If I told you that I produce and sell the best rice in Australia, you might all believe me. That will be a bad idea as I live in Singapore and we now know that Singapore does not produce much rice or food at all. One of the challenges of supply chain participants is that they do not have a way of assessing and aggregating this data into a common database. And that is where we come in.

We use blockchain technology to help connect participants and provide solutions to trade and finance. It is estimated that $2.1 trillion is needed annually as additional investment across supply chains if we are to achieve the SDGs by 2030. This is an enormous cost and at the moment, connecting funds, even where available, to farmers is both expensive and difficult. We are trying to provide the "plumbing," the digital infrastructure, to allow for those funds to move between financiers and farmers as well as giving trust in those data records for different financiers and buyers along the supply chain. We run a blockchain protocol that is based on a protocol called Ethereum, which is designed specifically to meet the needs of agriculture including high privacy requirements for different participants with standardization across data storage formats. We integrate and work with different applications to allow them to leverage this database solution.

We started in Australia working for 4 years building our technology and since worked with livestock farmers in Papua New Guinea, with Food and Agriculture Organization (FAO), and the government to deliver a livestock traceability solution for pig farmers. They are now using digital records as a way of accessing finance solutions. We have also worked with Rabo Bank and other big producers in Australia and at the consumer end with beverage and food production. We are a foundation and have the luxury of really working at low cost. We have created a digital toolkit for our partners.

9. Agunity by Thomas Gonzales, Marketing and Investor Relations Consultant

AgUnity was born 3 years ago with the profound mission to help the 500 million developing world farmers to lift themselves out of poverty. We spent 3 hard years working and living with farmers in remote areas of Kenya in Africa, in Southeast Asia, and the Pacific, and we discovered first-hand what their daily challenges are—lack of trust between the farmers and cooperatives, no reliable identification, and therefore no access to financial services.

We created the AgUnity phone. This $50 smartphone will give smallholder farmers a digital identity—a wallet—but most importantly, it gives farmers a secure and transparent transaction record system that they understand and use every day to sell their products to the cooperatives and buyers with confidence. With AgUnity, farmers can work with cooperatives in a relationship of trust. They are earning more and, in some cases, triple their incomes from one harvest season to the next. As a business, we are a platform. On our supply side, we integrate partners wanting to connect with farmers to trade products and offer them services. We work with banks, insurance, commodity buyers, and cooperatives that want to scale up and distribute their solution through AgUnity platform to a large community of remote farmers. On our demand side, we welcome farmer-beneficiaries to join the platform and benefit from all those services. To be viable, we generate revenue from subscription and transaction fees on the supply side.

We are already working with many organizations such as the World Food Program, Expo live 2020 and Conservation Target Areas/Biodiversity to rollout AgUnity at scale and roll out AgUnity in specific, remote farmer communities. For 2020, we have a project pipeline for an estimated 1 million farmer-beneficiaries. We generate revenue of more than A$1 million and today we are raising investment and sourcing funds to expand our platform to include many more farmers.

APPENDIX

Technology and Innovation Marketplace

AgUnity

AgUnity is an Australian-based start-up founded in 2016 with the ambition to help change the lives of over 1 billion smallholder farmers in the world. AgUnity provides a mobile and blockchain solution, Axsari, which improves trust and cooperation among smallholder farmers. and It is also used as a platform for a range of problems, including mobile banking for the financially excluded, and data collection for developed world farmers. Central to the AgUnity solution is equipping farmers with smartphones and Internet of Things technologies, which transfer agency to each individual farmer and empower their collective voice. The app runs on low-cost smartphones and connects to a secure and free blockchain cloud service that can be accessed offline.

ANT Robotics

ANT Robotics developed a rice seed sowing drone for rice farming with high precision and automatic flight. The rice seed is planted inside a capsule filled with peat moss to provide more effective, precise, and uniformly distributed seed sowing. The seed sowing mechanism is designed based on a spiral spinner that can provide sufficient amount of release force that can overcome disturbances and can propel the seed toward the desired target position. Results of experiments show that the seed sowing mechanism can control the position of the capsule within 2 centimeters.

CropIn

CropIn's SmartRiskTM is an agri-ecosystem learning platform that utilizes advanced satellite imagery, extensive historical and real-time data about land composition, and detailed weather and climate forecasts to help food growers and businesses track, monitor, and evaluate every aspect of cultivation. The artificial intelligence and machine learning based platform provides insights that enable sustainable and productive food security. It is able to detect cropping patterns and predict the future of the crop, informing stakeholders of the associated risks and opportunities. Through this technology, smallholder farmers who are unable to provide collaterals to financial institutions can gain access to financial aid. These loans can enable them to invest in better quality farm inputs or modern farm machinery or equipment that would, in turn, increase their yield and income.

EagleSensing

EagleSensing provides aerial analytical solutions for tropical agriculture. They develop solutions for crop management problems in large scale plantations, using proprietary software created to derive maximum value from aerial photographs and global positioning system data. Their aerial data collection and data analysis services allow farmers to gather crop and field data, assess crop health and growth, and identify problems and areas of concern. EagleSensing specializes in translating complex data into user-

friendly, utilitarian formats to assist clients in all stages of data interpretation and application.

Georа

Georа is a commercial blockchain protocol for agriculture. Its mission is to build technology designed to financially empower farmers and agribusinesses and create new value along agri-supply chains. Georа is founded by farmers and technology experts and provide digital infrastructure to trace, trade, and finance global agri-supply chains. Georа's open source technology helps the community bridge the gap between fundamental technical components and their application to real-world use cases. They do this by making information about physical assets standardized and securely shareable between participants along the supply chain. Through both assisted and self-onboarding programs, Georа is helping its community of technology companies and agribusinesses be more efficient, sustainable, and secure.

GrainPro

GrainPro provides postharvest handling and storage solutions for agricultural commodities. Their drying and storage solutions use modified atmosphere that help reduce food losses and improve food quality by protecting agricultural products against insect infestation, mold growth, oxidation, and rancidity. Their remote sensing technology enables close monitoring of the inventory and the quality of the stocks, reduces losses substantially, and makes the stocks predictable and insurable. GrainPro products are fit for storing and transporting organic products and do not require the use of chemicals insecticides. The gas barriers of all GrainPro storage products enable quality preservation of stored dry organic commodities.

International Rice Research Institute

The International Rice Research Institute (IRRI) South Asia Regional Centre (ISARC), in collaboration with national research organizations, has completed an Asian Development Bank-supported pilot project on climate-smart agricultural practices involving direct-seeded rice and alternate wetting and drying technologies with intercropping of vegetables between rice seasons and other appropriate crop management practices in Cambodia, Nepal, and Bangladesh. Application of these technologies using seeds of recommended variety in the pilot areas resulted in savings in water and labor cost and increased yield.

King Mongkut's University of Technology Thonburi (KMUTT)

The STEAM Platform of Transformation, piloted at KMUTT in 2018 in Bangkok, provides an experiential learning and training program on knowledge convergence, circular mindset and strategic communication skills and leadership and entrepreneurship. The STEAM Platform fosters youth leadership, especially in Asia and the Pacific, to accelerate the transformation of today's linear economy towards the emerging circular economy. The STEAM training program involves understanding technology innovation, strategically communicating innovation, and practice of innovation. The STEAM Platform focuses in building and growing ASEAN Youth Leaders and workforce equipped with STEAM knowledge and entrepreneurship skills in driving the region toward a sustainable future with Internet 4.0 and circular economy.

KMUTT Knowledge Exchange for Innovation Center

KMUTT's Knowledge Exchange for Innovation Center (KX) provides an innovation ecosystem support for food tech start-ups and businesses to deliver innovative solutions for a sustainable food industry in Thailand and the region. KX covers over 200,000 square meters of interactive space and provides a comprehensive platform for knowledge exchange among research institutions, start-ups, small and medium-sized enterprises (SMEs), large corporations, and funding organizations, as well as collaborations on innovative solutions for sustainable development. KX offers deep tech commercialization support in the areas of energy, food and agriculture, mobility, healthcare, and service industries and accelerating the adoption of digital and circular economy.

KMUTT Research Innovation and Partnerships Office

KMUTT has a multidisciplinary team of experts that has more than 30 years' experience in providing technical assistance and management to the Royal Project food plants, KMUTT staff are well-equipped with technical knowledge and skills required to ensure sustainable, safe, and efficient food production. KMUTT has a long history of working with agricultural and food industries in Thailand. KMUTT started in the 1980s by being responsible for the technical management of the Royal Project food processing plants located in rural areas. KMUTT's competencies include automation technology and postharvest technology; various food processing facilities; food safety, security, and quality; consumption and market analysis; and waste management.

KMUTT Social Lab

KMUTT Social Lab is a platform where academic people can apply their knowledge and develop technology to meet community demands. Academic staff and students are encouraged to do field work research and create solutions for real-world problems. The mechanism also encourages varied parties and strategic stakeholders to work hand-in-hand with the community.

The mechanism focuses on three main strategies to improve the beneficiaries' quality of life. These include food security, income generation, and human resource development. The Social Lab implements the concept of 3E4A (Engineering, Energy, and Environment for Agriculture). To adapt these technology transfer efficiently, capacity building for rural people is key to enable villagers to acquire, adopt, and adapt knowledge and technologies for poverty alleviation.

KMUTT Vegetable Production Plan

This vegetable production plan was developed to allocate fair revenue to small farm holders based on their varying skills, limited farmlands, and estimated demand requirements. A model of crop procurement plan under uncertain fulfillment abilities of the farmers and disruption risks was obtained to optimize procurement costs of an agro-business. This research is the second of its kind in the world that simultaneously addresses yield uncertainties, crop rotation requirement, and fair revenue and the first one to directly optimize fair revenue.

Netatech Pte Ltd

Netatech Pte Ltd developed CrowdFarmX, the world's first cooperative farming platform on the blockchain. The goal of CrowdFarmX is to overcome the world's food crisis by facilitating smallholder farmers' direct access to best-practice farming protocols, monitoring, and control of their farms to ensure food safety and maximize production as well as connecting farmers to global demand. CrowdFarmX seeks to form the base of a decentralized and self-sufficient community of farmers and agronomists and aims to ensure stable and secure access to a demand and distribution network. Farmers can potentially participate in aggregated farming and thus benefit by having assured buyers for their produce while buyers benefit from lowered prices with the elimination of costs from traders and intermediaries.

SatSure

SAGE Banker by SatSure is a product suite for banks and financial institutions to increase financial inclusion of small hold farmers, increase

Rural Development and Food Security Forum 2019 Proceedings

Smart rural development, effective agricultural policies, and efficient regulations are critical to ensure a sufficient, safe, nutritious, and affordable supply of food to Asia and the Pacific's growing population. Toward this end, the Asian Development Bank hosted the Rural Development and Food Security Forum 2019 to prompt governments in the region to provide the leadership and transformative change needed to generate rural prosperity and effective stewardship of land and water resources. Among the topics discussed were the farm income crisis, food insecurity and malnutrition, and rural distress and prosperity challenges. This report captures the stories and on-the-ground experiences of farmers, entrepreneurs and young agripreneurs to help prompt leaders to provide active leadership, effective resource stewardship, and promote transformative changes in rural development and food security.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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